



2nd INDIA DISASTER MANAGEMENT CONGRESS

4- 6 November 2009, Vigyan Bhawan, New Delhi

PROCEEDINGS





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nidm

Towards a disaster free India

Congress Secretariat

Second India Disaster Management Congress

National Institute of Disaster Management

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Preface

In the recent years there has been a phenomenal upsurge of knowledge and research on disaster management across a wide range of disciplines and subjects. New frontiers of knowledge are opening up at a fast pace in universities, scientific, technical and academic organizations, government agencies, corporate sectors, communities and sometimes purely on individual initiatives, but mostly in an isolated and segmented manner, without much interaction and interface among the related disciplines.

While the nature of knowledge and research in particular disciplines are such that this has to be anchored in the domain of specific disciplines, greater interaction and interface among the disciplines would serve the cause of disaster risk reduction in many ways. First, research in one discipline would be benefited by knowledge in related fields - it would validate, complement, and sometimes even correct the findings. Secondly, this would enlarge the perspectives of research in particular disciplines and provide a holistic framework for research. More importantly this would help to create a community of scholars, researchers and practitioners on disaster management who would be aware of the trend of research in different disciplines and able to interact with each other.

In order to create a platform where researchers and practitioners shall meet periodically, present their research papers, debate on the issues, challenges, shortcomings and opportunities and discuss the areas of mutual cooperation and road maps, the National Institute of Disaster Management (NIDM) had organized the India Disaster Management Congress in Vigyan Bhavan New Delhi on 29-30 November 2006. More than 1200 hundred delegates from all over the country attended and 350 technical papers were presented in 18 Thematic Sessions organized around Thematic Clusters. This was the largest knowledge conference on disaster management ever held in this part of the world.

Encouraged by the resounding success of the Congress, NIDM organized the Second India Disaster Management Congress in New Delhi on 4-6 November, 2009. A total of 26 Technical Sessions were organized around 13 Thematic Clusters of the Congress. More than 500 papers were received out of which 250 papers were selected for oral presentations and discussions.

We feel happy to present the proceedings of the Congress.



P.G.Dhar Chakrabarti

Executive Director

National Institute of Disaster Management

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Thematic Clusters and Thematic Sessions

Thematic Cluster – A: Geological Disasters

Thematic Session A1: Earthquake

S. No.	Title of the paper	Speaker
1.	Application of earthquake resistance guidelines and enforcement mechanism - Indian context	Prof. A.S. Arya
2.	Retrofitting of a Hospital Building – Delhi earthquake safety initiatives	Dr. D.K. Paul
3.	Earthquake test facility at SERC, CSIR- towards disaster preparedness of India	Dr K. Muthumani
4.	Earthquake resistant design & construction practices in India	Yogendra Singh Ratnesh Kumar Putul Haldar
5.	Construction Techniques: A Case Study of Earthquake Resistant Construction in State of Uttaranchal	Girish C. Joshi
6.	Proposed Rapid Visual Screening Procedure for Seismic Evaluation of RC Frame Buildings in India	Keya Mitra
7.	Constructional Practices, Climate Change and Disasters – Some instances from Kashmir G. M. Dar	
8.	Managing with Vulnerable Built-infrastructures in India	Chandan Ghosh
9.	Retrofitting of structures – principles and applications	Amlan Sengupta
10.	Jammu and Kashmir Earthquake Reconstruction Programme Uri Block, District Baramulla	Najmi Kanji
11.	Concrete Jacketing with Supplemental Damping for Seismic Retrofit of a Non-Ductile Concrete Building	Sandeep Donald Shah
12.	Importance of seismic microzonation in urban safety – a case study	Aftab Alam Khan
13.	Seismic hazard Microzonation of Guwahati city	T. Rahman
14.	Recent developments in earthquake forecasting	Devesh Walia
15.	Analysis of temporal heterogeneity in the magnitude of completeness & its uncertainty for a North East India region	Ranjit Das
16.	Seismic Vulnerability of National Capital Region Delhi from a Large Magnitude Earthquake in NW Himalayas	Arun Bapat
17.	Foreshock clustering and precursory changes in source parameters for the Kachchh Earthquakes Gujarat, India	Sandeep Kumar Aggarwal
18.	Possibilities of Earthquake Prediction using Ground and Satellite Techniques	Shourabh Bhattacharya A. K. Gwal
19.	Seismic Hazard Assessment of Kumaon Himalayan Region using Fractal dimension of the part earthquake sequence	P. N. S. Roy S. K. Mondal

S. No.	Title of the paper	Speaker
20.	Pseudo-seismic tunneling vis-à-vis earthquake precursor	Aftab Alam Khan
21.	Response time for earthquake preparedness from seismic alert system in Shillong and Guwahati	Devesh Walia
22.	Tsunami Reconstruction and CBDRR	KM. Parivelan

Thematic Session A2: Mass Movements (Landslide & Avalanches)

S. No.	Title of the paper	Speaker
1.	The Aknes rock slope: Early warning system and emergency preparedness	Dr. Vidar Kveldsvite
2.	InSAR Monitoring of High Risk Geohazard Areas using RADARSAT	Sh. Vernon Singhroy
3.	Stabilization of Varunawat Landslide in Uttarkashi Town, Uttarakhand Himalaya	Dr. P.C. Nawani
4.	Sonapur Landslide and its mitigation through RCC Cut and Cover Structure	Sh. S. S. Porwal
5.	Preliminary Analysis of Spatial and Temporal Variation of Landslide Hazard in India 2007–2009	Joyesh Bagchi Rakesh Kumar Sanjiv Sharma
6.	Hazards Mitigation through Application of Bioengineering Measures in Landslide Areas: A Case Study of Varunavat Landslide, Uttarkashi	Dr. H.B. Vashistha
7.	Forecasting Erosion Induced Landslides	Prof. Z. A. Roslan

Thematic Cluster – B: Hydro Meteorological Disasters

Thematic Session B1: Flood

S. No.	Title of the paper	Speaker
1.	Remarks by the Chairperson	R.C.Jha
2.	Key Note Address on International Dimension of Flood cooperation w. r. t shared regional river systems	Mr. R. Rangachari
3.	Innovative methods in River Erosion Control – A case study of erosion of Bhira-Palia Railway line by Sharda River in U. P.	M. U. Ghani
4.	Cofferdam, An Effective Tool for Emergent Flood Management Works-A case study of kosi barrage afflux bund breach closure	M. U. Ghani

S. No.	Title of the paper	Speaker
5.	Kosi Floods 2008: A Call for Cooperation	Ranjan Kumar Sanjay Srivastava Binod Shakya
6.	Flood Hazard Modelling and Flood Risk Assessment for a River Basin	Sh. Rakesh Kumar
7.	Incorporating Local needs and capacity for flood risk reduction	Victoria Devi P. C. Joshi
8.	Lessons learnt from Disaster Management of Recent Dam/ Embankment Break Events in India	M. K. Sinha S. M. Narulkar
9.	Flood Risk Assessment & Mitigation in Haryana: A Case study of Rohtak District	Nazia Talat Anil K Gupta Sreeja Nair
10.	Flood Hazard Vulnerability and Risk Assessment of the North India: Assessment of Concurrent Mitigation Options	Sandeep K Pandey Anil K Gupta
11.	Flood Forecasting Network of Mahanadi Basin- A Critical Review	Anil Kumar Kar A K Lohani NK Goel, G.P. Roy
12.	An Experiment Using the High Resolution WRF Model to Predict Heavy Precipitation over India	Anupam Kumar D. R. Pattanaik Y.V.Rama Rao
13.	Flood Risk Mitigation and Management Practices in Delhi	Sh. Mukesh Kumar
14.	Problem of Urban Floods in the developing cities of developing world	R. K. Agrawal

Thematic Session B2: Cyclone

S. No.	Title of the paper	Speaker
1.	Prediction of track and intensity of tropical cyclones over Indian Seas: Present Status and Future Challenges	Prof. U. C. Mohanty
2.	Recent Advances in Satellite Observations for Tropical Cyclone Studies: Indian Perspective	Dr. P. C Joshi
3.	Design of Flight Path for Tropical Cyclone Observation over Bay of Bengal	Dr P Goswami
4.	Possible Solutions to Improved Cyclone Track and intensity Predictions for better Disaster Management Practices	Dr M M Ali
5.	Tropical Cyclones of the North Indian Ocean - Their genesis and propagation	Dr SSVS Ramakrishnan
6.	Quantitative Precipitation Forecast for the Very Severe Cyclonic Storm Nargis: Sensitivity to Resolution and Connective Parameterization	Ms. Sujata Pattanayak
7.	Challenges in Tropical Cyclone Forecasting	Dr. H. R. Hatwar

S. No.	Title of the paper	Speaker
8.	Characteristic features of land falling cyclones and cyclone prone districts of India	Dr M Mohapatra
9.	A new stability index for forecasting Nor'westers	Prof. Sutapa Chaudhary
10.	Meso scale simulation of thunderstorm in Gangetic West Bengal with explicit representation of cloud microphysics	Dr. M. Mandal
11.	Simulation of Tropical Cyclones over Bay of Bengal during 2008-09 with WRF-ARW modeling system	Sh. Krishna K. Osuri
12.	Effects of Moist Convection & Resolution on Tropical Cyclone Predictability over North Indian Ocean	Saurabh Taraphdar
13.	Recent Developments in Storm Surge Prediction in the North Indian Ocean	Prof. S. K. Dube
14.	Development of long -term hazard planning and vulnerability assessment of storm surges	Prof. A. D. Rao
15.	Skill Assessment of Thermodynamic Indices in Forecasting Pre-monsoon Severe Local Thunderstorms over Kolkata- A Case Study	Dr AVN Satyanarayanan
16.	Numerical simulation of severe thunderstorm produced tornadoes over India with WRF model	Ms Litta AJ
17.	Data Impact Study on Simulation of Monsoonal Heavy Rainfall Events over India	Ashish Routray
18.	Linkage of science, institution and society in tropical cyclone disaster management in the state of Orissa	Dr Kamal Lochan Mishra
19.	Storm Protection Services of Mangroves; Evidences from the Super Cyclone of October 1999 in India	Dr. Saudamini Dash
20.	Dissemination to Response: In search of new strategies for Broadcast media in Cyclone warning of Bangladesh	Dr. M. S. Ullah
21.	Surface layer parameter during thunderstorm event during sub tropical monsoon region along eastern end of trough axis in India	Dr. Manoj Kumar

Thematic Session B3: Drought

S. No.	Title of the paper	Speaker
1.	Drought Assessment & Combating through weather based advisory services in India	Dr. L. S. Rathore
2.	Livestock Management in Drought	Dr. K. S. Ramachandra
3.	Drought situation over India	Dr. Jagvir Singh G. R. Iyengar T. N. Jha V. K. Jain

S. No.	Title of the paper	Speaker
4.	Rectification of Standardized Precipitation Index Classification for Drought Evaluation in Fars Province (Iran)	Dr. Syed Amir Shamsnia Nader Pirmoradian
5.	Drought management strategies in Agriculture in Andhra Pradesh	Dr. D. Raji Reddy G. Sreenivas
6.	Drought Management : A Case Study of India	Dr. Durgesh Nandini
7.	Monitoring and Early Warning system in drought Management	Dr. V. S. Prakash
8.	The potential of peer learning between Africa and Asia on Drought as a Development Issue	Dr. Aseem Andrews Yuko Kurauchi
9.	Impact of Drought and Flood on Indian Food Grain Production	Dr. Ajay Singh V. S. Phadke Anand Patwardhan
10.	Climatic Changes and forewarning of agricultural drought over western Rajasthan	Dr. A. S. Rao R. S. Singh R. K. Mall
11.	PANEL DISCUSSION Theme "Drought Risk Mitigation and Management"	J. S. Samra D. K. Chadha K. D. Sharma L. S. Rathore Suresh Kumar Rohilla B.R. Neupane K. S. Ramachandra Santhosh Kumar

Thematic Cluster – C: Man Made Disasters

Thematic Session C1: Industrial and Chemical Disaster

S. No.	Title of the paper	Speaker
1.	UNEP's Integrated Approach to Disaster Management	Dr. Stefano Fotiou
2.	Inculcating culture of Preparedness for Disaster Management in First Responders, Community & Schools – An Initiative By NDMA	Brig. (Dr.) B.K. Khanna
3.	Land -Use Planning and Communications: Risk Management and Vulnerability Approach for Industrial Disasters	Mr. Debanjan Bandyopadhyay Ms. Anandita Sengupta Prof. Cees J van Westen Prof. Anne van der Veen

S. No.	Title of the paper	Speaker
4.	Disaster Management vis-a-vis DGFASLI's Perspectives	Dr. S S Gautam Dr. B D Dubey
5.	Experience in developing an Integrated Approach in Disaster Management.	Mr. R P Bhanushali Mr. A Y Sundkar
6.	Disaster Management on Transportation of Hazardous Chemicals	Mr. T R Thomas Dr. S. Kamal
7.	GIS and Web-Enable System for Emergency Preparedness and Accident Reporting in India	Dr. Sanjay Gahlout Dr. Arpita Gupta Dr. Anil Kumar
8.	Disaster Disruption at Hydro-Power Station	Sh. S. K. Sood
9.	MARG concept and organisational efficiencies	Dr. Vijay Kumar
10.	Industrial & Chemical Disaster Management Integration to Holistic Framework: Challenge for Implementation of National Action Plan	Dr. Anil K. Gupta Ms. Sreeja S. Nair

Thematic Session C2: Nuclear Emergencies

S. No.	Title of the paper	Speaker
1.	Key Note Address on Safety Regulation in Nuclear Industry-Present Status and Challenges	Sh. S. K. Chande
2.	Nuclear and radiological emergencies-handling the challenges	Sh. A.P. Joshi
3.	Nuclear Power Prospects-Plans and Challenges	Sh. D.K. Goyal
4.	Post Radiological Nuclear Emergency Preparedness and Gaps	Sh. P. K. Bhatnagar
5.	NBC Disaster Management Services: Efforts and Preparedness at BEL	Sh. A.K. Atta Sh. A.K. Shet Sh. P. H. Jhaveri
6.	Role of Regulator in Control of Nuclear and Radiological Emergencies	Sh. S.K. Mishra
7.	Emergency Preparedness in Indian Nuclear Power plants	Sh. Sameer Hajela Sh. Sunil G. Ghadge
8.	Leveraging Human Resources for Effective management of CBRN Emergencies	Rajesh Arora Raman Chawla Vinod Kumar R. Goel M. Silambarasan R.K. Sharma R.P. Tripathi

S. No.	Title of the paper	Speaker
9.	Role of Medical First Responders in Management of Nuclear and Radiological emergencies(NREs)	Rajeev Goel Raman Chawla Vinod Kumar M. Silambarasan Rajesh Arora Rakesh Kumar Sharma Rajendra Prasad Tripathi
10.	Container based Nuclear Radioactivity Analysis Laboratory	Deepak Goplani D.K. Rawat Ravindra Kumar R.P. Samant Suresh Jyani
11.	Nuclear and Radiological Emergencies: Requirement of State of the Art Systems and Methodologies for Impact Assessment and Response	Pradeepkumar. K.S D.N.Sharma
12.	National Network for Early Detection of Nuclear Emergency:Indian Environmental Radiation Monitoring Network (IERMON)	C.K.G. Nair M.D. Patel S. Garg M.P. Ratheesh V.D. Puranik H.S. Kushwaha
13.	Summing up of deliberations	Dr. A. H. Khan

Thematic Session C3: Road Accidentst

S. No.	Title of the paper	Speaker
1.	Opening Remarks	Shri S. Sundar
2.	Perspective on Road Safety in India	Prof. Dinesh Mohan
3.	Road crashes and deaths in India: Need for integrated policies and programmes	Dr. G. Gururaj
4.	Road accidents - The man made disasters	Mr. SB Zhaveri
5.	Road Accidents Mitigation Program	Mr. Ranjan Mishra
6.	Road Accidents: A case study of ECR, Chennai	Sh. S. Satheesh

Thematic Cluster – D: Science & Technology

Thematic Session D1: Early Warning and Disaster Communication

S. No.	Title of the paper	Speaker
1.	Strategies for Early Warning of Tropical Cyclones to maximize relevance and effectiveness over India	Dr. Ajit Tyagi
2.	Real Time of Earthquake Monitoring for Early Warning of Tsunami	Dr. R. S. Dattatrayam
3.	Application of Wireless Sensor Network in Forest Fire Detection	Ms. Zeenat Rehena
4.	Implementing Inclusive ICTs: Mobile Cell Broadcasting for a Public Warning System in Maldives	Ms. Natasha Udugama
5.	Cyclone Disaster Warning and the Broadcast Media: A study on Peoples response in the coastal region of Bangladesh	Prof. M. S. Ullah
6.	Last Mile Connectivity: Technological Options	Sh. Pramod Sarpotdar
7.	Design and Development of GSM Abis interface over Satellite emulator to illustrate communication support for Disaster Management	Sh. P. K. Srinivasan
8.	An architecture of rapidly deployable communication network for Disaster Management	Prof. Chandan Mazumdar
9.	The Role of Social Network in Disaster Information and Management	Ms. Nihariaka Mohapatra
10.	The Role of Social Network in Disaster Information and Management	Niharika Mohapatra
11.	Setting up Multi Hazard Early Warning System: Relief to Development	Arup Patro

Thematic Session D2: Geo-Information Systems

S. No.	Title of the paper	Speaker
1.	Space Technology For Decision Support In Natural Disaster Management – Decision Support Centre Initiatives	Shri V. Bhanumurthy
2.	International Charter “Space and Major Disasters”: Response to Global Disasters	Dr. N.K. Shrivastava
3.	Web GIS for Offsite Emergency Planning in MAH Units	Dr. Sanjay Gahlout
4.	Customizing Geographical Information Systems (ArcGIS) for Earthquake Disaster Management	Dr P. Jothimani
5.	Multi-source land use land cover classification in a hilly terrain for landslide study	Dr. D. P. Kanungo

S. No.	Title of the paper	Speaker
6.	GIS based slope stability evaluation of a landslide complex-case study from Paglajhora, Darjeeling Himalaya, India	Niroj K. Sarkar
7.	Fire Management System using Geospatial Technology: A Case Study of Delhi	A.K. Sharma
8.	Accuracy Aspects in the use of GPS Technology for Geoinformation System	Dr. S. K. Katiyar
9.	Free Geospatial Information for Natural and Induced Disaster Risk Management- Indian Perspective	G. Prasad Babu
10.	Application of GIS and Remote Sensing for Disaster Prone Areas: A Case Study in Coastal Kerala	Manjush Koshy
11.	Predicting Seismic Vulnerable Zones Using GIS	K.S.A. Dinesh Kumar
12.	Ranchi Utility Information System (RUIS)	Kiran Jalem

Thematic Cluster – E: Social and Economic Issues

Thematic Session E1: Gender and Disaster

S. No.	Title of the paper	Speaker
1.	Welcome address	Ajinder Walia
2.	Introductory remarks	Chaman Pincha
3.	From Victim to Victor: Gender and Disaster around the Globe: Accomplishments and Challenges	Susanna Hoffman
4.	Man, Masculinities and Disasters: A Global Overview	Sarah Bradshaw
	Road Accidents Mitigation Program	Mr. Ranjan Mishra
5.	Gender Mainstreaming: Humane Gaps in Humanitarian Assistance	N Hari Krishna
6.	Gendered CBDRM in the context of Regional Development	Yoko Saito
7.	Bam Earthquake through the gender lens	Simin Saedi
8.	Role of Caste and Gender in the Context of a Natural Disaster: A Case Study of Super Cyclone in Jagatapada, Orissa	Shalini Mitra
9.	The Ideal Vs. Actual Of Domestic Violence in Post-Disaster Situation: The Efficacy Of Questionnaire As A Tool	Minakshi PC Joshi
10.	Reproductive Health Rights of Women: A Case for Maternity huts for Pregnant Women in Relief Camps	Jorge Caravotta
11.	Empowering and Mainstreaming Women for reducing risks from disasters and climate change: A Case Study of Mumbai Slums	Smita Kadam
12.	Gender & Disaster: Towards a feminist Approach	Nibedita Ray-Bennet
13.	Gendered ways of Combating Disasters: Role of Grassroots Women	Prof. Samir Das Gupta

Thematic Session E2: Children and Disaster

S. No.	Title of the paper	Speaker
1.	Child Care and Protection during Disasters	M. Bharat Kumar
2.	A Rights based Approach to Children in Disaster	Gerry Pinto
	From Victim to Victor: Gender and Disaster around the Globe: Accomplishments and Challenges	Susanna Hoffman Sameer
3.	CC CB DRR- Children are key players in Disaster Management: a case study	Sandhya Krishanan
4.	Strengthening Primary education and psychosocial resilience of children in flood affected area of North Bihar: case study from Bihar	Prabhat Kumar Yudhistir Panigrahi
5.	Child Protection in Emergency	Sh. Mohammad Aftab
6.	Child Trafficking following Cyclone Aila	Manavendra Ray
7.	Exploring the Potential of ICDS in mitigating the effects of disaster on children	Dr. Manju Dhaundiyal
8.	Child Centeredness in Disaster Response	Nirali Mehta
9.	Bihar Kosi Flood 2008 and Its Impact on Children	Sanjeev Bhanja

Thematic Cluster – F: Disaster, Development and Governance

Thematic Session F1: Mainstreaming Disaster Risk Reduction in Development & Financing Disaster Management

S. No.	Title of the paper	Speaker
1.	Welcome and Introduction	Prof. Santosh Kumar
2.	Introductory Remarks	Dr. P K. Mishra
3.	Key Note Address	Sanjeeva Saran
4.	Reduction of Poverty- An Important key to Mitigation	Maitreyee Chatterjee
5.	Mainstreaming Disaster Management into developmental Efforts	Dr. Pavan Kumar Sing Dr. S. K. Jain
6.	Learning to Live with disaster	Dr. Narottam Sahoo Dr. Bindu Nair
7.	Disaster Management: Key Concerns and Prevention Measures	Syedun Nisa
8.	Lessons Learnt from Chabahar Free Trade and Industrial Zone Disaster Management Master Plan as a Sustainable Development Framework	Shri Bijan Yavar Shri Maisam Mirtaheri
9.	Is Indigenous Knowledge enough to live with floods?? An Assessment in Indo- Nepal Flood Plains	Dr. Sanjay Srivastava Shri Vinod Shakya Shri Ranjan Kumar

S. No.	Title of the paper	Speaker
10.	Disaster as opportunity for Development: Social Impact Assessment of Gujarat Emergency Eq Reconstruction	Prof. Utpal Sharma Prof. Madhu Bharti
11.	Empowering Panchayati Raj Institutions for Disaster Risk Reduction	Shakti Kumar
12.	Mainstreaming DRR in Development in India : Incentives, Instruments and Measures	Nisheeth Kumar
13.	Disaster and development: An anthropological enquiry from policy to Practice	Sunita Reddy
14.	Mainstreaming DRR: Reconstruction to Development – A case study of Gujarat	V. Thirupugazh
15.	Financial arrangements for Disaster Management	Pavan Kumar singh & Nawal prakash
16.	Financing Disaster Management in India: Possible Innovations	Rupalee Ruchismita Javed Hazarika Mangesh patankar
17.	Disaster Management and commercial Banks	Bibhuti Mahapatra
18.	Insurance Mechanism and the Funding of Post-Disaster Relief	Dr. George E Thomas
19.	Funding Drought Risk in developing Countries: A Perspective Based on the Use of Products and Services from earth Observation Satellites	Sanjay Srivastava

Thematic Session F2: Involving Communities, Civil Society and NGOs in Disaster Management

S. No.	Title of the paper	Speaker
1.	Stakeholder Participation in Managing Coastal Disasters	Dr. Arul Aram
2.	People's methodology for community based disaster risk management- An experience from Uttarakhand	Dr. Surya Prakash
3.	School-based Disaster Risk Reduction: Lessons from Child's Right to Safer School Campaign and 2009 School Safety Audit in India	Vishal Pathak
4.	Involvement of Community, NGOs, and Civil Society in Disaster Management	Ms. Jesu Rethinam
5.	Findings from 2009 regional disaster micro-insurance evaluation	Rakhi Bhavanani Mehul Pandya
6.	Community Based Disaster Management: The case of Bangladesh	Mr. S. K. Singh

S. No.	Title of the paper	Speaker
7.	Community Based Disaster Risk Reduction in Myanmar – A Fellowship Approach	Colin Fernandes
8.	People’s Partnership Power to Respond to Disasters – A Mobile Campaign by Saritsa Foundation across 12 states of India from Kanya Kumari, Tamilnadu to Tawang, Arunachal Pradesh – A Case Study	Prof Colonel N. M. Verma
9.	Andhra Pradesh Relief to Development Program Initiative of Community Preparedness for Emergencies Response	K. Arup Kumar Patro
10.	Building Local Capacities for Disaster Response and Vulnerability Reduction – A Study on Community Resilience	Annie George
11.	Panel Discussion (Q & A)	Mihir R. Bhatt
12.	Key Remarks by the Session Rapporteur	Prof. P. C. Joshi
13.	Concluding Remarks by the Session Chair and the Co-Chair	Mr. Mihir R. Bhatt Ms. Zenaïda Delica-Willison
14.	Vote of Thanks	Dr. Surya Parkash

Thematic Cluster – G: Education, Training and Capacity Building for Disaster Management

Thematic Session G1: Education, Training and Capacity Building for Disaster Management

S. No.	Title of the paper	Speaker
1.	Training perspectives in Disaster Management: Indian Journey	Prof. Vinod K. Sharma
2.	Open Learning and Distance Education: Role in Disaster Management	Prof. Pradeep Sahni
3.	School Disaster Management: Lessons from Community-Wide Drills	Dr. Marla Petal
4.	Multi-hazard Risk Model: Innovative Tool for Assessing the Degree of Risk within School based DRR	Sh. Mehboob Ali Ajani
5.	Networking Higher Education Institutions for Climate and Disaster Resilience	Dr. Srikantha Herath Dr. Akhilesh Surjan
6.	Role of Engineering Education in Development of Human Resources for Preparedness and Management of Natural and Man-made Disasters	Prof. Khanindra Pathak
7.	Disaster Management in Ten Vulnerable Secondary Schools of Subarnpur District in KBK region of Orissa: A Societal Need	Dr. Satyanarayan Hota

S. No.	Title of the paper	Speaker
8.	Multi- to Interdisciplinary Disaster Management Paradigm in Higher Education, Research & Communication: Infusion Models	Dr. Anil K Gupta Prof. Mohammad Yunus Prof. R M Mishra
9.	Child Rights to Disaster Safe Education- Case Study of School Safety Programme in Delhi	Dr. Amir A. Khan Mrs. Shagufta N. Khan

Thematic Cluster – H: Disaster Response

Thematic Session H1: Role of Armed Forces, NDRF, Police & Civil Defence

S. No.	Title of the paper	Speaker
1.	Key note address: Role of Armed Forces, NDRF, Police & Civil Defence	Mr Arjun Katoch
2.	Role of NDRF in Disaster Management	Mr.R.K.Bhatia
	Origin and inception of NDRF	Sh. Mukul Goyal
	Role and responsibility of NDRF	Mr. Alok Avasthy
	Role of Police in Disaster Management	Mr. R K Sinha
3.	Role of Armed Forces in Disaster Management	Dr. Amarjeet Kaur
4.	NCC Cadets can do better in Disaster management	Prof Dhiren Vandra
5.	Discussion/ Questions & Answers	Speakers & Delegates

Thematic Session H2: Incident Command System

S. No.	Title of the paper	Speaker
1.	Introductory Remarks	J.K. Sinha
2.	Adaptation of the Incident Command System in Australia; evolution of ICS lessons learnt & best practices	Supt. Brian J. Graham
3.	Functioning of bureaucratic system during emergencies	Dr. B. Ashok
4.	Applications of ICS in response to Kosi Flood, 2008	Sh. P. N. Rai
5.	Institutionalization of the Incident Command System (ICS) in India	Dr. M. Bhaskar Rao
6.	Institutionalization of Incident Command System (ICS) for Effective Emergency Response Management	Col AKS Parmar
7.	Guru-Da-Gaddi Celebration at Nanded – application of ICS	Col. V. N. Supnekar
8.	Allocation of ICS in Orissa	Dr. Kamal Mishra

S. No.	Title of the paper	Speaker
9.	Implementation of ICS in Management of Religious Events in Maharashtra	Col. V. N. Supanekar
10.	ICS Piloting Process in Assam	Shri Debaprasad Mishra
11.	ICS Experience on Hurricane Katrina in New Orleans, US	Himadri Banerjee

Thematic Cluster – I: Emergency Health Management

Thematic Session I1 & I2: Public Health Emergencies and Mass Casualty Management

S. No.	Title of the paper	Speaker
1.	Overview on mass casualty incidents	Prof. M. C. Misra
2.	Modus operandi of the emergency number 108	Dr. Dnyaneshwar Shelke
3.	Public Health Response after Heavy Rains in Mumbai	Dr. Ranjit Mankeshwar
4.	Importance of Community Health Assessment through Community Based Approach in Post Disaster Period	Ms. Jasmine Mini
5.	Preparedness of Delhi Hospitals against mass casualties, with reference to COMMONWEALTH GAMES, 2010	Dr. Ratna Sud
6.	Information Communication Technology Facilitate Better Response to Public Health Emergencies?	Sh. Rajagopal
7.	Improve Quality of Lifeline Services to Achieve DRR	Shri Pradeep
8.	Impact of flood on health of under five children: A study on Diarrhea in Baharaich district, Uttar Pradesh	Shri P. C. Joshi
9.	Role of ICT in Emergency Health Management –H1N1 Pandemic Preparedness and Response	Shri K.Rajasekhar
10.	Kosi river floods 2008 Bihar- Collateral benefits of the polio eradication infrastructure-	Shri Sahil Pall
11.	Policies and Programmes Addressing Preparedness for Appropriate Infant Feeding Practices during Disasters in South Asian Countries	Dr. J. P. Dadhich
12.	A strategy to promote risk reduction in public health emergencies	Shri Srikrishna S. Ramachandra

Thematic Session I3: Disaster Psychosocial Care & Mental Health

S. No.	Title of the paper	Speaker
1.	Welcome Address	Dr. K Sekar
2.	Opening remarks	Dr. D Nagaraja
3.	Key Note National Speaker	Sh. Mukul Goyal
	Dr. J R Bharadwaj	Mr. Alok Avasthy
4.	Invited International Speaker Guidelines on Management of Psychosocial Support and Mental Health Services in Disasters	Mr. R K Sinha
5.	Overview	Dr. JayKumar C.
6.	Strengthening Communities and Recovery through Psychosocial Support	Dr. Subhasis Bhadra
7.	Impact of Events among the Community Level Workers in Disaster Rehabilitation Services	Dr. Jaykumar C.
8.	Holistic Approach to Disaster Management-Lessons from the Past for Future Directions	Prof. L. S. Gandhi Doss
9.	Psychological Risk-analysis of Terrorism	Nidhi Maheshwari V. Vineeth Kumar
10.	Coping and Social Support among the Survivors of Disasters	Sh. Subhasis Bhadra

Thematic Session I4: Pandemics

S. No.	Title of the paper	Speaker
1.	An introduction to pandemics and global scenario of H1N1 Influenza	Dr. R. K. Sharma
2.	The Epidemiology of H1N1 influenza and its progression	Dr. Rajesh Vaidya
3.	Mitigation strategies for management of Pandemic influenza A H1N1	Dr. P. Ravindran
4.	Role of Laboratory in Pandemic Influenza A H1N1	Dr. Shashi Khare
5.	The role of alternative medicine in pandemic H1N1 Influenza	Dr. Rajesh Arora
6.	Importance of Hospital preparedness and intensive care during pandemic H1N1 influenza	Dr. Shakti Gupta
7.	Issues of Pharmaceutical intervention in H1N1 Influenza in India and abroad	Dr. Y. K. Gupta
8.	Public health issues and role of State Government in the pandemic	Dr. R. P. Vashist
9.	Importance of Public private participation in pandemic H1N1 Influenza	Dr Aruna C Ramesh
10.	Psychosocial Impact of Pandemic Influenza (H1N1)	Dr. Jayakumar
11.	Work Continuity Plan for H1N1 Pandemic	Maj Gen J. K Bansal
12.	Role of International Agencies in Pandemic Influenza	Dr. Sampath Krishnan

Thematic Cluster – J: Emerging Issues and Concerns

Thematic Session J1: Climate Change

S. No.	Title of the paper	Speaker
1.	The recent projections of climate change over India	K. Krishnakumar
2.	Adapting Indian agriculture to global climate change	P.K.Agarwal
3.	Climate change and its impacts on the water resources with a special emphasis on floods and droughts disasters	R.D.Singh
4.	Early Warning System and Disaster communication in changing climate Scenarios	D.R.Sikka
5.	Global warming and the Characteristics of Water under changing climatic conditions: A critical review	Sudip Mitra
6.	CC adaptation to water induced hazards: a study in the flood plains of the Brahmaputra river basin in eastern Assam	Dr. Partha J. Das
7.	Glacier lake monitoring using remote sensing and GIS in the baralalacha la region, Himachal Himalaya	Rajesh Kumar
8.	A comprehensive glacial lake outburst flood risk assessment in the hindu kush–Himalayas	Arun B. Shrestha
9.	Performance of DRR strategies in changing climate: A case study of eastern UP	Praveen Singh
10.	Empowering Communities to understand climate change	Colin Fernandez
11.	Climate Change adaptation: Is it all about 'good' development	Harjeet Singh
12.	Climate Change: To learn to adapt is the best policy	Vinson Kurian

Thematic Session J2: Urban Risk Mitigation

S. No.	Title of the paper	Speaker
1.	Development of Risk and Vulnerability Analysis model in a Regional Context	B.K. Sengupta Haimanti Banerji
	Adapting Indian agriculture to global climate change	P.K.Agarwal
2.	Capacity Development for Strengthening Disaster Preparedness, Mitigation and Management at the level of Urban Local Bodies	T.N. Gupta
	Early Warning System and Disaster communication in changing climate Scenarios	D.R.Sikka
3.	Predicting Urban Heat Island (UHI) Risk and Micro-Climat Change In Delhi Metropolitan Region Using Geoinformatics	Sh. R. B. Singh

S. No.	Title of the paper	Speaker
4.	Transportation Issues in Disaster Management	Pawan Kumar S.Y. Kulkarni M. Parida
5.	Fire Following Earthquake and Role of GIS	Sh. R. C. Sharma
6.	Micro-tremor studies of Heritage buildings	Y. Pandey P.K.S. Chauhan
7.	Disaster Risk Reduction Through Urban Planning	Ashwani Luthra
8.	Climatic Resiliency for Indian cities	Mahua Mukherjee
9.	Integrated Urban Development With Real Time Urban Hazard Information	Sudhakar. K
10.	Amendments in Town & Country Planning Legislations for safety in Natural Hazard Zones of India	Ved Mittal

Thematic Cluster – K: Corporate Sector in Disaster Management

Thematic Session K1: Corporate Sector in Disaster Management

S. No.	Title of the paper	Speaker
1.	Lessons Learnt and Public Private Partnership in Business Continuity	R Magesh Babu N Murali
	The Epidemiology of H1N1 influenza and its progression	Dr. Rajesh Vaidya
2.	Disaster Management in Indian Aviation Sector: A Bangalore Greenfield Airport Model	K.J Devasia
3.	Government policy and guidelines on Corporate Business Continuity Planning	Karthik Vaidyanathan
4.	BCM in a disaster affected area	Patrick Kishore
5.	Corporate sector in Disaster Management	Sh. Venkataram Arabolu
6.	Panel Discussion	Dr. Goh Mo Heng Mr. Patrick Kishore Mr. Murali Mr. Karthik Vaidhyathan
7.	Session Round Up	Mr. Dhiraj Lal
8.	Vote of Thanks	Dr Chandan Ghosh

Thematic Cluster – L: Media and Disaster Management

Thematic Session L1: Role of Media and Disaster Management

S. No.	Title of the paper	Speaker
1.	W.A. Naqvi, Executive Producer	Aaj Tak
2.	Ravish Kumar, Journalist	NDTV
3.	Prof. Santosh Kumar	NIDM

Thematic Cluster – M : Post-Disaster Recovery

Thematic Session M1: Post-Disaster Recovery and Reconstruction: International Experience and Best Practices

S. No.	Title of the paper	Speaker
1.	Sustainable recovery and reconstruction framework	Christoph Pusch
2.	Rebuilding Kobe – Experiences from Japan	
3.	Earthquake reconstruction in Latur India	Krishna Vatsa
4.	From reconstruction to mitigation - Turkey	Salih Erdurmus
5.	Reconstruction experiences after Gujarat earthquake	Ranjan Banerjee
6.	Reconstruction experiences of Post-Tsunami - Aceh	Kedar Verma
7.	Reconstruction experiences in Tamil Nadu after Indian Ocean Tsunami	CV Shankar
8.	Reconstruction experiences after Pakistan earthquake	Gen. Sajjad Akram
9.	Towards the Development of a comprehensive framework of recovery and reconstruction in South Asia	PG Dhar Chakrabarti

PROCEEDINGS

Inaugural Session

Inaugural Session

The Second India Disaster Management Congress held in Vigyan Bhawan, New Delhi from 4-6 November, 2009. The inaugural session started with the presentation of bouquets to the dignitaries and lighting of the ceremonial lamp.



Mr. P. G. Dhar Chakrabarti, Executive Director of the National Institute of Disaster Management welcomed

Gen. N. C. Vij, Hon'ble Vice Chairman of the National Disaster Management Authority and other dignitaries on the dais which included Mr. G. K. Pillai, Union Home Secretary, Ms. Margareta Wahlstorm, UN Assistant Secretary General for Disaster Risk Reduction, Mrs. Aruna Roy, distinguished Social Activist, Professor A. S. Arya, Professor, Emeritus and Dr. Nitin Desai, Former Under Secretary General and currently Member of Prime Minister's Panel and Climate Change, Dr. Amit Mitra, Secretary General, Federation of Indian Chambers of Commerce Industry and Mr. Roberto Zagha, Country Director, World Bank in India.

Mr. Chakrabarti explained that four factors provided impetus to the planning and designing of the Indian Disaster Management Congress. First, in India, as in the rest of the world, the concept of disaster management is undergoing a metamorphosis - from management of the events of disaster to comprehensive management of the risks of disaster. This requires looking into the nature and the causes of the natural and man-made hazards, the social and the economic vulnerabilities of the people, the consequences of disasters and the tools and methodologies for prevention, mitigation and preparedness of disasters. This has necessarily involved a large number of disciplines and subjects into the field of disaster management from the earth sciences to material sciences, from civil engineering to information and communication technology, from medicine and



mental health sciences to social sciences and behavioral sciences, public administration and management. This multi-disciplinary interaction resulted in a phenomenal upsurge of knowledge and research on Disaster management. Secondly, repeated events of disasters in this part of the world and the sufferings to millions of people, has brought about a large number of government and non-government and inter-governmental organizations into the field of disaster



management. The day-to-day experience in responding to the events of disasters and reducing the risks of disasters, and the process of recovery and re-construction, has generated wealth of knowledge and good and bad practices on disaster management, which need to be shared, discussed and analyzed. Thirdly, as the knowledge on disaster management is expanding, it is also getting fragmented in multiple disciplines, micro disciplines, sectors and compartments. The canvass of research in this field is also getting so fragmented that often it gives only a tunnel vision, missing the overall framework, contexts and objectives. Therefore, there is a need for more inter-disciplinary interaction among the scientists, scholars and policy makers and practitioners on disaster management. India Disaster Management Congress has been designed to provide such a platform for interaction among scientists, researchers and practitioners on a wide range of issues. Concluding his address, he urged all to pay homage to those poor men, women and children who lost their lives and suffered in the Orissa Super Cyclone a decade back. The untold sufferings of hundreds of thousands of unknown people contributed to the evolution of the modern disaster management system of the country, he said.

Mr. G. K. Pillai, Union Home Secretary, Government of India congratulated the National Institute of Disaster Management for taking the initiatives in planning, designing and organizing the 2nd India Disaster Management Congress. He mentioned that the country has faced four successive mega disasters in short span of 12 years. Each one of these disasters had killed more than 10,000 people and affected the livelihood of millions and damaged the assets worth billions of dollars. Valuable lessons have been learnt from many of these disasters and there has been improvement in



holistic management of disasters at all levels. He informed that National Institute of Disaster Management, which has established its branches all over the country, is training more than 25 thousand cutting edge functionaries of Government and Non- Government organizations. A knowledge conference like the IDMC where hundreds of minds of scientists, researchers and practitioners would assemble and interact on the burning issues of disaster management should surely to be of immense value and significant to all. He added that the Government would look forward to the outcome of the Congress and its recommendations. He assured that all major recommendations of the Congress would be followed up in a time bound manner.

Ms. Aruna Roy, Social Activist stated that when disasters occur, whatever nature they may be, the large majority of people on whom it is impacted are the poor, underprivileged and the people who cannot really raise their voice to protest. Although, there is no control over natural disasters but the repeated occurrences of manmade disasters are matters of very serious concern. In the name of development, rampant constructions are put up ignoring the inherent laws of nature. While advocating the people's right to know, she mentioned that people should be timely warned about disasters, and also should be informed how to manage them. Every useful information should be shared with the



people and there should be accountability and proactive transparency at all levels. These are some of the issues, the congress should address. Secondly, people should be involved with the management of disasters. In this context, she pointed out that public administration in many countries is fraught with corruption and it takes away the quality of the management. Therefore, there is a need for transparency and accountability which can make disaster management efficient and responsive. She concluded her address by quoting from "Speaking Truth to Power" by Jeremy Cronin, a poet from South Africa that 'we have to speak truth to power, make truth powerful and power truthful'. In larger sense, if this is done, disasters will be better managed. She urged the delegates to look at the transparency and accountability provisions, as a system and as a part of management exercise to contain disasters.

Dr. Nitin Desai, Member, Prime Minister's Council on Climate Change, stated that when the word disaster is used, it usually means a sudden event, an earthquake, volcanic explosion, a Tsunami, but there are slow onset disasters like drought, or other types of hydro-meteorological emergencies like, floods or cyclones, which may build up over days or weeks; or a sudden large scale epidemic or may include manmade events which may cause large scale damage to lives and properties. Climate change would definitely impact on hydro-meteorological disasters; but the impact of climate change is slow, tedious, bit by

bit, and is like a slow illness which one tends to ignore. The two key areas which he talked about are the glacier melt in the Himalayas and the problems in the Sunderbans. The slow but definite melting of glaciers would increase the risks of glacial lake outburst, which means a vast quantity of water will flow down resulting in incidents of floods, particularly in the eastern flowing rivers in India while in the long run there would probably be an increase in water shortages. He added that to handle such a situation we can certainly make assessments of the risk involved and to see what sort of action can be taken to anticipate, to ensure that the impact is not quite as large as it could otherwise be. Therefore, the question of climate change requires an examination of all these issues, not just on the basis of historical data, but also on the basis of how these things are likely to change because of climate. He stressed that we need to be better prepared in anticipation of disasters, and design appropriate strategies for coping with all of these varieties of possible extraordinary events. He concluded by saying that nothing that is being done is going to work unless an effective local governance is in place. It is the arrangements at the local level in the villages and districts which are really going to prepare the country for coping with disasters and climate change. He wished the congress a success and hoped that deliberation in the congress would address these issues and the country would look forward to the outcome with great interest.



Prof. A. S. Arya, Professor, Emeritus of IIT Roorkee, mentioned that there are two huge problems so far as earthquake is concerned in this country or in the SAARC region. First is the safety of new constructions. Second, a huge unsafe stock of buildings in this region and the plan of action in this regard. As per 1991 census, there were 197 million units, and the number has increased to 249 million in 2001 census out of which 111 million are brick buildings and about 76 million housing units are adhoc or kachcha. He posed a question that whether these units are safe against the disasters, such as earthquakes, floods, cyclones, etc. The answer will be almost NO. Therefore, the government has a huge task to ensure that whatever is built should be disaster resistant. The important



question now is how to achieve zero tolerance against disasters and make the buildings safe. In this regard, he mentioned about the available technology to retrofit the existing building to make them safe, and advocated that the local bodies must revise their 'building by-laws' so that the dwelling units/buildings are strengthened from the earthquake and other disasters. While talking about new buildings, he raised the issue in relation to Indira Awas Yojana houses. It was pointed out that the funds provided by Central Government are so inadequate that no safety against any disaster can be built in those houses. Therefore, there is a need to look at this problem to build disaster safe houses, for which adequate funds should be provided by the Government.

Dr. Amit Mitra, Secretary General, FICCI in his address mentioned that last decade witnessed some of the worst disasters in the world resulting in enormous economic and financial losses, destruction of industrial activity, all of which leads to issues of employment, livelihood and small and medium enterprises. Loss of human life, injuries and casualties are the key areas of concern. He stated that although industry is aware, but not enough in terms of end to end process in industrial projects right from inception, planning to the end regarding disasters and for that matter even emerging market industries and perhaps some in the developed world are not quite in tune with the concept. He elaborated that National



Disaster Management Authority, FICCI and NIDM have worked together, still a lot is to be accomplished. He further added that since Ministry of Home Affairs stands at the centre of this process, FICCI would like to continue with its support and contributions in future, as well. He explained the work done by FICCI in Gujarat Earthquake. In this regard, he recognized the contribution made by Dr. Arya in providing an earthquake resistant modular housing design. He explained the problems he encountered in the reconstruction phase of the Gujarat earthquake. The Gujarat example was quoted as a successful PPP model. He expressed concern that, although there has been sustainable industrial growth during last 10 years, but in the process, there are massive information gaps, consciousness gaps and most importantly the will of the entrepreneur to include disaster management in their system. He explained the initiatives taken by FICCI in conducting training programmes, workshops on Disaster Risk Reduction and International conference and Special Data Infrastructure (SDI) with department of science and technology, marine hazards with science and technology department, national conference on chemical disaster management. The biggest challenge now is how in the midst of phenomenal growth, phenomenal entrepreneurship development, resource generation, the profits could be re-invested back into the system, to bring disaster management in the centre of corporate activity.

Ms. Margareta Wahlstorm, UN Assistant Secretary General and Special Representative of UN Secretary General on Disaster Risk Reduction, in her address stated that the timing of this conference is very significant considering the enormous challenges that are posed by the impacts of the growing risks and natural disasters. There is irrefutable and clear evidence that disaster trends are increasing, resulting in increased economic losses. Much of these increasing disaster losses are the result of a very rapid economic growth leading to increased exposure of economic assets and infrastructure to hazards. This global economic growth has certainly not been disaster resilient and if rapid economic growth has to



be sustained, economic growth has to be made disaster resilient as well. Although comparatively, we are better prepared, but that is not enough. Since economic losses due to disasters have impacted both poor and developed countries, many countries, including developed countries, are taking steps to find ways to reduce disasters losses and India is a leading member of this group of nations to strengthen their national resilience. She lauded India's efforts towards reducing disaster losses and mentioned about some very significant achievements, such as, the launching of the comprehensive institutional measures to reduce disaster losses. In this regard, she mentioned about the setting up of NDMA, with a very tightly woven structure over the country and with the clear objective to build a safer and a more disaster resilient nation. The Disaster Management Act has mandated the constitution of the National Disaster Response Force for deploying all types of threatening disaster situations and the National Institute of Disaster Management with its role to lead the excellence of human resources development at national level that would help increase the knowledge overall. In terms of best practices, India has clearly set the pace also in financial monitoring and planning process that serve as a model for other countries to follow. There was a strong call for increasing focus on risk reduction. In trying to address this challenge a phenomenal upsurge in knowledge and research on the subject of disaster management across a very wide range of scientific disciplines has been witnessed. This congress is also part of the global effort to increase knowledge. But in this regard it was mentioned that the UN global assessment report on disaster risk identifies that the scale of current financial investments and local capacity is indeed inadequate to convert that knowledge into disaster resilient infrastructure and livelihoods. And in this context this Congress will help to understand and how to scale up such investments.

She mentioned that there will be discussions on wide range of thematic sessions in the Congress. But one underlying theme is that disaster risk reduction is everyone's responsibility. While concluding her address she called upon to ensure that risk reduction is an obvi-

ous component of a resilient and sustainable development. With this integrated approach, to Disaster Risk Reduction and with its emphasis on prevention, mitigation and excellent preparedness and response countries like India and many others will be able to preserve its future and current development investments and to minimize the losses to lives, livelihoods and property. She wished the Congress great success.

Mr. Roberto Zaghera, Country Director, World Bank in his address, mentioned that natural disaster has been part of human history and will continue to do so. These cannot be stopped but the effects can be mitigated and managed. India has made great strides in moving from reactive emergency response to proactive risk mitigation which is the source of the reduction of costs. India is the leader in the field of disaster risk management and preparedness. The Disaster Management Act, the creation of the National Disaster Management Authority, the formulation of National Policy Guidelines to ensure more than management of various



hazards and the development of flexi programmes and emergency preparedness, cyclone risk mitigation and earthquake preparedness are remarkable achievements. These are the examples for other countries to adopt. Throughout the world, the World Bank has made disaster management a central theme of its work because for variety of reasons, including the costs of disasters and the long term economic impact of disasters. He mentioned that this Congress is a great opportunity to share knowledge and research and thanked NIDM for providing an avenue for enhancing the multi-dimensional knowledge and understanding of disasters and their mitigation.

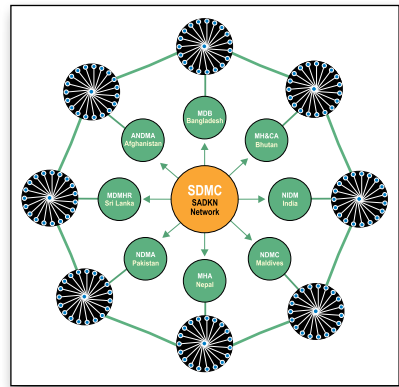
Gen. (Retd.) N. C. Vij, PVSM, UYSM, AVSM, Hon'ble Vice Chairman, NDMA, deeply appreciated the various views and the concerns expressed by some of the panelists and assured that all the concerns, the entire gamut of the disaster preparedness in the country is being attended to seriously. The Disaster Management Authority as the apex body in the country in the disaster management, have taken concerted steps to realize the vision of a disaster resilient India. He appreciated and placed it on record the contribution made by the National Institute of Disaster Management. He added



that the disaster management policy which is being announced soon will highlight the paradigm shift in the approach to disaster management. The major areas of concern has been the mainstreaming of disaster management into the field of the governance of the country. In this regard, he mentioned about structural measures taken by the Ministry of Finance in issuing instructions that any new infrastructure which has to come up into the country will have to go through a disaster resilience audit. As far as the non-structural measures are concerned, these are being supported in a big way by preparing the community making them beware to face the disasters as the first responders themselves in a far better equipped and trained manner. Also, in the field of education, awareness generation is being attended to in a big way and also the national disaster response force have been raised at the various levels. Among other initiatives which are in the offering is with regard to forecasting and mentioned that revamp of the IMD is underway. He further elaborated various initiatives taken by NDMA such as GIS platform, vulnerability analysis and risk assessment and forecasting and early warning systems and disaster resilient habitat and mitigation projects which are in the offing. One of them is the communication and information system, very important in case of nuclear and radiological emergencies. Another Pilot project on the school safety will be undertaken. It was further informed that the education on disaster curricula is being imparted. He also highlighted the on-going training programmes for various levels in government. The endeavours of NDMA have involved NCC cadets and NYKS in conducting various mock drills involving schools in various parts of the country. To handle emergency situations, NDMA has raised 8 battalions of NDRF and 2 more battalions are underway. These battalions will have the support of good state of equipment and also equipments for handling the chemical and radiological emergencies. He landed the role of NDRF battalions during Kosi floods. It was also informed that process has started for revamping of civil defence and the civil defence is now going to be district centric rather than the town centric model. NDMA has also approached the corporate to look into their corporate social responsibility and contributes towards better preparedness in the field of disasters in the country, by way of contributing in their own areas of interest, in their own areas of expertise and they can contribute in the areas of making sure that the school buildings in the areas in the districts in which they have set up their industry are being taken up for disaster resilience. He hoped that with all these initiatives, the country would be in a better position in another 5-10 years to handle disasters most effectively. He thanked all and wished the congress a success.

Launching Beta Version of SADKN

Gen. (Retd.) N. C. Vij, Hon'ble Vice Chairman, National Disaster Management Authority launched the beta version of South Asia Disaster Knowledge Network (SADKN). The portal will act as the gateway for sharing of information and resources on every type of natural and manmade disasters in South Asia. SADKN will provide decision makers with the needed geospatial context for assessing hazards, vulnerabilities and risks of disasters in the region. It will contain information on the entire range of the disaster management life cycle from risk assessment, to prevention, mitigation, early warning, response, recovery



and reconstruction. This portal will provide ready access to clear, understandable, user-friendly information about emergency management and updates about the disaster and other services like that of weather forecast, discussion forum, geographic & thematic maps etc, which are integral to managing disaster. SADKN is a network of networks that would link the government agencies, scientific, technical, and academic institutions, NGOs, corporate sector and individuals of South Asia to share knowledge on disaster management.

Presentation of Disaster Mitigation Awards

Disaster Mitigation Awards under individual and institutional categories were presented by Hon’ble Gen. N. C. Vij, Hon’ble Vice Chairman, NDMA

In recognition of his significant contribution to DRR in Nepal and in the rest of world, the Congress honoured Mr. Amod Mani Dikshit Founder President of National Society for Earthquake Technology (NSET) Nepal with the Disaster Mitigation Award in Individual category.



Citation of Disaster Mitigation Award to Mr. Amod Mani Dikshit

“Born in 1948 in Kathmandu Valley of Nepal, Mr. Amod Mani Dixit studied Geological & Mineralogical Sciences from the Leningrad Mining Institute, Russia and Geotechnical Engineering from the Asian Institute of Technology, Bangkok and earned Master’s Degree in both the disciplines. He started his professional career in 1973 with the Department of Mines & Geology, Government of Nepal which he served for 6 years before he joined a private engineering consulting firm as its Director. He founded the National Society for Earthquake Technology - Nepal in 1994 and is being working as its Executive Director since then.

Mr. Dikshit was driven by a firm conviction that scientific knowledge of geology, seismology and engineering should be demystified and a massive awareness built among all the stakeholders, particularly the vulnerable communities in the rural and the urban areas, to build a safe habitat that can withstand the hazards of nature. For this purpose he undertook a number of innovative projects for reducing the risks of disasters, many of these funded by bi-lateral and multi-lateral agencies. Some of these projects include the School Earthquake Safety Programme, Municipal Earthquake Risk Management Programme, Mason Training Programme, Shake Table Demonstration project, Programme for Enhancement of Emergency Response etc. Many of these programmes have been implemented in several countries of South and South East Asia. NSET today is one of the very few South Asian NGOs that have a global presence.

Mr. Amod Mani Dikshit has played a key role in the development of several policies and programmes on disaster management in Nepal, including the recently announced National Strategy for Disaster Risk Management. It was largely due to his initiative that January 16 is observed as the Earthquake Safety Day in Nepal to commemorate the devastating earthquake of 1934. His contribution for several global initiatives on earthquake risk management has been widely acknowledged.

The Congress awarded Disaster Mitigation Award in the Institutional category to the Indian National Centre for Ocean Information Services (INCOIS) for the significant contribution it made for the development of Multi-Purpose Tsunami Early Warning System for the region.



Citation of Disaster Mitigation Award to INCOIS

“The Indian National Centre for Information Services (INCOIS) is an autonomous body under the Ministry of Earth Sciences, Government of India set up with a mission to provide ocean information and advisory services to the society, industry, government and scientific community through sustained ocean observations and constant improvements through systematic and focused research.

Initially conceived as a provider of operational data and services, INCOIS has been transformed into a knowledge and information technology enterprise for the oceanic realm. They have carved a niche for themselves by providing operational ocean information to the entire country using advances in Space technology. Ocean science and ICT which is now being adapted by several countries in the Indian Ocean region. Further, they serve as observer of the Indian Ocean using cutting edge technology, including the Argo profiling floats. INCOIS is the Regional Data Centre and Regional Coordinator of International Agro Project in the Indian Ocean region. It also operates as a secretariat of Regional Alliance for Global Operation Observation System in the Indian Ocean region.

Following the Indian Ocean Tsunami in December 2004, the INCOIS was entrusted with the prime responsibility for establishing National Tsunami Early Warning System in collaboration with various national institutes. The system that has been set up comprises a real-time network of Seismic Stations, Bottom Pressure Recorders and Tide gauges to detect Tsunamigenic earthquake and to monitor tsunamis and their arrivals. It operates round the clock on data reception, display, analysis, modeling and decision support system. It generates and disseminates timely advisories to the Emergency Operation Centres of Central and State Governments for further dissemination to the public. For this purpose, a satellite based Virtual Private Network for Disaster Management Support has been established. The efficiency of this end-to-end system was proved during the large under-sea earthquake of 8.4 M that occurred in September 12, 2007 in the Indian Ocean”.

Prof. Santosh Kumar, Head of the Policy Planning Division, NIDM summed up the inaugural session and expressed sincere gratitude and a vote of thanks to the dignitaries and the participants of the inaugural session. He expressed sincere thanks to all partner organizations for their generous financial support to make the congress a success.



Earthquake

Concept Note

Earthquakes represent a risk in many parts of the world, particularly Western South and North America, China, Japan, Philippines, Iran, Turkey and northern part of India, to name a few of the higher seismic risk regions. Assessing the seismic risk, determining mitigation alternatives and making a decision about what to do and doing it adequately with the utilization of knowledge, methods and data from disparate fields, including the geosciences, engineering, emergency planning, business continuity, insurance and economics, form the gamut of earthquake risk management process. Effective disaster reduction depends upon a multi-sectoral and interdisciplinary collaboration among all concerned stakeholders. While there have been notable achievements in the mitigation of natural hazards in recent times and while awareness of risk from natural and environmental disasters has considerably increased in global scale, there remain areas where loss of life and impoverishment of large communities continue to increase at an alarming rate. The severity and frequency of disasters and their impact on the society will intensify in near future, thus requiring the urgency for sustained strategies to reduce disaster risk. In the 2nd India Disaster Management Congress (IDMC-2009) all level decision makers (from ministers to local authorities), scientists, technocrats, leaders of the executive and legislative powers, doctors, social activists, NGOs & INGOs, relief organizations, business corporate, representatives from private sectors and media are invited to take part and help devising strategy for the reduction of disaster impacts on the population, vital infrastructure and property.

About 59% of India's geographical area is under the threat of moderate to severe earthquakes. The increase in demographic pressure, unplanned and ill-planned development practices and poor quality construction techniques have contributed immensely to the proliferation of seismic risk. Almost the entire northeast region, northern Bihar, Himachal Pradesh, Jammu & Kashmir and some parts of Kutch are in seismic zone V (IS 1893 - 2002), while the entire Gangetic plain and some parts of Rajasthan are in seismic zone IV. In the last 19 years the country has experienced eight major earthquakes that took more than 25000 lives and thereby affecting the local or regional economy. The effect would be colossal if such earthquakes hit metro cities where developmental activities are alarmingly high. In India, where 90% of the population lives in buildings built without proper guidance from qualified engineers and architects, occurrence of an earthquake of even a medium scale spells disaster.

The country has been classified into four macro-seismic zones indicating the intensity of damage or frequency of earthquake occurrences. These zoning maps indicate broadly

the seismic coefficient that could generally be adopted for design of buildings in different parts of the country. These maps are based on subjective estimates of intensity from available information on earthquake occurrence, geology and tectonics of the country. The Indian seismic zoning is a continuous process, which keeps undergoing changes as more, and more data on occurrence of earthquakes becomes available.

Context

National policies on earthquake risk mitigation, preparedness, emergency response, and recovery and reconstruction, individually and collectively shall be addressed to:

Reduce increasing the risk to people, building stock, and lifeline infrastructure that future construction and urban development will lead to increased earthquakes.

Start decreasing the risk to community, businesses, organizations, buildings, and infrastructure already placed at risk to future earthquakes by the vulnerabilities of past urban developments. Devise planning and implementing ways to respond to and recover from the inevitable earthquake, including the unthinkable extreme event—a catastrophic earthquake in the Himalayan belt or Tsunami effect due to oceanic subduction plate movement—that will severely disrupt the production, distribution, and financial systems of habitat, industries, vital establishment and the nation as a whole.

Ensure implementation of bye laws relating to earthquake resistant design and constructions To spread awareness amongst vulnerable communities to develop seismic hazard and risk microzonation map in order to examine and evaluate seismic safety of their own dwellings and to take measures for the retrofitting of the buildings.

Seismic risk reduction demands a systematic evaluation of the hazards, vulnerability and risk mapping of the entire region. Town and Country Planning Acts, Master Plan, Development Control Rules and Building Regulations of some of the metro cities in the country have mentioned adequately on the importance of safety requirements against natural hazards. Moreover, roles and responsibilities of different stake holders namely, owner, builder, developer, architect, engineer and the personnel in the regulatory bodies/authorities have been defined but they are not adequately put to practice due to lacking in performance oriented testing, mockdrill and accountability of disaster safety measures in the form of pilot projects.

As per guideline issued by National Disaster Management Authority (NDMA) many states have already formulated broad Disaster Management Plan, keeping in view the nature of natural and man-made disasters likely in the State with appropriate response mechanism for action at various levels, starting from State level headquarters through the district headquarters, towns down to the local village units. Appropriate preparations keeping in view the State level disaster mitigation plan in respect of preparedness, prevention, capacity building, training, mockdrills, the nature of equipments and machinery needed to be provided for has been underway.

Proceedings

This session started with brief introduction of the all the three Keynote speakers by Dr Chandan Ghosh, NIDM, along with the session overview, in which selected present-

tations in five thematic categories, such as 1) Earthquake resistant design, 2) Seismic Microzonation & Earthquake forecasting, 3) Seismic rehabilitation and retrofitting, 4) Earthquake forecasting and early warning and 5) Post earthquake reconstructions. Out of the 55 abstracts received 22 presentations were made.

Prof. A S Arya, in his keynote address on “**Application of earthquake resistant design guidelines and Enforcement mechanism– Indian context**” expressed that structural designers must pay attention to the determination of earthquake forces based on codal provision. Mentioning about the no. of BIS Codes on earthquake resistant design of buildings, he stressed for the mandatory uses of design Codes. The Codal provisions must be incorporated in the Building Byelaws of the Local Bodies so that they could be enforced legally. Further, he mentioned that there is an urgent need of large scale capacity building of architects, structural and other professional engineers along with the masons and bar benders etc. Prof. Arya also explained various kinds of structural failure of buildings during past earthquakes, including soft storey failure and damaged brick and reinforced concrete buildings. Some of remedial measures/techniques available with the BIS and BMTPC have been explained by him. In conclusion, he has pointed out the necessity of earthquake vulnerability and risk assessment of buildings as an essential item in the national guideline prepared by NDMA.



Dr. D.K. Paul, IIT-Roorkee spoke on “**Retrofitting of a Hospital Building – Delhi earthquake safety initiatives**” and briefed the audience about the criteria for the selection of the five buildings, namely Delhi Sachivalaya, Police Headquarters, GTB Hospital, Divisional Commissioner’s Office and Sr. School at Ludlow Castle. Push over analysis of a ward block of GTB hospital was presented, showing plastic hinge formation at target displacement while taking into account of the bare and infilled frame. The beams and columns of the ward block were found safe for shear at target displacement and they were also safe for shear due to off-diagonal action of infills.



Dr. K. Muthumani, SERC, Chennai, made a presentation on “Earthquake test facility at SERC, CSIR- towards disaster preparedness of India”. He apprised the audience with the country’s most advanced 3-D Shake table testing facility created at SERC. Some of the works being carried at SERC are: 1) Computer based tools for seismic analysis and strength evaluation of existing buildings, 2) Development of suitable retrofitting schemes for the various structural elements and systems, 3) Regional risk and vulnerability analysis of RC framed structures & unreinforced brick masonry buildings. The shake table can generate either full scale or scaled ground motions representing any design spectrum, in all three orthogonal directions. While describing the new shake table facility with features like Synchronous operation of the two tables, Pseudo-dynamic testing through which seismic tests can be performed without inducing any time-dependent inertial forces Dr. Muthumani showed tests carried on RC frames with soft storey, Indian type brick buildings etc. with video clips.



Mr. Yogendra Singh, IIT-Roorkee presented his paper on “**Earthquake Resistant Design and Construction Practices in India**”. Based on the field survey conducted in the National Capital Region to assess the expected seismic performance of multistorey buildings, he has categorized the common deficiencies found in the buildings as per FEMA-310. Regularity of building plans and elevations and adequacy of building structures in shear and overturning were explained. He explained that a majority of the buildings are ill prepared to handle the ground shaking hazard expected in the area as per Indian seismic design code, indicating a very poor enforcement of code. An investigation of the construction practices prevailing in the area also reveals that the ductile detailing practices as per Indian code of practice are not being followed. He has used ASCE-41 methodology for assessment of building performance and HAZUS methodology for assessing the seismic fragility of buildings. Capping on the design period, as specified by the code, is the most crucial provision for controlling the expected performance of the buildings. The presenter opined that there is two fold increase in the design base shear if design period as per India codal specification is adopted.



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Girish C. Joshi, DMMC, Dehradun, presented his paper on **“Construction Techniques: A Case Study of Earthquake Resistant Construction in State of Uttaranchal”**. The presenter opined that even after immense progress in earthquake engineering, overwhelming large proportion of the building stock still has lower standards of earthquake safety and these would give way in case of earthquake. Public, at present, do not adhere to correct design and construction methodology while using modern seismic design methods or even the use of our indigenous practices. Case study of Uttarakhand State clearly brings forth deterioration of time tested indigenous construction practices and proliferation of nonscientific and improper use of concrete. He stated that such a lacuna adds to the vulnerability of the region that is at present much higher than what it was a decade before when the region last experienced a major quake.



Keya Mitra, BESU, West Bengal, made a presentation on **“Proposed Rapid Visual Screening Procedure for Seismic Evaluation of RC Frame Buildings in India”**. She mentioned that severe damage and poor performance of RC buildings in India during Bhuj-2001 earthquake are a matter of serious concern. She has presented a screening method for seismic safety of existing buildings in Ahmedabad so that prioritization may be undertaken on the deficient buildings. RVS methodologies developed in other countries (eg, FEMA, 2002 in the US and METU, 2003 in Turkey) are not appropriate for application in Indian conditions. She has developed an expression for assigning Performance Scores to buildings based on presence or absence of some very general, broad based and easily observable vulnerability parameters that can be seen from a sidewalk type survey. The buildings were surveyed for around twelve vulnerability parameters such as open storey, short column, re-entrant corners, overhangs, etc., which were then analyzed statistically to arrive at a methodology for conducting RVS for Indian buildings.

G. M. Dar, IMPA, Srinagar, talked on **“Constructional Practices, Climate Change and Disasters – Some instances from Kashmir”**. While sharing some data on the South Kashmir Snowstorm (2005) and the Kashmir Earthquake (2005) the presenter expressed that the traditional construc-



tional practices followed earlier have been more disaster resistant. While mentioning about the impact of Climate Change, he has stated that over a period of time, due to receding glaciers, declining snowfall, high frequency and intensity of natural disasters, people have shifted to the modern constructional practices without much consideration to disaster mitigation. He felt the need to incorporate all possible safety measures in the constructions on modern lines side by side to preserve the heritage and tradition like the Dhaji Dewari and the Taaq System as well as the Gujjar Dhokas.

Chandan Ghosh, NIDM, presented his paper on **“Managing with Vulnerable Built-Infrastructures in India”**. He stated that growing population, ill-planned habitat and non-engineered building practices have compounded the risk of many urban and rural conglomerations. Thus, assessing the multi-hazards and risks of built infrastructures, taking appropriate structural and nonstructural mitigation measures and managing the post-disaster events efficiently are some of the challenging tasks of disaster management. He mentioned that the country has developed National Building Code (2005) and hazard specific codes of practices and guidelines for about last five decades. In spite of availability of such documents, enforcement mechanism, applicability and implementation is found most deficient. Existing Town and Country Planning Acts, Master Plans, Area Development Rules and Building Bye-laws and Regulations do not address safety requirements. To ensure empowerment and accountability of the various actors involved in building construction, namely, owner, builder/developer/promoter, architect, structural engineer, supervisors, local body personnel must be involved in approval of plans, inspection of constructions before issuing the completion certificates.



Amlan K. Sengupta, IIT-Madras, gave a presentation on **“Retrofitting of structures – principles and applications”**. After giving a brief treatise on retrofitting technology, Dr. Sengupta explained various steps that encompass condition assessment of the structure, evaluation for seismic forces, selection of retrofit strategies and construction. He demonstrated some applications of retrofitting techniques on buildings, industrial struc-



tures, bridges, urban transport structures, marine structures and earth retaining structures. He apprised the audience about various features of the “Handbook on seismic retrofit of buildings”. The book covers the principles, strategies for retrofit of different types of buildings, geotechnical and foundation aspects, advanced applications, quality assurance and two case studies.

Najmi Kanji, Aga Khan Development Network, New Delhi delivered a talk on **“Jammu and Kashmir Earthquake Reconstruction Programme Uri Block, District Baramulla”**. She has mentioned that Aga-

Khan foundation has implemented reconstruction program in 17 villages (55 hamlets) of the Uri Block and covered 2,458 households with an aim to rebuild private and public infrastructure, strengthen and enhance existing livelihoods and build community capacity for disaster preparedness. The reconstruction and retrofitting of public and private infrastructure was based upon introducing seismic resistant building techniques into the area



by training local masons through the construction of demonstration houses, including traditional building practices such as *Dhajji Dewari*. A total of 97 local masons were trained (23 worked full time on the AKDN programme) to help communities construct 418 seismic resistant homes. Of these, 160 were for the most vulnerable households, largely comprising women-headed families with little income, which were identified by the communities themselves.

Sandeep Donald Shah, Taylor Device India Ltd., Gurgaon, while presenting his paper on **“Concrete Jacketing with Supplemental Damping for Seismic Retrofit of a Non-Ductile Concrete Building”** explained a case of a seven story non-ductile concrete framed building of early nineties vintage. Analysis results revealed that the structures did not have sufficient structural capacity to resist even a moderate earthquake. To ensure a higher level of safety, reduce the risk of exorbitant repair costs and minimize building downtime after an earthquake, it was intended that the seismic upgrade of the structural system will target the performance standard of ‘immediate occupancy’. While presenting the methodology, Mr Shah gave an account of the use of robust conc-frame along with dampers. Analysis results of the retrofitted block showed that the dampers dissipated significant portion of the seismic energy, reduced displacements and story drifts and limited the seismic non-linear demand on the concrete members. He emphasized that seismic upgrade methodology proved to be technically sound, easy to execute, less disruptive to the occupants and resulted in significant savings both in terms of time and cost.

Aftab Alam Khan, SDMC, Delhi, gave presentation on **“Importance of seismic microzonation in urban safety – a case study”**. Prof. Khan mentioned that site characteriza-

tion by assessing the geological state of art of a given area through earthquake-hazard microzoning should be the most prioritized task in any urban planning. Moreover, identification of active faults or the relation to any active fault source, quantification of fault activities, quantification of the ground motion, and determination of seismogenic site response are the essential components in a microzonation task. He has presented a case study for microzonation of

Dhaka University Campus, Bangladesh in which a composite site specific microzoning map is proposed for Dhaka University Campus for all future safe construction planning and strengthening of existing vulnerable buildings and structures.

T. Rahman, National Institute of Technology, Silchar, Assam gave his talk on “**Seismic hazard Microzonation of Guwahati city**” Dr Rahman stated that there are 59 active seismic source potentials around the city, which have the potential to induce severe ground vibration during an earthquake. In calculating the local site effects and to know the engineering properties of soil, soil samples from different 650 borehole locations of Guwahati city have been collected. Surface level seismic hazard of Guwahati city has been calculated accounting for local site effect. These surface level seismic hazards can be used conveniently as design basis ground motion parameters for designing of engineering structures in the city.

Devesh Walia, NEHU, Shillong, gave presentation on “**Recent developments in earthquake forecasting**”. According to him, earthquake forecasting is the process of estimation in unknown situations and can refer to estimation of time series, cross-sectional or longitudinal data and incorporate intuitive judgments, opinions and subjective probability estimates. Despite considerable research efforts by seismologist, scientifically reproducible predictions cannot be made to a specific hour/day, or month but for well-understood faults, seismic hazard analysis and assessment maps can estimate the probability that an earthquake of a given size will affect a given location over a certain number of years. The purpose of the forecast is to give the probability of strong shaking at any location within the next 24-hours and such as an attempt is being made for California. There are many precur-



sors of the earthquakes being recorded and the studies are being carried out to use, analyse and model these precursors so as to forecast the earthquake.

Ranjit Das, IIT-Roorkee, gave a talk on “**Analysis of temporal heterogeneity in the magnitude of completeness & its uncertainty for a North East India region**”. Based on the magnitude of completeness determined by using four methods namely MAXC (Wiemer and Wyss, 2000), EMR (Voessner and Wiemer, 2005), Goodness of Fit (Wiemer and Wyss, 2000) and MBS (Shi and Bolt, 1982) method a moving time window of 10 years has been taken to fix the starting year of the catalogue. It is observed that the magnitude of completeness has been improved indicating better detectability of the seismic events with time in the region. Out of the four, the Shi and Bolts method is found to yield poor estimates of the quality of the catalogue compared to other three methods. The seismic hazard parameters, namely ‘a’, ‘b’ and ‘ M_{max} ’, have been established based on the completeness magnitude M_c . The comparison of the return periods w.r.t the catalogue has been carried out for quality assessment of the methodologies being used for estimation of seismic hazard parameters.

Arun Bapat, Pune, while presenting on “**Seismic Vulnerability of National Capital Region Delhi from a Large Magnitude Earthquake in NW Himalayas**” showed grim future citing Kangra (1905), Mexico (1985) and Bhuj (2001). Citing a recent report from Geological Survey of India (GSI) he has opined that the probability of occurrence of a large magnitude earthquake is as high as 0.95 in the state of Uttarakhand and Himanchal Pradesh. He has cited about Wenchuan (Sichuan -2008) earthquake of magnitude 8.0 on 12 May 2008, in China in which a large number of toads were leaving ponds and roaming on nearby road. The abnormal animal behaviour (which cannot be explained within the presently established framework of science), according to him, should be accepted as a reliable seismic precursor.



Sandeep Kumar Aggarwal, Institute of Seismological Research, Gujarat gave presentation on “**Foreshock clustering and precursory changes in source parameters for the Kachchh Earthquakes Gujarat, India**”. He showed how seismicity in Kachchh is being monitored by dense network of more than 20 broadband seismographs. As the earthquake locations are precise it has been possible to observe foreshock earthquake clustering and pairing of mainshocks for seven earthquakes of M_w 3.8 to 4.7 (maximum magnitude of study period), and characteristic features of 2001 Kachchh-Bhuj earthquake aftershocks during 2007 to 2009. Clustering of Four to fourteen foreshocks in areas of 2.5 km to 20km radius for duration of 7 to 25 days has been observed. His study gives hope of prediction of earthquakes as is being done for Koyna, India and first time for Kachchh region in India.

Shourabh Bhattacharya, Barkatullah University, Bhopal, gave presentation on “**Possibil-**

ities of Earthquake Prediction using Ground and Satellite Techniques”.

He has discussed some of the vital methodologies involved for detection of certain anomalies that can be useful for earthquake prediction if carried out with consistent efforts. He has mentioned that the study of electromagnetic emissions during a seismic event has attracted a large number of physicists and seismologists. Among the electro-magnetic emissions during earthquakes, the Ultra low frequency

(up to a few Hz) and the Extremely low frequency (3Hz to 3kHz) prove as an effective mode to study the precursors associated with moderate as well as large scale earthquakes. These emissions propagate up to the ionosphere. He presented the electric field data recorded by a low altitude satellite during a recent Indonesian earthquake (3.68°S , 135.46°E , 07:36:00 hrs. UT and 100 km from Enarotali) that measured 6.1 on the Richter Scale.

S. K. Mondal, ISMU, Dhanbad, gave his talk on “**Seismic Hazard Assessment of Kumaon Himalayan Region using Fractal dimension of the Past Earthquake Sequence**”.

He has applied the fractal statistical tool to understand the nature of earthquake occurrence from the past earthquake occurrence. The correlation dimension D_c of the past earthquake was calculated. In some areas drop in D_c value was observed. The D_c or the correlation dimension is inversely proportional to the degree of clustering of the events. They are used in the region for the possible future great earthquake. The parameter D_c drop may be the condition for the future great earthquake, which is biased by the condition of the

completeness of the data set used and the geological structure of the region. Finally he emphasized that seismic hazard assessment must be primarily based on combined geologic and seismological data information.

Aftab Alam Khan, SDMC, Delhi, gave his 2nd presentation on “**Pseudo-seismic tunneling vis-à-vis earthquake precursor**” and opined that a great majority of earthquakes occur almost with certainty in and around the regions of active lithospheric-plate collision margins. The geodynamic process accounts for continuous strain and temperature buildup due to frictional stress field development at each geologic interface of variable viscos-



ity and variable depths. Geodynamic process is responsible for leaking and channeling of stress energy from the source where, under stress many crystalline materials exhibit irreversible plastic deformation caused by the motion of lattice dislocations. On the scale of the individual mineral grains, which make up the rocks, plastic deformation means that dislocations are generated and begin to move. In plastically deformed microcrystals, internal dislocation avalanches lead to jumps in the stress-strain curves, called strain bursts. These strain bursts closely resemble macroscopic plastic instabilities and each strain burst corresponds to the formation of a narrow slip line or slip band. When such lattice dislocations, strain bursts and slip line occur for a large dimension then it should lead to generation of nonseismic signals. The nucleation of an energy bombardment inside the earth occurs not only by pressure factor but also by temperature factor resulting in the generation of non-seismic signals. One such nonseismic signal occurs before the occurrence of an earthquake due to the rise in subsurface temperature. As a result of this the geomagnetic field is reduced. The reduction in geomagnetic field adversely affects the propagation of electromagnetic waves. The propagation of electromagnetic field is superseded by pseudo-seismic propagation prior to brittle failure through rupture. The seismic energy radiated during catastrophic rock failure represents only a fraction of the total energy. A large portion goes into frictional heating of the rocks along the dislocation plane or may be converted into potential energy. This is inferred to occur at the zones of brittle – plastic transition of the crust at depth range of 10 - 15 km.

Devesh Walia, NEHU, Shillong, gave his 2nd presentation on “**Response time for earthquake preparedness from seismic alert system in Shillong and Guwahati**”. He shared with the audience that the physical geological process in the Indo-Burmese Arc (IBA) is actively generating earthquakes of magnitudes 5.6, 5.3 and 5.9 respectively within a span of 23 days during August and September 2009 which has created a fear psychosis and apprehension amongst the residents of the Northeastern part of the Indian subcontinent particularly those residing in growing cities like Shillong and Guwahati. This part of the subcontinent is one of most active regions of the world. It consists of mainly three units, approximately east-west extending eastern Himalaya, which marks the continental collisional boundary between the underthrusting Indian plate beneath the Eurasia plate; approximately N–S extending IBA, which extends further southward to join the Andaman Arc, and the Eastern Himalayan Syntaxis (EHS), which lies at the junction of the above two. Dr Walia warned that the occurrence probability of an earthquake $M < 7$ in the region is very high, thus resulting in damages to Shillong and Guwahati city which are about 300 km away. He has advocated for a



Seismic Alert System (SAS) for Shillong and Guwahati, capable of announcing 42 seconds before the arrival of earthquakes from the IBA between the window latitudes 24 ° N and 27 ° N and Longitudes 94 ° E and 95 ° E, may be planned for installation.

K. M. Parivelan, Chennai, gave presentation on “**Tsunami Reconstruction and CBDRR**”. He mentioned that the Indian Ocean Tsunami of 2004 brought in numerous changes in our perception of disasters, and related policies and practices as well. Notably it acted as catalyst for speedy introduction of National Disaster Management Act of 2005 and formation of institutional mechanism such as NDMA and other similar authority at State level, District level and up to Panchayat levels. Emergence of such legal- institutional mechanisms are on one side, there is larger emphasis on community resilience vis-a-vis multi-hazards on the other side. The post-tsunami rehabilitation and reconstruction itself had very many inbuilt community based disaster risk reduction (CBDRR) programmes. Many civil society organisations spearheaded the CBDRR movement. Now it is time to take stock of CBDRR in the context of tsunamis tackling in particular and other hazards in general.

Recommendations

- ◆ NBC-2005 to be adopted as the basis for all structural design, fire protection, building and plumbing services, building materials and construction practices (and construction safety) and for proper protection, upkeep & maintenance of water bodies by modifying the departmental construction codes/ specifications/manuals of Govt. construction departments.
- ◆ Forecasting and prediction of earthquakes are the topics yet to be vigorously pursued in India although in every conference some papers following one or more of the known approaches such as continuous tracking of crustal movements, seismic, geo-electric, geomagnetic, geochemical, geothermal observations and geodetic and ground water measurements and reference to unusual animal behaviour.
- ◆ The strengthening of all building development and regulating agencies with the right level of professional human resources to deal with proactive responses needed with the building professionals and builders. The professional human resource pooling for contiguously situated human settlements and the related regulating agencies should be attempted, considering the socio-economic and budgetary constraints of smaller level local bodies dealing with building regulation work.

Road-map

- ◆ To undertake micro-zonation surveys in fast expanding urban agglomerations falling in the disaster prone regions for preparing land use and development plans based on local site effects. Based on the recent events priority may be given to the settlements where ground subsidence has been observed.
- ◆ To ensure proper performance of the existing buildings and housing stock to withstand the forces of natural hazards in future, it is necessary to create mechanism for carrying out safety audit and facilitate adequate financial support for retrofitting and strengthening wherever necessary.

- ◆ To ensure empowerment and accountability of the various actors involved in building construction, namely, the owner, the builder/developer/promoter, the architect, the structural engineer, supervisors, the local body personnel involved in approval of plans, inspection of constructions and issuing of building use permits.
- ◆ To ensure that all new building constructions have mandatory provisions of safety elements against earthquakes, cyclones and floods.
- ◆ To assess the hazard safety of existing buildings and to demonstrate and encourage owners for retrofitting of unsafe buildings, particularly those which are critical to the safety of large number of people.
- ◆ To initiate a pilot project with various building service agencies where all multi-hazard resistant measures shall be demonstrated and checked its performance with an aim to device a template for screening existing buildings so that risk mapping standards can be established.

Mass Movements (Landslide & Avalanches)

Concept Note

Mass movements are massive failures of slope masses including rock, debris, soils and snow/ice that cause loss of life, economy, environment, land and natural resources. These events are widespread and frequently recurring geological hazards that disrupt socio-cultural and commercial activities, communication and transport services, basic amenities and utilities like power, drinking water and irrigation supply etc. in the affected area. These mass movements are also often associated and sometimes even form a major part of other disasters such as earthquakes, floods, thunderstorms, heavy rainstorms, cyclones, forest fires, wild fires, volcanoes and so on. Haphazard human activities like construction of roads, buildings, structures and infra-structure facilities; mining, quarrying, deforestation and logging; blasting; disturbances in natural drainage and slope conditions etc. have further aggravated the incidences of these disastrous mass movements. Besides aggravating the hazardous processes, humans have also increased their vulnerability and exposure to the consequences of these mass movement by occupying areas highly prone to such hazards and unrestricted unscientific development of critical structures such as dams, tunnels, bridges and highways at such sites. This has led to other potentially hazardous events like dam bursts, glacial lake outburst floods, flash floods, debris flow and bursting landslide dammed lakes. If one considers the cumulative impacts of mass movements including all such primary and secondary hazards directly or indirectly related to mass movement, the losses would be thousands of billions of Rupees besides innumerable losses of human lives.

A World Bank Report (2005) indicates that 3.7 million square kilometers of land area of the globe is exposed to landslides and the population exposed to it is 300 million i.e. 5% of world population. About 8,20,000 km² is identified under high risk category which has a population of 66 million at high risk. The CRED data shows that landslides are responsible for 17% of all fatalities from natural hazards worldwide. It has been observed that Asia is the worst affected continent due to landslides and within the Asian countries, it is South Asian Countries which are more affected and even among the South Asian Countries, India is the most affected country. About 25% of the India's landmass (~0.82 million square kilometers) is prone to landslides. These unstable hill slopes are spread across 22 States and 2 UTs to varying extent. Even in the Indian scenario, the Himalayan States suffer more due to landslides compared to Western Ghats, Nilgiris etc. Some of the studies have indicated that on an average, a landslide occurs at almost every two kilometers along the highways in Himalayan terrain. Although individual landslides in these areas do not result in mass causality or heavy damages yet the cumulative losses over a period of time are comparable to other disasters like

earthquakes, cyclones and floods. Average Annual losses are estimated to be approximately 3-4 billion Rupees (INR) besides loss of hundreds of lives and other intangible damages.

However, the losses are rising due to increased occupation of human population on susceptible slopes and unscientific haphazard development without due consideration to landslides risk management.

Context

As outlined above, the losses/risks from landslides in the hilly terrains have a rising trend and need a serious concern to minimize these losses and protect people's life, property, infrastructure, environment and natural resources. National Disaster Management Authority, Government of India, took a great initiative by issuing national guidelines on landslides and avalanches on 23 June 2009 to guide the Central Government, State Governments, District Administration, different Ministries/Agencies/Organization in preparation of plans for management of landslides and avalanches. But still there are lot of existing gaps in information, data-bases, maps, methodologies, techniques and technologies in this field and few dedicated efforts have been made in education, training, research and capacity building of human resources to cater to the needs of this sector. A systematic action is required for building reliable and credible databases on mass movements, preparation of inventory maps, hazard zonation maps at different scales for use by various stakeholders, vulnerability and risk assessment studies, classification and prioritization of the risks, prevention, mitigation, preparedness, response and risk reduction measures. An overview of the status of practices in landslides risk management indicates that the application of state-of-art technologies in assessment, prevention, mitigation, monitoring, warning, and preparedness is lacking in Indian context. Most often crude traditional approach of constructing a retaining wall (made of gabions or RR masonry) is followed at landslide sites as a reactive measure. There is a need to shift this attitude for a proactive continuum risk management. Not much use of scientifically prepared hazard and risk zonation maps has been made in selection, designing and development of sites/ projects. There is also a dire need to prepare minimum standards for landslide/avalanches database, inventories, hazard zonation mapping, investigation and management.

The country lacks good rehabilitation, relocation/resettlement, and reconstruction policies which affect adversely the affected people of these areas. A significant reduction of risks/losses could be achieved by preventing/minimizing the exposure of people and properties through landuse and developmental regulations and enhancing the coping capacities of communities. Little attention is given to the use of indigenous knowledge, information, skills, expertise/ experiences and local resources while planning and implementing activities related to management of mass movements.

NIDM has a national mandate to undertake training, capacity building, networking, linkage, coordination, dissemination of knowledge, documentation, and research related to disaster risk management. In order to achieve its goal, the session on mass movements has been included in the Second India Disaster Management Congress to address various issues mentioned above.

Proceedings

Dr. Vidar Kveldsvite, Norwegian Geotechnical Institute made a presentation on **“The Aknes rock slope: Early warning system and emergency preparedness”** highlighting that large rock slides can be predicted based on accelerating creep behavior. After an overview of the physical details and geology of Aknes Rock Slopes, he discussed about displacement inferred on the basis of photogrammetric data, extensometers, GPS and Total Station. He informed that NGI established a monitoring system including permanent GPS network with 8 antennas, total station with 30 prisms, Ground based radar with 8 reflectors, 5 surface rod extensometers, tiltmeter, crackmeter and 8 geophones for micro-seismic network. In order to record sub-surface movements, inclinometers and piezometers were used. The climatic conditions were also monitored for temperature, precipitation, snow depth, and wind speed. Alarm threshold criteria were decided based on total displacement, velocity and acceleration. Alert levels were classified into green, blue, yellow, orange and red. These were communicated through various media including 26 sirens with sound signals and messages in Norwegian, English and German. Automatic phone calls were sent to all registered phoned. Emergency plans have also been prepared and tested at the site.



Mr. Vernon Singhroy, Canada Centre for Remote Sensing gave his presentation on **“InSAR Monitoring of High Risk Geohazard Areas using RADARSAT”** discussed about the results of InSAR monitoring of several High Risk Geohazards–Landslides, Earthquakes and volcanoes- areas using RADARSAT 1 & 2 images. It was mentioned that the Interferometric Synthetic Aperture Radar (InSAR) Monitoring and coherent target monitoring techniques (CTM) with installed corner reflectors, is now routinely being used in monitoring landslide activities along strategic transportation and energy corridors in Canada, China and Latin America. InSAR technique are also used to monitor landslide motion triggered by permafrost melt in the Canadian arctic, debris flows, rock avalanche, and deep-seated landslides in mountainous areas in Canada China and Venezuela. RADARSAT InSAR images have also been used to monitor seismically active



areas in Canada, as well as volcanic areas in Japan. The results of these case studies will provide guidelines for the uses on advanced SAR techniques for disaster mitigation related to geohazards. Finally, it was concluded that both differential InSAR and CTM are providing a useful monitoring tools of various landslide processes under different slope, moisture and lithological conditions.

The differential InSAR provide a rapid and simple deformation activity of the geological process and therefore is easily understood. CTM provide more detailed corner reflector results correlated with other in-situ measurements are more complex, but do provide a site specific geotechnical information that are required for mitigation measures.

Mr. P. C. Nawani, NIRM in his talk on **“Stabilization of Varunavat Landslide in Uttarkashi Town, Uttarakhand Himalaya”** discussed landslide hazards and mechanism of land sliding. He presented his work on Varunavat Parvat landslide of Uttarkashi town and informed that on 24 Sept, 2003 a massive landslide triggered on Varunavat hill and disastrously affected the life and property of Uttarkashi town. He elaborated the causes of this particular landslide, immediate action taken to control the damages and difficulties faced during the stabilization of landslide. He mentioned that based on the preliminary geological and geotechnical investigations coupled with geophysics and drilling of the slide zone and slope stability analysis using numerical methods, the treatment and stabilization plan was devised and implemented in a phased manner for different parts of the entire slide. Thus, an integrated approach was adopted for the long-term stabilization of the area. Then, he highlighted about the challenging treatment and stabilization works of the landslide which is overlooking the Uttarkashi township. He informed that most effective design solutions were adopted for long term slope stabilization to ensure perfect restoration of slope stability and to avert any such incident in future.



Mr. S. S. Porwal (VSM), Border Roads Organization gave a presentation on **“Sonapur Landslide and its mitigation through RCC Cut and Cover Structure”**. He discussed about Sonapur landslide located on National Highway 44 between Shillong and Agartala. The landslide



blocked the highway for 60 days in 1988. Although numerous investigations were done and several remedial works also carried out, yet it did not stabilize. BRO planned to construct a cut and cover tunnel structure across an active landslide for the first time in India. The tunnel was 123m long, 8m wide and 9m high. The speaker proposed that a similar structure can also be used as avalanche protection and underground structures.

Mr. Joyesh Bagchi, Geological Survey of India presented on **“Preliminary Analysis of Spatial and Temporal Variation of Landslide Hazard in India 2007–2009”**. Vulnerability profile of the country was explained. It was informed that landslides constitute one of the most damaging disasters for India affecting 15% area, spread over 22 States and one Union Territory. Almost all landslides are located either in the Himalayan and the Arakan-Yoma belt of the North-Eastern parts of the country or the relatively stable domains of the Meghalaya Plateau, the Western and Eastern Ghats and the Nilgiri Hills. He talked about the landslide susceptibility in India. He informed that landslide incidence data had been obtained from various sources viz media reports, central and state government agencies and websites. However, the major contribution is from various Regional and Local Offices of Geological Survey of India. An attempt was made to analyse the landslide activity around the country in two annual cycles i.e. March ‘07 to April ‘08 and March ‘08 to April ‘09. Information on 445 (dates available for 331) landslide incidences had been assembled for the first cycle and 59 for the second. He made a comparison of landslide incidences between the two cycles and observed that Landslide occurrence varies significantly both spatially and temporally; almost all the landslides were preceded by relatively long duration rainfall or high intensity rainfall for a short period; and Landslide distribution spatially follows the landslide susceptibility. He also informed that the data collected from the specified sources has several gaps due to inherent limitations in data collection network and to some extent in data transmission. The intensity of landslide hazard in different parts of the country, density of casualties resulting due to landslides and correlation of landslide density with monsoonal activity was explained.

Mr. H.B. Vasistha, Forest Research Institute, gave a presentation on **“Hazards Mitigation through Application of Bioengineering Measures in Landslide Areas: A Case Study of Varunavat Landslide, Uttarkashi”**. The application of bioengineering measures in landslide stabilization was elaborated. In this regard, it was explained that once these landslides occur, massive amount of debris containing soil, small and big boulders are generated and deposited. It was pointed out that unless appropriate measures for protection of these loose materials are not attempted, a continuous fear of damage to the ecosystem as well as to public property will always remain. He emphasized that



vegetation can be used to arrest further loss to the ecosystem and society in landslide damaged areas. He presented the case study on Varunavat landslides and also informed that here bioengineering measures have been used to check further damage due to erosion of loose materials.

Mr. Z. A. Roslan, International Research Centre on Disaster Prevention, gave a presentation on **“Forecasting Erosion Induced Landslide”**. The speaker discussed about the landslide tragedies in Malaysia Since 2002 - January 2009. He emphasized that landslides are a major problem in Malaysia. He concentrated on the erosion induced landslides. It was mentioned that combination of two main factors

namely rainfall erosivity and soil erodibility can be used as a predictive tool in forecasting erosion induced landslide. By knowing the level of rainfall erosivity and soil erodibility impact of an area, the potential risk of erosion induced landslide can be made known.



Flood

Concept Note

A flood is an excess of water (or mud) on land that's normally dry and is a SITUATION where inundation is caused by high flow, or overflow of water in an established water-course, such as a river, stream, or drainage ditch; or ponding of water at or near the point where the rain fell. A flood can strike anywhere without warning, occurs when a large volume of rain falls within a short time.

Floods are recurrent phenomena since time immemorial. Almost every year some parts of the world or the other are affected by the floods of varying magnitude. Even in the same country of the region different parts have different climates and rainfall patterns and, as such, it is also experienced that while some parts are suffering under devastating floods, another part is suffering under drought. With the increase in population and developmental activity, there has been tendency to occupy the flood plains which has resulted in more serious nature of damages over the years. Because of the varying rainfall distribution, many a times, areas which are not traditionally prone to floods also experience severe inundation. The effect of climate change is yet another factor under study in recent times to assess the impact on flood. Flood indeed is the single most frequent disaster faced not only in India but by various part of world including the South Asia region.

Context

Flood in the above first region, is severe and quite frequent with very high silt charges in the rivers. Some of the rivers like Teesta, Torse and Jaldakha have a tendency to change their courses while in flood. Flooding in the second region is more or less an annual feature which is aggravated by drainage congestion. The major problem in the third region is that of inadequate surface drainage which causes inundation and water logging over vast areas. The fourth region does not have very serious problem of flooding except for some of the rivers in Orissa. The delta areas of some of these rivers on the east coast periodically face flood and drainage problems in the wake of cyclonic storm Assam, Bihar, West Bengal, U.P. and Orissa are the worst flood affected states. The percentage of flood prone area to total area of the state is highest in Bihar followed by Assam and west Bengal.

Within the overall master plan for the basin & the region, there has to be a well thought of plan as also a contingency plan, in each state involving steps required to be taken before the onset of floods during the floods and post- flood management. This calls for integrated planning to ensure a safe living for all those residing in the flood plain & to become development in these areas indeed sustainable.

Some of the recent disasters have exposed the gap of an effective response capacity that can save valuable lives. The most recent example is 2008 floods. As per EMDAT estimates, approximately 14 million people were affected by floods in South Asia and more than 2700 lost their lives. Contrary, North America had more than 11 million people affected by flood but only 44 lost lives. In East Asia, 7 million were affected due to floods but only 367 lost lives; in south East Asia 4.4 million were affected and 400 died. This necessitates efforts at national & regional levels to mitigate the effect of flood in an effective manner.

Proceedings

The contributed papers broadly focused on structural management of flood related problems mostly in the Ganga and Mahanadi basins. Problems associated with urban flooding due to heavy rains, use of dynamical flood forecast technology, meso-scale weather and its forecasting, flood risk management and mitigation strategies were also addressed in other papers.

Mr. R. C. Jha, CWC in his opening remarks, outlined the mitigation strategies. He touched upon the importance of embankment and also about the design aspect to take care of the problem of siltation in some of the river basins.

Mr. R. Rangachari, Centre for Policy Research, presented his key note address on **‘International dimensions of Cooperation on flood Management of shared river systems’**. Since Plan fund allocation for flood control is meager the emphasis should be to reduce the vulnerability to disaster. It was mentioned that presently more money is being spent on repairs than the original cost of the basic structure. The logic of cooperation in shared systems was explained by him. While explaining the logic of cooperation in Shared Systems of Trans-boundary waters it was mentioned that trans-boundary waters extend hydrological interdependence across national frontiers, linking users of the shared system, and vast hydropower potential may exist in one country but its market in the other. He went on to say that the real solution to flood problem in one nation may lie in another. He suggested the need for complementarities of acting in cooperation



and harmony, while safeguarding national interests which is paramount. He explained that Expanding developmental cooperation through bilateral and regional efforts made in the past had emphasized the need for better bilateral cooperation and understanding which unfortunately is not happening at the level, it ought to be. He explained the existing bilateral arrangements between India and Nepal, India and Bhutan, India and China. There is a need for converting water to wealth for which potentials of cooperative development of South Asian river systems needs to be explained to the full. It was brought out that, given a cooperative frame by the countries involved and a variety of trade-offs, development of the water resources and sharing the resultant benefits could be a positive sum game. Each nation will stand to gain more by it than what it can ever hope to achieve on its own, acting independently. It was opined that the three-country study team on cooperation in developing the GBM region would constitute an abundance of wealth and energy that must be creatively and cooperatively used. It was stressed that we can move forward collectively toward a better future or suffer the privation of self-abnegation.

Mr. M. U. Ghani, GFCC presented two papers entitled **‘Innovative methods in river erosion control - a case study of erosion of Bhira-palia railway line by sharda river in UP’** and **‘Cofferdam., an effective tool for emergent flood Management works - a case study of Kosi barrage afflux bund Breach closure’**. Erosion of the river banks in India have become recurrent event causing enormous problem for the people and the Government. With the increase of population along the bank of the rivers, the resources are over exploited. As such, it is imperative to adopt scientific approach for erosion control. The most responsible factor for river bank erosion is the flow of large quantity of silt in the river. Therefore, there is a great need either to check entry of silt into the river or desilt it when it has entered into the river. The remedial measure adopted to tackle the erosion problem of Bhira-Palia Kalan railway line by the river Sharda in Lakhimpur Khiri district of U.P was explained.

In his second paper he explained, Cofferdam as a watertight temporary structure designed to facilitate construction projects in an area which are normally submerged underwater. It was mentioned that Cofferdam is installed in the work area to expose the bed of the body of the water so as to enable construction activities, perform other types of work, enact repairs in dry environment. Variety of materials and the type of constructions were explained. It was added that, had the three cofferdam in the three channels through which water was flowing to the breached section not been constructed across the main course of Kosi river, the closure of breach would not have been possible. Similar kind of measure was taken for the closure of left bank embankment of river Bagmati down stream of the Dheng Railway bridge.

Mr. Ranjan Kumar, SAARC Disaster Management Centre (SDMC) presented a paper on **“Kosi Floods 2008: A Call for Cooperation”**. He opined that the element of flood risk reduction goes much beyond the technological elements and some of non-structural elements need to be brought into the realm of cooperation. With the same socio-cultural and economic roots, Kosi basin, a home to the poorest community of the region, requires cooperation of different kind - contextual, inclusive and more holistic.

Missing link in the regional cooperation was highlighted, and it presented a framework laying emphasis on the regional cooperation in the form of early warning systems, cross-boundary information sharing, social networking, cooperation to share the river-basin ecosystems and overall a regional strategy for flood risk reduction.

Mr. Rakesh Kumar presented a paper on **“Flood Hazard Modelling and Flood Risk Assessment for a River Basin”**. It described estimation of floods for different return periods for the various stream flow gauging sites of the river reach using the L-moments approach as well as development of the rating employing least squares techniques. It presented modeling of flood inundation for various return periods as well as the depths of flooding using the HEC-RAS package. Flood Hazard Modeling may be carried out using the hydrologic-hydraulic approach, remote sensing, GIS, flood frequency analysis and rating curve analysis. Various types of maps such as: flood inundation maps, flood hazard maps, flood risk zone maps, flood plain zoning maps may be prepared using this technique. Such maps provide detailed information on the areal extent, depth and duration of flooding as well as the associated risk. These maps may also be put to the broad spectrum of uses including implementation of land use regulations and flood plain zoning bylaws. The flooded areas for some of the years for the study area simulated by the HEC-RAS package have been compared with the flooding mapped using the satellite data employing the GIS package ERDAS. It was felt that these maps may be used for land use planning, flood insurance purposes and flood damage reduction. It was further added that the calibrated and validated hydrologic model, as described in the study may be coupled with a distributed rainfall-runoff model. For this purpose, antecedent rainfall forecasts based on radar, satellite based instrumentation and high resolution Numerical Weather Prediction (NWP) models and may be used for simulation of flood inundation, depth of flooding and risk associated with the flooding in real time for flood mitigation and management. Presently, there are many uncertainties in forecasting heavy rainfall and the uncertainty should be minimised, quantified and presented as an integral part of the forecast, he felt. He concluded that it would help in providing improved flood hazard warning and lead to better flood management and flood damage reduction.

Ms. Victoria Devi, Delhi University presented her paper on **“Incorporating Local Needs and Capacity for Flood Risk Reduction”**. The paper analysed the local capacity and needs of a flood affected village in the Bahraich district of Uttar Pradesh, India. It was suggested how capacity and need can be enhanced and addressed so that risk from the flood is not only reduced but sustainable development is brought about. The village where the study was conducted is a perennially flooded village and the villagers suffer from inundation at least two to three times in a year. Flood risk reduction programmes mainly focuses on the physical component of the risk like building of check dams, developing a scientific early warning system. Often the social and cultural component of the risk remains neglected. This at times led to failure in choosing the right strategy for flood risk reduction. Ideally, any risk reduction programmes should be holistic in approach and should incorporate the local needs and capacity so that the programme is cost effective and sustainable.

Mr. M. K. Sinha, Narmada Control Authority presented a paper on **“Lessons Learnt from Disaster Management of Recent Dam/Embankment Break Events in India”**. Four case studies were discussed. A number of important initiatives have been taken up to mainstream disaster risk reduction into the process of development. It called for a “multi-pronged strategy for total risk management, comprising prevention, preparedness, response and recovery, on the one hand, and for initiating development efforts aimed towards risk reduction and mitigation, on the other. It was added that actual achievement, however, depends on the detailing done or to be done in different possible scenario. One such possible disaster scenario pertains to dam/embankment break situations. Breaching of Parechu landslide dam, Pratapura dam, Jaswant Sagar dam in recent past (2005 onwards) and more recently Narmada Main Canal have given us opportunities to analyse the strength and weaknesses of evolving disaster management systems in the country, which would help us to re-orient ourselves to deal with dam/embankment break scenario more effectively.

Ms. Nazia Talat, TERI School of Advance Studies, presented her paper on **“Flood Risk Assessment & Mitigation in Haryana: A Case Study of Rohtak District”**. The Topographical settings and geo-morphological processes under the regional environmental influence give rise to hazards that may cause disasters if not mitigated at the risk stage itself. River Yamuna and Ghaggar are the two rivers which cause floods in Haryana. It was also mentioned that some of the districts in the south western part have the problem of poor drainage. Rohtak district comes under the flood-prone regions of Haryana. It was also felt that the level of ground water is higher (shallow) in many parts of the district also contribute to water logging and floods after heavy rainfall. However, the quality of ground water is bad in many parts of the District and as such cannot be used for agriculture. Canals are the main sources of water in Rohtak and the groundwater remains unexploited. This is a significant reason for higher levels of ground water in those areas. It was therefore suggested to take measures for using the saline water.

Mr. Sandeep K. Pandey, PG College, UP presented the paper on **“Flood Hazard, Vulnerability and Risk Assessment of the North India: Assessment of Concurrent Mitigation Options”**. It was stated that the hazard situation is due to accentuation of the catchments characteristics, channel morphology, sediment transport characteristics etc. The vulnerability assessment is a crucial input to understand the probable loss that may occur. The degree of vulnerability is dependent on the economical, educational and flood educational status of the people. The risk of the area is prominence of hazard possibilities at the vulnerable points, which is higher in the flood affected areas of the North Bihar. At the same time, the mitigation options like preparedness approaches and post-disaster learning cell are not able to achieve their real aim and objectives. So the need of time is to strengthen the post disaster responses to make the policies and preparedness plan to reduce such devastating conditions.

Mr. Anil Kumar Kar presented a paper on **“Flood Forecasting Network of Mahanadi Basin- A critical Review”**. He explained about the necessity of flood forecasting and reviewed the current methodology involved in flood forecasting and suggested some

possible improvements. The suggestions include, preparation of an integrated flood risk management plan earmarking village\area\structure likely to be affected at different flood magnitude at delta head. The runoff models need to be significantly improved, along with upgraded hydrologic network covering all sub-basins upstream and downstream of Hirakud reservoir and real-time telemetry. Improved cyclone warning for predicting impact in the coastal flood prone areas is also needed. Predicting potential inundation would require close-contour topographic survey of the delta, river L/S and C/S surveys, and use of 1-D and 2-D hydrodynamic models. To conclude, it was suggested that there is an urgent need to upgrade the data collection and transmission network, after rationalizing existing and proposed central and state network.

Mr. Anupam Kumar, IMD presented a paper on **“An Experiment Using the High Resolution WRF Model to Predict Heavy Precipitation over India”**. He presented the study of recent heavy rainfall events that occurred during 7th to 11th July, 2008 over parts of Orissa, coastal Andhra Pradesh using Weather Research and Forecasting (WRF; version 3) Meso-Scale Model at a horizontal resolution of 27 km. Also, the sensitivity experiments were conducted with the WRF model to test the impact of microphysical and cumulus parameterization schemes in capturing the extreme heavy rainfall event. Keeping the same cloud microphysics as WSM-3 scheme (Simple ice scheme) the WRF model run was carried out using three cumulus parameterization schemes viz., Kain-Fritsch, Betts-Miller-Janjic and Grell-Devenyi. Another run with WRF model was also carried out with no cumulus scheme. The results of these experiments indicate that although all three cumulus schemes could capture the genesis of the depression reasonably well, the Betts-Miller-Janjic scheme was found to be superior during the initial period of the system, whereas, the Kain-Fritsch scheme was found to be superior during the latter part (when the system was intensified). Similarly the heavy rainfall event over Orissa and adjoining areas was well captured in the Kain-Fritsch and Grell-Devenyi schemes with Kain-Fritsch is found to be more consistent. Although, the present result is based on one case study, more experiments are needed for detailed analysis.

Mr. Mukesh Kumar presented a paper on **“Flood Risk Mitigation and Management Practices in Delhi”**. He made an effort to highlight important initiatives taken at state level in Delhi to mitigate the risk due to floods. It was stated that due to unplanned development, the Sahibi river has now been converted into Najafgarh Drain. The flood prone areas of Delhi are adjacent to Yamuna and Najafgarh drain. The unplanned and ill planned development, due to population pressure, has resulted in creation of urban drainage congestions. The flood problem of Delhi can be classified mainly into two categories i.e., flooding due to Yamuna River and/ or Sahibi River and other is due to local urban drainage congestion. The main cause of flood fury in Delhi area is mindless unplanned urbanization in the form of illegal & unauthorized colonies, encroachment on natural drainage system, increased paved / pacca area, heavy rain fall of short duration, the impact of climate change, heavy discharge into river Yamuna and Sahibi River, lack of local water bodies & lakes and congestion & covering of existing storm water drainage system for reclamation of high value land for other development activities. Gov-

ernment of Delhi has realized the importance of flood risk mitigation in the state. In its efforts government has established structural and non-structural measures to reduce the impending flood risk in Delhi.

Mr. R. K. Agrawal, Kelo Project Survey Divison presented the paper on “**Problem of urban floods in the developing cities of developing world**”. He said that rainwater often leads to catastrophic results in the form of floods like what is happening in Bihar, Assam and several places of the country. Floods in the 21st Century have taken a new form, primarily restricted to the developing and improperly planned urban areas, termed as urban floods. The devastating effect of the urban floods of Mumbai is an example in this regard. It was, therefore, focused on the various causes and effects of urban floods and environment. The paper also dealt with central theme, i.e. overlooking of natural watersheds by our planners and policy makers while undertaking developmental activities. It explains how macro/micro watersheds are the key to understand the problem of urban floods. To conclude, he suggested some necessary steps which ought to be taken for curing this problem.

To sum up, Mr. Rangachari suggested to give utmost priority to Reduction of disaster risk, i.e. vulnerability. He felt that the moving water body cannot be dealt in compartments like districts, states, or even country in case of rivers running across borders. They should be dealt as hydrological units. He also suggested that money spent after the disaster is enormous when it is compared with the funds required to avert such disasters, but generally such work is not carried out in time.

Recommendations

- ◆ Flood control should be considered in overall perspective and for this purpose, the existing bilateral arrangements, mechanisms and treaties signed between India and the neighbouring countries need to give a boosted momentum to achieve the identified goals.
- ◆ The approaches of erosion control and construction of coffer dams need to be considered based on techno-economic considerations utilizing locally available manpower and materials to the extent possible with tactful strategy.
- ◆ An effective regional cooperation needs to be ensured for a proper strategy for flood disaster risk reduction.
- ◆ Better understanding of physiological and hydro-meteorological features of the catchments is essential for success of a disaster risk reduction and preparedness programme.
- ◆ The flood risk reduction programmes should be holistic in approach and incorporate the local issues like family planning, health, local knowledge, micro credit, self-help groups, economic enhancement and area specific risk reduction programme.
- ◆ A proper analysis of strength and weaknesses of disaster management mechanisms associated with the failures of dams including landslide dams should be done and our future disaster risk preparedness and mitigation programmes should be re-oriented considering the results of such an analysis.

- ◆ Proper maintenance of already created assets should be given priority.
- ◆ Proper documentation of disaster management processes should be done.
- ◆ Vulnerability analysis, based on economical and flood educational status, is crucial input for flood hazard assessment.
- ◆ A proper combination of structural and non-structural measures should be considered for effective flood management. Flood forecasting plays an important role during floods; which should be based on modern technologies and catchment-specific needs.
- ◆ The available modern methods of rainfall prediction are useful in improving the forecasting ability of hydrologists but a judicious selection based on specific operating conditions is required for application of a particular model of rainfall prediction.
- ◆ There is a need to take effective steps against unplanned urbanization in the form of illegal & unauthorized colonies and encroachment on natural drainage systems to avoid future flood risks.
- ◆ The urban floods have harmful effects on human lives and the environment as a whole. The natural watersheds should be duly considered in development of a strategy for urban flood management and city development planning.
- ◆ The latest scientific methods for assessment and simulation of flood inundation, hydrological models, GIS based models and L-moments approach for estimation of floods of different return periods should be used in view of need of a good analysis and a reliable database for study of climate changes.

Cyclone

Concept Note

The extreme weather events like cyclone and severe local storm are most devastating and deadly weather events all over the world. The tropical cyclone can be defined as a low-pressure area with strong winds rotating anti-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. The nomenclature of the cyclone is region specific. It is referred to as tropical cyclone, hurricane and typhoon over tropic, Atlantic and Pacific region respectively. Conceived over warm tropical oceans and nurtured by the converging moisture, the mature tropical cyclones are associated with violent wind, torrential rainfall and the worst of all, the cumulative effect of storm surges and the astronomical tides are the three major elements of tropical cyclone disaster. The severity of cyclonic hazard can be gauged from some of the major calamitous cyclones that include the cyclones of 1876 and 1970 in Bangladesh which together killed more than 5 lakh people, Orissa Super Cyclone of 1999, the very severe cyclonic storm Nargis of 2008 etc.

The North Indian seas (Bay of Bengal and Arabian Sea) have the least number of cyclones in a year than any other part of the world. But, their impact has been much more devastating in this region due to a combination of factors such as coastal topography, storm surge, coastal population density, science and technological advancement, infrastructural development, social and economic conditions etc. Though early warning systems for cyclones have been in operation for centuries now, recent developments suggest that the cyclone hazard can be better dealt with the concept of cyclone risk management which in addition to an effective early warning integrates various other mitigation and preparedness measures.

At the same time, severe local storms like thunderstorms / tornado are a mesoscale system of space scale of a few kilometers and time scale of some minutes to few hours. Most of the parts of the tropics observed thunderstorms and occasionally tornadoes, but the severe thunderstorms formed over eastern and north eastern part of India in the pre-monsoon seasons which are locally known as “Kal-baishakhi” or “Nor’westers”. Strong heating of landmass during mid-day initiates convection, which moves from northwest and gets intensified by mixing with warm moist air mass from the Head Bay of Bengal. It produces heavy rain, lightning, thunder, hail-storms, dust-storms, strong surface wind with squalls and down-bursts. By the same season, the northwest India also gets convective dust-storms locally called as “Andhi”. These severe thunderstorms have significant socio-economic impact which leads to loss of life, property and standing crops in the eastern and northeastern parts of the country. An accurate location specific and timely prediction is required to disseminate adequate warning to various sectors.

The thematic session on “Cyclone and Severe Local Storm” in this respect will provide a platform for exchange of ideas, findings of scientific research and disaster management experience of those working on these extreme weather events. The session is expected to describe all the essential components such as research and development on various aspects of cyclone and severe local storm, involvement of disaster managers in managing risk management and policy makers. Session Focus: The thematic session will focus on following aspects of cyclone and local storm risk management

- ◆ Genesis and evolution of cyclonic system
- ◆ Cyclone track and intensity prediction
- ◆ Storm surge prediction
- ◆ Severe local storm prediction
- ◆ Cyclone warning system
- ◆ Cyclone risk mitigation and preparedness

Proceedings

In this session 21 papers were presented.

The first session was chaired by AVM Dr. Ajit Tyagi, India Meteorological Department

who made introductory remark on objective of the session. Prof. U. C. Mohanty, IIT Delhi presented the first lead talk entitled “**Prediction of track and intensity of tropical cyclones over Indian Seas: Present Status and Future Challenges**”.

According to him, in recent a series of high-resolution, non-hydrostatic, primitive equation mesoscale models such as PSU/NCAR MM5, WRF (ARW & NMM), ARPS, ETA and HWRF are used for the simulation /



prediction of tropical cyclones. He illustrated the skill of prediction of track and intensity of the tropical cyclones over Indian seas.

Dr. P. C. Joshi, ISRO Ahmedabad presented his paper on “**Recent advances on Satellite Observation of Tropical Cyclone studies: Indian perspective**”. He argued that with the development of advance sensor technology and with the availability of a variety of satellites orbiting the earth, it seems appropriate to adopt a multi-spectral multi-sensor combination that takes advantage of the inherent benefits of each and can likely lead to improved tropical cyclone analysis results. His study showed that individual brightness temperatures and derived parameters are correlated with Tropical Cyclone (TC) intensity, intensification potential, and can help in TC positioning. Unique features of the tropical cyclone structure and the movement using the recent satellite observations were also described.

Dr. P. Goswami, C-MMACS, Bangalore presented his paper on “Design of Flight Path for Tropical Cyclone Observation over Bay of Bengal”. While emphasizing growing expectation and demand for longer range and higher accuracy, it is a recognized fact that improved initial states can significantly increase skill in forecasting track and intensity of tropical cyclones. He presented an optimum flight path for drop sondes with a series of simulations of tropical cyclones with synthetic assimilation to determine optimum flight path for dropsondes. To ensure a large domain but sufficiently high resolutions the model presented used a variable resolution Global Circulation Model (GCM) that combines the advantages of a limited area model and a global model. The paper considered thirty cases, including storms and cyclones representing different locations, seasons, years (1990-2005) and strength over the Bay of Bengal to evaluate the methodology. The simulations indicate distinct locations of maximum effects for the dropsondes for tropical cyclones in pre and post monsoon periods. While the location of maximum effect for cyclones in October-November period is around 110E that for the cyclone in April-may is around 90E. He added that results can be used for improving cyclone forecasting through more sophisticated (but expensive) targeted observations.

Dr. M. M. Ali, National Remote Sensing Centre, Hyderabad talked on “**Possible Solution to Improved Cyclone Track and Intensity prediction for better disaster management practices**”. It was stated that developing an ensemble model combining the soft computing techniques and numerical models using ocean average temperature can improve cyclone track and intensity prediction. In his opinion, the soft computing techniques, like the artificial neural networks (ANN), could yield better results compared to the numerical models.

Dr. S. S. V. S. Ramakrishna, Andhra University while simulating cyclone Mala, Gonu, Nargis and Aila emphasized that Madden Jullian Oscillation (MJO) strongly modulates a climatological pattern of cyclogenesis in the Indian Ocean region. He presented his paper which investigates dynamical aspects and ambient conditions in the North Indian Ocean which are favorable for the formation of the Tropical Cyclones. Simulations of the above four systems (Mala, Gonu, Nargis and Aila) were made using MM5 and WRF meso scale models and the results were presented. The observed relationship between the Tropical Cyclone activity and the MJO was examined using a 10 year Outgoing Long wave Radiation (OLR) data from the NCEP/NCAR Reanalysis. It was found that the MJO strongly modulates a climatological pattern of cyclogenesis in the Indian region where more cyclones form in the active phase of the MJO.

Ms. Sujata Pattanayak, IIT Delhi presented her paper on “**Quantitative Precipitation Forecast for the very severe Cyclonic Storm Nargis: Sensitivity to Resolution and Convective Parameterization**”. In her study, the state-of-the-art, non-hydrostatic dynamic core of Weather Research and Forecasting (WRF-NMM) model was used to evaluate the unique characteristics of tropical cyclone precipitation forecast by calculating the skill of rainfall forecast in terms of a) ability to match observed rainfall patterns; b) the ability to match the mean value and volume of observed rainfall; c) the ability to produce the extreme amounts often observed in tropical cyclones. Model sensitivity to horizontal reso-

lution was investigated using 27 km and 9 km of model simulation over the same domain area. Further sensitivity tests were also performed using different convective parameterization schemes available in the WRF-NMM model. Findings show that variation in predicted peak precipitation is highly resolution dependent. The station wise precipitation forecast and the QPF response to changing resolution both were found to vary significantly with choice of convective parameterization.

The second sub-session was chaired by Dr. Swati Basu, Ministry of Earth Science (MOES). In this sub-session, Dr. H. R. Hatwar, IMD Pune presented the lead talk entitled “**Challenges in Tropical Cyclone Forecasting**”. Outlining the main challenges in respect of tropical cyclone predictions he identified three factors (a) will the Cyclone hit the coast and where and when (b) what will be its intensity and (c) What will be the cumulative damage? In this presentation, he discussed the IMD’s operational forecast track errors and some of the major initiatives taken to improve the track and intensity forecast by the department. He concluded with his observation that more research effort is needed for non conventional data-satellite products, radar inputs, etc. and importance of aircraft and dropsonde facilities for tropical cyclone structure and intensity forecast.

Dr. M. Mohapatra, IMD presented a paper on “**Characteristic feature of land falling cyclone and cyclone prone districts of India**”. The paper using cyclone data from 1891-2008 tries to analyze characteristic features of Tropical Cyclones land falling over coastal districts and to find cyclone prone districts of India. The cyclone proneness of a district was assessed using a composite rating procedure based on five parameters, viz (i) total number of TCs, (ii) total number of severe TCs, (iii) maximum wind, (iv) probable maximum storm surge and (v) probable maximum precipitation for the district. These parameters take into consideration the frequency and intensity of TCs along with associated adverse weather conditions. Based on different categories of ratings, the districts were classified into moderately prone, highly prone and very highly prone districts. The study shows that cyclone proneness is very high for the the districts of south 24 praganas & Midnapore (West Bengal), Balasore, Kendrapara, Bhadrak, Jagatsinghpur & Ganjam (Orissa), Nellore, Guntur, east Godabari and Srikakulam (Andhra Pradesh) and Kanchipuram (Tamil Nadu). Spatio-temporal variability of frequency of TCs and severe TCs landfalling over different coastal districts were also analysed based on mean, coefficient of variation, linear trend coefficient and periodicities. The results indicate that the landfalling TCs for the coastal districts in west coast are trendless and random in nature. They show epochal behavior with maximum landfall during 1971-1990 over coastal districts of West Bengal, north Orissa and south Andhra PradeMr.

Prof. Sutapa Chaudhary, University of Kolkata presented her paper on “**A New Stability Index for forecasting Nor’westers**”- a type of local severe storms occurring during the pre – monsoon season (April – May) in Kolkata and. precise forecast of such storms with sufficient lead time is essential to mitigate the associated catastrophe. Her study tried to formulate a single stability index from the broad ranges of available indexes which may help in forecasting Nor’westers over Kolkata. The forecast quality detection parameters were computed for the available indices using conventional statistical method to select the rel-

evant indices with appropriate ranges for the prevalence of Nor'westers. Her results show that Lifted Index (LI) within the range of (-) 5 to (-) 12 degree Celsius and Convective Inhibition Energy (CIN) within the range of 0 to 150 J/kg are the most pertinent indices for the genesis of severe local storms over Kolkata during the pre – monsoon season (April – May). The forecast of Nor'westers with NPI as the stability index was validated with the observation of India Meteorological Department (IMD) and Doppler Weather Radar products of 2007 and 2008.



Dr. M. Mandal, IIT Kharagpur presented his coauthored paper entitled “**Meso scale simulation of thunderstorm in Gangetic West Bengal with explicit representation of cloud microphysics.**” In this study the focus is on representation of cloud physics for mesoscale simulation of thunderstorms in Gangetic West Bengal. The study was conducted in three folds. At the outset, attempt was made to investigate the change in the behavior of cumulus convection scheme and explicit cloud physics scheme in numerical simulation of thunderstorm with model resolution. Secondly, sensitivity of various microphysical schemes in numerical simulation of thunderstorms was investigated through a set experiment. Finally, performance of two mesoscale community models toward simulation of few thunderstorms in Gangetic West Bengal is compared. The simulated results indicate a deep cloud system, having a liquid-phase at lower altitudes and ice-phase at higher altitudes. The rainfall is over predicted in the Goddard GSFC and Mixed phase microphysical schemes whereas it highly under-predicted in the Simple Ice and Schultz scheme. The rainfall associated with the thunderstorm is relatively better simulated using Reisner microphysical scheme. Other related parameters viz., wind, temperature, pressure is better simulated using Schultz scheme.

Mr. Krishna K. Osuri, IIT Delhi in his presentation on “**Simulation of Tropical Cyclones over Bay of Bengal during 2008-09 with WRF-ARW modeling system**” attempted to assess the skill of the high resolution meso-scale model WRF-ARW in the simulation of Tropical Cyclones (TCs) over Indian seas particularly, for Bay of Bengal (BoB). For this purpose, five most recent land falling TCs during 2008-09 over the BoB namely Nargis, Rashmi, Khai Muk, Nisha and Aila were simulated in real time. In this study, the WRF model with horizontal resolution of 27 km, utilized the initial and boundary conditions obtained from Global Forecasting System (GFS) analyses/forecast products of National centers for Environmental Prediction (NCEP), USA. Making a comparison of WRF model tracks and operational tracks he argued that WRF model was able to capture the major features of tropical cyclones including development from initial depression, intensification, tracks and landfall.

Mr. Sourav Taraphdar, Indian Institute of Tropical Meteorology, Pune presented his

coauthor paper “**Effects of Moist Convection and Resolution on Tropical Cyclone Predictability over North Indian Ocean**”, in which, he addressed the problem of incorporating moist processes at 10 km resolution in predicting the track and intensity of tropical cyclones (TC) over the North Indian Ocean. The second objective of the study was to find out the combined role of moist convection and resolution in limiting the predictability of TC. Two recent TC were taken as the example for the study. The experiments were carried out following three strategies. In first, moist processes represented by parameterized convection and explicit microphysics; in the second, by explicit microphysics only, and in the last, by convection only. The Results revealed that hybrid framework of convection (parameterized and explicit) produces better forecast of track and intensity of the Tropical Cyclone compared to the other two strategies. He argued that the study establishes moist processes have more dominant role in the error growth of short range forecast of TC compared to resolution.

Third sub session was chaired by Mr. D. R. Sikka, Retired Director, Indian Institute of Tropical Meteorology, Pune. Prof. S. K. Dube, IIT Delhi presented the lead talk entitled “**Recent Developments in Storm Surge Prediction in the North Indian Ocean**” He argued that storm surges associated with severe tropical cyclones are the most damaging and emphasized real-time monitoring and warning of storm surges is of great interest. He added that it is necessary that problem of the storm surge be seriously addressed by the countries of the various regions through collective efforts and in an integrated manner. The frequency of tropical cyclones in the North Indian Ocean is not high as compared to northwest Pacific, still



the coastal regions of India, Bangladesh and Myanmar suffer the most in terms of loss of life and property damage. The reasons, besides the inadequate prediction of storm surges accurately, are the low lands all along these coasts and considerable low-lying huge deltas, such as, the Gangetic delta and the Ayeyarwady delta. He provided an outline of storm surge prediction system with his findings of high resolution model in application to some of the recent cyclones. The main objective of the present paper was to highlight the recent developments in storm surge prediction in the Bay of Bengal and the Arabian Sea and also some steps in the direction of vulnerability mapping with the objective of long term storm surge hazard planning, management and mitigation.

Prof. A. D. Rao, IIT Delhi presented his work “**Development of long -term hazard planning and vulnerability assessment of storm surges**” in which he emphasized role of a reliable vulnerability mapping process in risk reduction. In the paper, a case study of Disaster Management Plan for coastal stretch of Andhra Pradesh and Orissa was presented

using more than 100 years cyclone and associated storm surge data. Return periods for various cyclone events were also determined. The maximum probable surge amplitudes were simulated using numerical storm surge models. The maximum probable total water levels were also calculated by superimposing the tidal amplitudes and wind wave setup on the surge amplitudes. The 50-year return period event was considered for computation of total water levels and based on this, protection measures suggested for prevention of flooding along the coasts. He argued that development of location specific integrated prediction system is crucial for assessment of cyclonic risk and vulnerability.

Dr. A. V. N. Satyanarayan, IIT Kharagpur presented his work entitled **“Skill Assessment of Thermodynamic Indices in Forecasting Pre-monsoon Severe Local Thunderstorms over Kolkata– A Case Study”**. He explained that prediction of thunderstorms is one of the most difficult issues in weather forecasting. Deep convective clouds which develop on a small spatial and temporal scale and operational numerical models with good horizontal resolutions are not successful in predicting not only the location and the time of convection initiation but also the type and intensity of thunderstorms. Severe thunderstorms are frequently associated with heavy rainfall, hail, or local storms that are a major cause of natural disasters. Improving the prediction of thunderstorms more particularly, severe ones may help to prevent or mitigate damage. In the study he emphasized on the pre-monsoon thunderstorm over Kolkata. The study broadly evaluated several convective indices with respect to their skills and efficiency to predict thunderstorms and proposed suitable threshold values for indices to predict occurrence of thunderstorm activity during pre-monsoon months over Kolkata.

Ms. A.J. Litta, IIT Delhi presented her paper **“Numerical simulation of severe thunderstorm produced tornadoes over India with WRF model”**. It was mentioned that tornadoes are rare weather phenomenon involving a violently rotating column of air, which is in contact with both a cumulonimbus cloud and the surface of the earth. This dangerous phenomenon occurs mostly in the United States, but occasionally occurs in other parts of the world including India. In the study, they made an attempt to simulate two events- one in Ludhiana in 2007, and the other in Rajkanika, Orissa in 2009, using Non-hydrostatic Mesoscale Model (NMM) core of the Weather Research and Forecasting (WRF) system with a spatial resolution of 3 km for a period of 24 hours. The study showed that the model, simulated well both dynamical and thermo dynamical variables for the occurrence of tornado over Ludhiana and also over Rajkanika, and agree reasonably well with the observations. The results of these analyses demonstrated the capability of high resolution WRF-NMM model in simulation of severe thunderstorm produced tornadoes and determined that the 3 km model improve upon current abilities when it comes to forecasting severe thunderstorms.

Mr. Ashish Routray, National Centre for Medium Range Weather Forecasting, Noida presented his paper entitled **“Data Impact Study on Simulation of Monsoonal Heavy Rainfall Events over India”**. In this study, he attempted to numerically simulate a record-breaking heavy rainfall event on 26-27 July 2005 occurred over Mumbai to

evaluate the performance and overall effectiveness of the three dimensional variational (3DVAR) data assimilation system for simulation of the localized heavy rainfall event. Two numerical experiments were carried out using WRF-ARW modeling system with a domain (horizontal resolution 30km) to study the specified event. The first experiment, namely the control simulation (CNTL), the low-resolution global analysis was used as initial and boundary conditions of the model. It was noticed that the model was not able to comprehensively capture the amount and location of the localized rain event. The second experiment, called as 3DV was carried out after the model initial condition was improved with insertion of the conventional and non-conventional observations through 3DVAR data assimilation scheme. The results indicated that the improved initial condition of the model through 3DVAR enhanced the model simulations. He informed that the model performed well in another heavy rainfall event on 25-28 June 2005 occurred over Gujarat. The results indicate that the improved initial condition of the model through 3DVAR is enhanced the model simulations.

The fourth sub session was chaired by Dr. H. R. Hatwar, IMD Pune. Dr Kamal Lochan Mishra, Orissa State Disaster Management Authority presented the lead talk entitled **“Linkage of science, institution and society in tropical cyclone disaster management in the state of Orissa”**. He provided a summary of devastation during Orissa super cyclone 1999 and argued that Science and technology played a vital role in the neo-disaster-management set up contributing immensely not only to the disaster rescue, relief and response activities but also assisting the decision support system for better disaster management. In his opinion for such disaster management, scientific institutions which were confined to their labs have started extending their tangible contribution to the disaster managers at all levels to serve the vulnerable and the affected people. He emphasized that the Society in general and the community in particular is identified and emerged as the strongest stakeholder in the entire process of disaster management. The experience in Orissa shows that careful coordination between the institution building, society and the scientific institutions is the ultimate elixir for facing disasters.

Dr. Saudamini Das, Institute of Economic Growth, Delhi made a presentation **“Storm Protection Services Mangroves: Evidence from the Super Cyclone of 1999”**. She attempted to present mangrove analysis and tried to quantify impact of mangrove cover in minimizing losses. She provided an outline of her methodology of the study and argued that total death may have doubled during Orissa cyclone 1999 in the absence of mangrove cover.

Dr. M. S. Ullah, Chitagong University presented his coauthored paper entitled **“Dissemination to Response: In search of new strategies for Broadcast media in Cyclone warning of Bangladesh”**. He argued that many other factors such as poverty level, education, frequency of exposure, house pattern, availability of cyclone shelters and God’s mercy are important other than media broadcast warning message in public response to cyclone warning. He concluded with his recommendation that (a) cyclone warning should be reoriented according to the need and understanding of the public; (b) radio and television should take care to check authenticity of broadcast warning; (c) broadcast

media such as radio and television should operate round the clock in Bangladesh if there is a depression and (d) comprehensive education/awareness campaigns should be undertaken at all levels.

Dr. Manoj Kumar, BIT Ranchi presented his study, “**Surface layer parameter during thunderstorm event during sub tropical monsoon region along eastern end of trough axis in India**”. His paper deals with the analysis of thunderstorm and dust storm events that occurred over humid subtropical monsoon area of India, during summer season. Three extreme weather conditions cases for thunderstorm on May 19, 2008, March 6, 2009 and thunderstorm activity on 20th March, 2009 were discussed in this paper. It was observed that as storm intensifies, wind shear stress, turbulent kinetic energy per unit mass increased abruptly and it started to decrease as storm settled down. It was also tried to quantify the general trend of these parameters during active summer season when strong hot and dry wind condition prevailed from March to June in this region.

Recommendations

- ◆ Enhancement of observations over data sparse oceanic regions as well as establishment of mesoscale-network of observations over vulnerable regions.
- ◆ Implementation of better assimilation techniques utilizing all available data including land surface, remote sensing (satellite, DWR, UAV, aircraft) data etc. for initialization of mesoscale models.
- ◆ Extensive use of coupled mesoscale atmosphere-ocean-wave model for better track and intensity prediction of tropical cyclones.
- ◆ Preparation of probability forecasts for striking potential of cyclones using multi-models for effective and reliable warning system.
- ◆ Better prediction of storm surges and associated costal inundation along with providing information on river and estuarine water level height.
- ◆ Identification of risk / vulnerability zones of coastal regions.
- ◆ More intense and systematic interaction among scientific community, disaster managers and society.
- ◆ Awareness, community involvement & preparedness and social defense mechanism need to be strengthened.
- ◆ Introduction of disaster management courses / special subject in all graduate level technical education.
- ◆ Improved techniques for mangroves generation and maintenance to reduce casualties.

Drought

Concept Note

The word drought reminds us about the lack of water, failing crops and non-availability of fodder. Drought, a most complex and least understood natural disaster, is a recurrent climatic phenomenon in several part of the country, which is affecting more people than any other disaster. Drought should not be viewed only as a physical phenomenon or natural event as it results in significant socio-economic and psychological impacts, regardless of level of developments, although the symptom of these impacts tends to differ. Drought is not a temporary phenomenon as seen through our experience, but is long lasting and it cripples and affects the poor and the rural the most. Drought impacts in all agro-climatic regions, but more severally in arid and semi-arid regions. A deficiency in rainfall in a certain period, as measured against the expected average rainfall for the period, causes depletion of both surface and ground water levels, and adversely affects the water supply and agricultural operations. The differences in regional rainfall pattern, human response and resilience, slow-onset, and diverse academic perspective make it difficult to provide a precise definition of drought and meteorologist always find it difficult to predict the drought well in advance to pre-empt drought preparedness.

Context

The Indian agriculture virtually linked to the monsoon performance has suffered several onslaughts from recurring droughts. The droughts of 1985,1986 & 1987, 2000,2001 &2002are recent examples of how potentially severe disasters were successfully tackled through technological and managerial innovations. If such droughts could be predicted in advance some actions might be possible to minimize the disastrous consequences. A whole range of inputs from various scientific departments and organizations may help in meeting this objective.

Proceedings

The Thematic session on drought had 3 lead talks and 7 contributory papers dealing mainly on drought assessment, drought evaluation, drought management strategies including early warning system, impact of drought on food production, drought in relation to climate change and drought as a development issue in Afro-Asian region and sharing of inter-regional information on drought related issues to build inter-regional partnership. The broad spectrum of papers presented covered different aspects of scientific, agricultural and socio-economic aspects.

The issues that were discussed in the session can be broadly summarized as given below:

- ◆ Drought Assessment & Combating through weather based advisory services.
- ◆ Monitoring and Early Warning system in drought Management.
- ◆ Livestock Management in Drought.
- ◆ Drought situations over India, its management with a case study.
- ◆ Impact of Drought and Flood on Indian Food Grain Production.
- ◆ Drought management strategies in Agriculture in Andhra Pradesh.
- ◆ Climatic changes and forewarning of agricultural drought over Western Rajasthan.
- ◆ The potential of peer learning between Africa and Asia on Drought as a developmental issue.
- ◆ Rectification of Standardized Precipitation Index Classification for Drought Evaluation in Fars Province.

Dr. J. S. Samra, Chief Executive Officer, National Rainfed Area Authority, Government of India, chaired the session. In his opening remarks, he explained that drought is a slow process, appearing and disappearing very slowly. He wanted the administrators to understand some of the hidden problems of drought, like, the shortage of live stock, loss of fertility of land and depletion of groundwater resources. He explained this hidden phenomenon with some examples. The rice crop, if lost, amounts to loss of 6 months of toiling of the farmer, whereas the loss of orchard will mean loss of 15-20 years of toiling of the farmer, he explained. Similarly the drought which occurs before pollination in coconut areas, like Wynad district of Kerala will affect the crop of the same year, whereas if it occurs after pollination will affect the crop of next year, he added. Further the perennial losses will include groundwater depletion which is also a hidden phenomenon.



He explained that the peculiarity of 2009 drought was that, it started initially with deficit rainfall, continued by normal rainfall and then again deficit rainfall all over the country to be followed by unusually excess rainfall in some drought prone areas. He emphasized the shift in approach of people towards drought by sharing his experience that in 2009 drought, all were asking for extra energy instead of food for work programme, as usually, use to be the case. He pointed out that the significant shift was towards mitigation from usual relief. However he opined that the extra power like subsidy on diesel will also lead to over exploitation of groundwater, which was the main source of water in the drought period.

Dr. L.S. Rathore, IMD delivered a lecture on **“Drought Assessment & Combating**

through weather based advisory services”. He mentioned that defining drought itself is a complicated

issue and discussed the role of Agromet Advisory Services (AAS) in combating drought. He went on to elaborate several indices developed by IMD based on rainfall status, drought severity, aridity index (I_a) based on water deficit and water need, its departure percentage to know the drought category. The role of AAS in combating drought which

include observation, whether forecast, diagnosis of weather related stresses, weather based farm management advisory, Advisory bulletin dissemination was enumerated. The Components of variability in weather and climate, role of information in farm management, Milestones achieved by IMD in AAS, the task of National Centre for Medium range forecasting, the Agro met R&D back up of ICAR were elaborated and the challenges of weather forecast for various utility and the ultimate launching of the AAS by converging of IMD and NCMRWF in a single window from 01.04.2007 were explained.

The advisory preparation and its dissemination to various targets groups were discussed and National Level Agromet Advisory bulletin preparation for the Ministry of Agriculture for taking important decisions in Crop Weather Watch Group (CWWG) meeting, besides, communicating to all the related Ministries and various concerned organizations and NGO for their use was also discussed in detail.

As a sum up of the talk the topics like Mass Mode of Dissemination like All India Radio, Television and print Media the web pages of IMD etc and feed back mechanism were covered.

Dr. K. S. Ramachandra, National Rainfed Area Authority presented a talk on **“Livestock Management in Drought”**. It was felt that drought is normally associated with crop failure, drinking water scarcity and out migration of people, and mentioned that livestock in drought prone areas are considered as best coping mechanism against crop failure, providing regular income and much needed safety net, as they can be sold, pledged or traded. The speaker explained the situation depicting some examples of a situation of 1987 drought of Barmer district of Rajasthan. The Mitigation



strategies and available options were discussed and shown in the form of tables and various options were evaluated. Objective of drought mitigation strategies included ensuring survival of farm business, minimum loss of productivity, minimal number of animals for optimizing available resources.

Dr. Ramachandra further stressed that the Management Practices to be adopted should include, (a) not to keep animals under direct sunlight, (b) Provide proper ventilation in sheds, (c) avoid Over crowding of animals in shed, (d) preferably early mornings and late evening feedings, (e) less hours of grazing and shorter distance. He felt that Contingent Plan for drought mitigation from livestock perspective is not well developed in our country. Focus is mostly on drought relief measures and both short and long term strategies need to be developed for mitigation. The long term strategies were discussed in detail. And the options available include harnessing unsown area for taking up cultivation of short duration crops of sorghum, bajra etc. as fodder, in sugarcane growing areas Sugarcane tops and dry sugarcane leaves may be transported, enriched for crude protein content and fed in scarcity areas. Sugarcane baggase and press mud may be treated and transported to deficit areas for survival feeding. Partially damaged wheat and other grains may be diverted for feeding to save productive animals. He felt that the present drought relief is largely oriented towards organizing cattle relief camps and providing health protection but he stressed that the focus to be given for sustenance of productive animals, CRF norms needs a relook, and productivity loss to be compensated and there is a need for establishing a National Feed Grid.

Dr. Jagvir Singh, National Centre For Medium Range Weather Forecasting gave a presentation on **“Drought situations over India”**. The study presented an insight on inter-annual and intra-seasonal variability of Southwest Monsoon Season (SWM) rain over sensitive parts of India in recent past ten years. He explained about the simulations of atmospheric conditions by Numerical Weather Prediction (NWP) Models at National Centre for Medium Range Weather Forecasting and their results about droughts in India in the past decade. He explained that in beginning of 21st century, India suffered first all India drought in 2002. Thereafter, SWM rains have been normal keeping our country safe from droughts. But major parts of northwest India have been facing drought like situations frequently. There have been negative departures of about 20% or more than those of normal values over these areas. He observed that as per observations from year 2002 to 2008 by Gravity Recovery and Climate Experiment (GRACE) satellites have shown depletion of ground water by an average rate of 4 cm (+/-1cm) / Year over Rajasthan, Punjab, Haryana and Delhi. Analyses of long term observations have shown, number of events with less than four days continuous rain spell have increased and prolong dry epochs also have increased over India. He went on to say that the country has suffered a financial loss of about 14,98,722 US\$ and 350 million people got affected badly due to drought in past ten years. He stated that rain deficiency in 2009 is worse than that of SWM rain of season. He opined that it requires analyzing the observed facts of rains in more details and study the associated atmospheric conditions responsible for such scenarios using latest and NWP capabilities.

Dr. Syed Amir Shamsnia, Islamic Azad University of Tehran presented his paper on **“Rectification of Standardized Precipitation Index Classification for Drought Evaluation**

in Fars Province". He stated that with the climate conditions in Iran, drought is always expectable and to cope with its damages, it is important to know its features and for defining drought, the phenomenon of drought should be turned from qualitative and descriptive to numeric and quantitative. He added that basically a drought index is a function consisted of different drought-based environmental factors, resulting as a number at the end. Standardized Precipitation Index is one of the most important indices upon which drought evaluation is achieved with the range of precipitation. The various drought indices are Palmer Drought Severity Index (PDSI), Crop Moisture Index(CMI), Surface Water Supply Index (SWSI), Percent Normal (PN) and Standardised Precipitation Index (SPI). In his study, three classifications have been compared. SPI is one of the indices that presented for drought Monitoring. SPI is a strong tool for rainfall data analysis which aims at assigning a numeric value to precipitation to compare the areas with different climate and is calculated in short term (3,6, and 9 months) and long term (12, 24 and 48 months). In any time scale, the SPI mean would reach zero in a location and its variance equals to 1. He felt that it is an advantage because it is a normalized index. To classify SPI drought severity, it is believed that the drought appears within a period when SPI is negative consistently and drought starts when SPI is down to zero and it stops when the severity values are positive. He explained that thus a classification is determined with 30-year results compatible with the study on climate conditions at every aspect. The evaluation and comparison results of three classifications in Fars Province showed that the modified classifications due to adjustment of SPI ranges according to proper drought threshold resulted in a more accurate classification he felt.

Dr. D. Raji Reddy, Acharya N.G. Ranga Agricultural University, Hyderabad, presented his paper on **"Drought management strategies in Agriculture in Andhra Pradesh"**. He mentioned that Andhra Pradesh has historically been one of the drought affected states in India. Out of the 23 districts in Andhra Pradesh, four districts of Rayalaseema namely, Anantapur, Chittoor, Kadapa and Kurnool, four districts of Telangana namely Ranga Reddy, Mahaboobnagar Nalgonda and Medak and one district of Coastal Andhra namely Prakasam are drought prone districts. Rainfed crops like jowar, maize, groundnut, greengram, blackgram and sunflower and one water-intensive crop like rice are mainly affected owing to drought in these districts, he said. He felt the drought conditions occur due to failure of South West Monsoon, delay in arrival of SW monsoon, break in monsoon conditions or early cessation of SW monsoon. He explained, Rainfed agriculture in India depends on onset of monsoon and the rainfall distribution during crop growth season. The amount of rainfall and the time of onset of monsoon decides the type of the crop to be grown, he said. The timely onset and well distribution of monsoon rain in the



month of June and July decides the area coverage of rainfed crops. Any deviation in onset of monsoon rain results in significant change in area covered by different crops. Drought during crop season will have significant influence on growth and development of crops which leads to reduction in yield, he said. Drought can be managed by closely monitoring seasonal conditions, suggesting contingent crops on near real time basis, adopting different farm level options like changing the sowing dates, adopting different crop varieties and supplemental irrigation using micro irrigation and advance weather information on occurrence of drought through extended range forecast/seasonal climate forecast and disseminating agromet advisories issued based on medium range forecast for mid-season corrections, he said. To conclude it was mentioned that these measures have shown to reduce the adverse impacts of drought.

Dr. Durgesh Nandini, Indira Gandhi National Open University presented her paper on **“Drought Management: A Case Study of India”**. This paper covered social aspect of drought. She spoke about integrated use of surface and groundwater, gainful imple-

mentation of NREGA and control of Artificial Price rise and deliberated upon the phenomenon of drought and disaster management system in India. The objectives of her study were to explore the causes and impacts of drought; analyse the existing drought management system in India; and suggest necessary measures to mitigate the disaster. In common parlance, drought denotes scarcity of water. In this situation, crop failure due to lack of rains is



the most common form of drought, she opined. Drought reverses the development process, creates health problems, encourages unsocial behaviour, demoralises the people, and leads to migration thus exporting conflict and resentment to the neighbourhood regions. Vulnerability to drought, from economic angle reduces the demand within the economy generally, increases defaults on loans in rural sector, and reduces the Government revenues. The affects of droughts on national economy were elaborated. Given the large size of the country and the very high time and space variability of the southwest monsoon rainfall, it is not surprising that no part of India can be regarded as free from the likelihood of occurrence of drought. She briefly explained various programmes for drought management like Desert Development Programme, Drought Prone Area Programme, and Food for Work Programme. As the disaster preparedness is a very cost-effective component of disaster management preparing the community for meeting the challenges was considered essential.

Dr. V. S. Prakash, Karnataka State Natural Disaster Monitoring Centre delivered lecture on **“Monitoring and Early Warning system in drought Management”**. He explained about the drought monitoring which consists of Analysis of recent events, comparing the

current situation with historical context – Temporal and Spatial – Early, Mid, Late Seasons, identifying areas affected by drought, consequences of drought and then effective communication to decision makers. According to him Drought is of two types: i.e. conceptual, which helps to understand the drought and its effects, and operational, which helps to identify the phases and intensity of drought. He then explained about a survey conducted about the opinion of people about the drought related issues, governmental initiatives, crop insurance benefits, weather forecasting, response system and ultimately how the relief reached the needy. He also touched upon the gaps and remedies available.

It was stressed that timely and reliable data and information must be the cornerstone of effective drought policies and plans, and opined that monitoring drought, presents some unique challenges because of the distinctive characteristics of drought. The objective of an early warning system is to alert the community of any impending hazard so that they can take preventive measures, he stressed. An early warning system basically has four components – Capturing the precursor events, transmission of this data to a central processing facility, alert recognition of an impending crisis and warning dissemination. Capturing the precursor events is generally a technology driven process for most disasters and the human element plays a vital role in the data capture. Transmission of this data to the central processing facility is also totally technology based. Alerts are generated based on data analysis and sometimes, alert generation may take some time, as a decision making process may be involved. The dissemination of warning to the vulnerable sections again has both technology and human elements. He advocated for Comprehensive effort to evolve and standardized area specific guidelines for drought, Creation of a partnership to develop and implement an integrated drought monitoring system and a suite of products to meet the needs of different sectors. In conclusion, it was mentioned that Investments on excellent monitoring system, generating scientific input for the mitigation and preparedness—especially risk management, will pay a large dividends in reducing societal vulnerability and therefore the risks associated with drought, and recommended for policies that encourage self-reliance and the sustainable use of natural resources which will be more effective in the long term and will reduce the need for governmental intervention.

Dr. Aseem Andrews, NDMA presented a paper on **“The potential of peer learning between Africa and Asia on Drought as a development issue”**.

He discussed mainly on issues like Potential of Africa-Asia networking and on Africa – Asia Drought Risk Management Peer Assistance. It was stated that globally, and especially in developing countries, drought is one of the significant natural disaster in terms of spatial extent, duration of exposure, mortality and long-term socio-economic and environmental



implications, posing a serious impediment to the achievement of Millennium Development Goals (MDGs). Over the past decade, a number of initiatives have pioneered partnerships among like-minded countries in Africa to strengthen their capacity for drought prevention, preparedness and recovery systematically. The gaps identified are the limited opportunities for networking and technical exchange of best practices between African and non-African experts and practitioners. A wealth of knowledge - based resources already exists in Asia for drought coping and resilience building, both at policy and practice levels, many of which are deemed relevant in the African context as well. Discussing on the Potential of Africa – Asia networking, it was felt that much of this potential remains unrealized. In order to help bridge gaps between knowledge producers and users, the call has been made for more institutionalized South-South cooperation and more formalized inter-regional communication strategies between Africa and Asia.

Dr. Ajay Singh, IIT Bombay presented a paper entitled **“Impact of Drought and Flood on Indian Food Grain Production”**. The Indian agriculture is highly dependent on spatial and temporal distribution of rainfall and Agriculture provides livelihood to almost three fourth of population of India. Climate extremes such as drought and flood affect agriculture severely. An account of impact of climate extremes viz. drought and flood, on Indian food grain production was presented in his paper. There are temporal fluctuations in food grain production. It was pointed out that after mid-eighties there is a decline in the area of food grain while maintaining an increase in production of food grain suggesting the improvement in agricultural technology and policy. As per analysis, the impact of drought on Indian agriculture is more severe than that of flood. He explained that Rabi food grain production, depicts better adaptability to drought than kharif food grain production mostly due to better access to irrigation infrastructure. Among the various food crops analyzed, all, except jowar, can effectively face flood events. Wheat and jowar perform relatively better during drought events. Since rice is staple food in the sub-continent, management of rice productions against climate extremes needs special attention for food security and sustainability.

Dr. A. S. Rao, Central Arid Zone Research Institute, Jodhpur in his paper on **“Climatic changes and forewarning of agricultural drought over Western Rajasthan”** mentioned that the study of time series data has showed that there is an apparent increase in annual rainfall at a linear rate, with respect to entire region, though this change is not uniform at all places. It indicates rising as well as decreasing trend. It was informed that the Daily rainfall data of arid Western Rajasthan for long period (1901-2007) have been utilized to form an annual rainfall time series. The time series are subjected to linear trend analysis, with respect to all the 12 district headquarters of the region. To study the climatic shift in the region, mean moisture index (Im), intensity and frequency of drought have been worked out over Western Rajasthan. The study has shown that there is an apparent increase in annual rainfall at a linear rate of 21 mm per century with respect to entire regions. However, this change in rainfall is not uniform at all the places. Out of 12 districts, nine district headquarters viz.; Nagaur, Jalore, Sri Ganganagar, Sikar, Jodhpur, Churu, Jaisalmer, Pali and Barmer indicated increasing trend whereas, at remaining three places of Hanuman-

garh, Bikaner and Jhunjhunu have shown decreasing trend. The shifts in the moisture index line of -80.0 does not show any continuous increase or decrease of desertification conditions in the arid zone of Western Rajasthan. Whatever shifts have been noticed with respect to space and time were only temporary causing mild spurts of aridity and desertification. The Frequency of drought revealed that over different places, its frequency varied between 4 and 8 per decade in the past. Besides, three mild droughts, each decade also experienced at least either one severe or two moderate nature of droughts. The probability of occurrence of severe droughts, however, indicate highest percentage of 21 at Jaisalmer and 20 at Barmer which showed that these extreme western parts of the region experience droughts of severe nature at least once in every five year period. It was suggested that monitoring of cumulative weekly rainfall during different kharif crop growing seasons is very simple but can be successfully used as an indicator for early warning of agricultural drought for different crops in the Western Rajasthan. The data recorded over CAZRI, Jodhpur in the recent past revealed that if enough sowing rain is not received latest by 27th meteorological week i.e before middle of July, there is a likely chance of occurrence of terminal drought for pearl millet at reproductive phase of the crop as observed during drought years 2000 and 2004. Similarly, if adequate sowing rains do not occur by the end of July, there is no possibility left to grow even short duration kharif pulses successfully. In his concluding remark, he shared experience of 2002, when adequate sowing rain did not occur by middle of August, the entire region was wiped out under severe drought.

Dr. D. K. Chadha, former Chairman Central Ground Water Board, Ministry of Water Resources stressed for the need to create a dedicated data base and web site on drought mitigation. Dr. K. D. Sharma, National Rainfed Authority, emphasized for evolving integrated safety nets works like crop insurance etc to save the farmers to some extent during the drought. Dr. B. R. Neupane, UNESCO stressed for knowledge base as it will go a long way in mitigation of drought. He advocated for simplistic Agromet advisories for the farmers, so that it can be understood and followed by them. Dr. D. R. Sikka suggested for a survey to be conducted by IMD, to know the feed back from the users and farmers about their advisories.



Recommendations

- ◆ Creation of Knowledge-base covering all aspects of droughts and establishment of national and international knowledge network on drought management.
- ◆ Investments on excellent monitoring system, generating scientific input for the mitiga-

tion and preparedness – especially risk management. This will pay large dividends in reducing vulnerability and therefore the risks associated with drought

- ◆ Safety nets like weather based insurance may be evolved and integrated with the development, thus mainstreaming the disaster with the development process.
- ◆ Promotion of integrated use of land, Surface and ground water and manpower in such a way through various Government sponsored schemes that the drought period can be utilized for long term drought mitigation measures.
- ◆ Simplistic advisories to farmers for implementation in the field level.
- ◆ Preparation of a drought manual.
- ◆ Establishment of more cattle relief camps in the drought prone areas.
- ◆ Establishment of National Food Grid for the cattle population.
- ◆ As drought frequency may increase under climate change, efforts to be devoted to introduce drought resistance crop varieties.

Industrial and Chemical Disaster

Concept Note

It is now realized and well recognized that all disasters are the result of human influences. However, there are certain categories of catastrophe where the initiating event or the cause of hazard is manageable under human control and capacities by technology, participation and management. Such disasters are usually preventable and if not, then certainly controllable by way of disaster mitigation and emergency response-preparedness in advance. Industrial disaster consists of all the disasters that occur due to mishaps or failures in industry or related activities and also the disasters that affect the industrial functions, property and productivity. However, there are no hard lines between the two and also from the so called 'natural disasters' because of increasing understanding of the overlapping nature of causes, consequences and mitigation measures besides the interdisciplinary nature of the central risk management approach. 'Chemical Disasters' and 'Industrial Disasters', terms often used with confusion has a valid reason of being each of these to be sub-category of another. There may be chemical disasters not necessarily an industrial one and on the other hand, there may be industrial disasters other than chemical accident. A chemical disaster may occur due to both, natural or man-made sources, however, in view of growing chemical usage and industrial development worldwide, the pre-disaster prevention and mitigation of chemical (industrial) disasters is a serious concern. Besides, the category 'industrial disasters' is applicable for any major activity or system that involves workers-employer, production, formulation/manufacturing, and business/ financial benefits, when it is affected by a disaster or a disaster that originates from within that industrial system/location. Chemical disaster may involve a hazardous chemical that may have - flammable and or explosive, toxic, corrosive, radioactive, highly reactive - one or more of these properties.

Context

There are currently over 1949 Major Accident Hazards (MAH) units in the India besides other small and medium-sized industries, in huge numbers, all across the nation and new industries are also coming up at rapid rate. Chemical accidents may occur due to lack of safety measure, technical failures, a human error or negligence or another disaster of natural or anthropogenic origin, e.g., flooding, landslide, earthquake, etc. The release of hazardous material may occur in case of an accident during manufacture, storage, handling, transport, use or disposal stage of its life-cycle. Besides these accidents, there were several instances of chemical disasters occurred due to failures of tailing dams, dykes, ash-ponds, hazardous waste facilities, ETP failure, mass contamination, etc. in manufac-

turing, electronic, metallurgical and other industries. Serious disaster risks are involved in water resource engineering projects including hydro-power plants. Mining industry is the one ever known for its hazard potentials whether during mining operations (underground or surface), transport, ore/mineral processing, transport, storage, etc. which are often in the form of fire, gas toxicity, explosion, flooding, subsidence, etc. There are various environmental tools like EIA, Audit, Life-cycle Assessment, Risk Assessments (Safety Risk Assessment, Health Risk Assessment, Ecological Risk Assessment), Ecological Footprint, etc which have been frequently used in developmental planning. Risk Assessment originally started for product risk assessment in the industrial sector has now been widely accepted for various natural disasters as well. However, other tools are still to be re-looked for their application in various phases of disaster management. A National Guidelines on Chemical Disaster Management has been released by National Disaster Management Authority (2007) as per the provisions of DM Act 2005. There is already an established framework for chemical emergency management at various levels, viz. national, state, district and local crisis groups (under EPA 1986) and a holistic disaster management framework has recently emerged under the DM Act 2005, manifesting a wide gap between the two at planning and functional levels. Integration of the two is a key challenge as is the basic need for implementing the national guidelines and the action plan at different levels.

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Mr. K. C. Gupta, Director General, National Safety Council chaired the session and stressed the need for greater interaction among various disciplines for ensuring effective planning and preparedness for curbing down the incidences of chemical mishaps within industry and outside. Industry is prone to all types of disasters, depending upon the location of the particular unit and vulnerability of that particular location. Therefore, though the specialisation is required in different fields of disaster management but we can not have compartmentalised approach to disaster management when it comes to practice. Hence, it is important that in practice, the management and the experts who assist them within the units, have a holistic multi-hazard disaster management plan in place. When we talk of industrial disasters, let us not limit the concept of industry to manufacturing sector. There is an ambitious programme of infrastructure-development projects which is prone to disasters. Mining sector is known for its hazards of accidents and coal to fire. Disasters during road or rail transport of hazardous materials are also important area of concern. Lessons have to be learnt from the past mistakes/mishaps. There are serious gaps in knowledge and



we need to document the industrial disasters. Arrangements at the local level are essential for disaster prevention and response. Competent and trained manpower is a serious limitation in infrastructure and industrial sectors. Disaster management must focus prevention in all disasters.

Dr. Stefanos Fotiou, UNEP presented a paper on **“UNEP’s Integrated Approach to Disaster Management”**. He discussed the increasing environmental disasters be the natural or anthropogenic or industrial, and complexity of their impacts on communities, resources and economies throughout the world. Environmental impacts and losses resulting from disasters jeopardise the development by affecting various environmental services, supplies and resources that are required for anthropogenic and development activities, and thus, also create the hazards and vulnerability for future disasters or conflicts. UNEP has interventions for all the disasters but has devoted programmes for chemical safety. UNEP extends leadership role providing support to the governments and private sector in management of industrial disasters. Awareness and Preparedness at Local Level (APELL) of UNEP was a successful programme in India, and the next phase of APELL has multi-hazard approach.



Brig. B. K. Khanna, NDMA spoke on **“Inculcating Culture of Preparedness in First Responders”**. He discussed the initiatives of NDMA towards inculcating culture of preparedness in first responders, community and schools and focussed on chemical disaster management, through the means of mock exercises. Effective role of community is important in the ‘off-site’ emergencies. Mock exercises in industrial disasters were conducted in the most accident hazard units. A table-top has been conducted as a planning approach to develop the mock-exercise plan. It was informed that NDMA conducted over 150 table-top and mock exercises so far, to learn the positive lessons, opportunities for improvement and clarifying roles under ‘Incident Command System’ for ‘on-site’ and ‘off-site’ scenarios. Lessons learnt were documented and reviewed.

Mr. Debanjan Bandyopadhyay, International Institute of Geo-information Science & Earth Observation presented a case study of **“Land-use planning as a risk minimizing tool”**, and discussed the case of Haldia district of West Bengal. Zoning approach for siting of industries as well as for understanding the levels of risk and vulnerability to technological hazards, but in the multi-hazard environment, can offer wider benefits. The effective management and access of information about the hazardous chemicals is crucial in preparedness and response to the accidents. Environmental Risk Reporting and Information System (ERRIS) has been developed for study using GIS approach. The similar framework can be replicated for the other industrial regions of the country. Spatial Environmental

Planning is an effective approach for disaster risk reduction and mitigation centric developmental planning at regional or district levels.

Dr. S. S. Gautam, Ministry of Labour and Employment discussed the importance of institutional framework and role of DGFASLI in industrial disaster management that is focussed mainly on prevention, mitigation and preparedness by ensuring standards of design, safety and management. DGFASLI is responsible for occupational safety and health at 12 major ports of the country. It has four regional Labour Institutes. It collaborates with International Labour Organisation (ILO) and has brought in the concept of major accident hazard management. There is a Dock Safety Division at DGFASLI. Role of DGFSLI in chemical disaster prevention and preparedness by ensuring module protocols, inspections and by developing capacities of the related sectors needs a highlight.

A paper on the **“Experience in Developing Integrated Disaster Management”**, was presented by Mr. R. P. Bhanushali, National Safety Council who highlighted the roles and achievements of the National Safety Council in area of disaster management in the country. National Safety Council has been established by Government of India and it launched the first programme on emergency preparedness called APELL in India with the support of UNEP during late 1980s. NSC has a multi-hazard approach to industrial disaster management and its activities include focus on manufacturing, mining, tourism, infrastructure, and other industries as well. NSC’s approach of disaster management strategies were recommended in the National Guidelines on Chemical (Industrial) Disasters, released by NDMA.



A paper on **“Disaster Management in Transportation of Hazardous Chemicals”**, was presented by Mr. T. R. Thomas, Petroleum & Explosive Safety Organization discussed the importance of risk management and emergency preparedness for chemical disasters during transportation, enumerating the role of PESO as mandated under the Petroleum Act, Explosives Act and the Rules. A number of accidents took place in last 5 years that involved transport vehicles carrying explosives, petroleum and compressed gas. Design and implementation of standards of safety and procedures for such carriages and their drives/owners and also for other stakeholders, have been developed by PESO. PESO is an authority for granting a clearance for location and transport of hazardous materials from the explosive safety angle.

“GIS and Web-enabled System for Off-site Planning and Reporting”, were the highlights of paper by Mr. Sanjay Gahlout, NIC. The NIC’s experience of GIS based hazard and vulnerability assessment carried out in the joint initiatives with the Ministry of Environment and Forests (Govt. of India) involving other stakeholders including state governments

was discussed. GEPR comprises of digitized maps and that of the industrial clusters/surroundings comprising major chemical industries. Phase I and II of the project has been completed and the Phase III is being undertaken. A Web-enabled Chemical Accident Information and Reporting System (CAIRS) provides an online accident reporting and analysis mechanism. Off-site emergency planning can be further improved with enhanced utility in the form of GIS based disaster management planning involving multi-hazard approach for all environmental disasters.



Mr. S. K. Sood, Nathpa Jhakri Hyrdopower Proejct of National Hydroelectric Power Corporation made a presentation on **“Disaster Disruption at Hydro-Power Station”**. The case of disaster risk management and rehabilitation of power generation system at Nathpa Jhakri Hydro-power Station during an exceptional flood in the Satluj river in August 1997 that had disrupted the entire system causing emergency to Dam site, Power house was discussed. The disaster management plan already in place, was an added advantage of proactive preparedness. The disaster management in the plan site was a success story enumerating the important of well documented and tested plan and effective emergency organisation. The unprecedented silt load was disallowed to enter into the water conductor system and restoration of power generation in a shortest time was in itself an example.

Dr. Vijay Kumar, Tarapur Industrial Area’s Mutual Aid Response Group presented the establishment and functions of the **“MARG concept and organisational efficiencies”**. Tarapur Industrial Area is on of the prominent chemical zone of Maharashtra where more than 400 small chemical manufacturing units were located and now increased to around 1000 in numbers including units mainly chemicals, textiles and engineering categories. TIMA, Directorate of Industrial Health and Safety and Tarapur Industrial & Manufacturers Association takes up programmes of awareness on industrial safety and health. TIMA has inculcated a culture of cooperation among various units and has given significant confidence in the emergency response system.

“Chemical Disaster Management Integration to Holistic Disaster Management” was the highlight of paper by Ms. Sreeja S. Nair and Dr. Anil K. Gupta, NIDM. Dr. Anil K. Gupta discussed the key challenges in integration of chemical disaster management with the holistic disaster management at various levels. There are three different and compartmentalised systems working almost parallel on disaster management; (a) Environment and Pollution Control; (b) Revenue/Relief and Disaster Management and (c) Labour/Factories and Industrial Safety. There are again aberrations in the flow of authority and responsibility from Central, State, District to Local levels. There are different systems under – Envi-

ronmental Protection Act (1986), Factories Act (1948) and Disaster Management Act (2005) and lack integration. There are NDMA and SDMA and now the proposal for Environmental Management Authority (EMA) at various levels, and the convergence among these have to be worked out.

Discussions of the session included the themes of the paper that could not be presented orally. Proper setting of industries and land-use

were found to be initial stage of disaster risk management and role of Geological expertise, remote sensing & Geo-informatics and enviro-legal implications in various phases of planning and preparedness, that requires knowledge of geo-hydrological features, surface characteristics, atmospheric and climatic patterns, mapping approaches and fast access of information. Disaster management in the mining sector especially coal and the underground mining related challenges of toxic gas release, explosion, flooding, fire, etc have been pointed out. Issues of hazardous waste management in the industries, laboratories, hospitals and research centres were highlighted. It was pointed out that ‘tourism’ being a fast coming industry needs focus of disaster management, especially in the sites of hilly and coastal areas. Disaster management for the ‘information technology’ industry also received mention. Large hospitals and research laboratories are also industry, was advocated in the discussion. Delegates suggested that NIDM and National Safety council, in collaboration with relevant Ministries and Departments must take initiatives for disaster management for all industrial sectors including chemical, mining, hydro-power, tourism, IT, construction, hospitals, etc. Besides, hazardous chemicals, batteries, acids, pesticides, etc. in educational institutions and household also need attention in disaster management, be it for earthquake, floods or building collapse or fire.



Recommendations

- ♦ ‘Industrial and chemical disasters’ management has to be considered in the broader sense covering all the hazards/accidents and disasters that occur/affect within industrial premises, related to industrial materials and processes, and disasters/mishaps affecting industry and production.
- ♦ DM Philosophy: The philosophy of ‘zero tolerance’ means preventing and containing the trigger event and vulnerability rather than preparing only for worst-case scenarios. It requires overhaul of the industrial risk management philosophy in the country. Lower-order risks on different time-scales that may lead to major hazards also need serious concern to avoid catastrophic risks. Corporate sector roles and responsibilities need to be emphasized.

- ◆ Land-use and geo-environmental planning is the first level risk reduction in industrial disaster management. It must be adequately emphasized in the regional development and spatial environmental planning of urban/industrial areas. Lessons of zoning atlas and environmental risk mapping approach have to be revisited in the context of disaster reduction in multi-hazard framework.
- ◆ Various environmental tools including of risk assessment, vulnerability characterisation, cost-benefit analysis, economic evaluation of environmental impacts, environmental (environment, safety, water and health) audit need to be re-worked for integration with holistic disaster management, looking to greater emphasis on role of environmental impact assessments (EIA) and strategic environmental assessment (SEA, environmental assessment of policy, plan and programmes) as per the recent experiences of UN-ISDR, UN-OCHA, UNEP, WHO, etc.
- ◆ Role of Space-technology and geo-informatics in environmental planning for risk management, decision-making and emergency response planning for effective response preparedness has to be blended with the entire framework of disaster management. An information and knowledge centre to be established on relevant aspects to support the data-needs, risk assessment, planning, decision and training needs. Chemical risk mapping in a multi-hazard framework has to be undertaken as a basic requirement for disaster management planning at regional scales.
- ◆ Capacities of State-level ‘Disaster Management Centre’s’ (at ATIs/Universities, etc.) are weak in terms of training design and deliveries on industrial and chemical disasters and need to be addressed in a mission mode, by NDMA and NIDM involving MoEF, NSC, NIC, DGFASLI, NEERI, DGMS, ICAR, GSI, ISRO-DMS, Corporates – FICCI, CII, ASSOCHAM, ICC, etc.
- ◆ Institutional Capacities: Focus on industrial disasters at the nodal DM institutions like NIDM and Disaster Management Centres at State-ATIs is very weak due to giving stress on only worst-case scenarios (which usually occurs in less probability). This needs to be strengthened and reinforced.
- ◆ Focus on industrial & chemical disasters is inadequate in the ‘disaster management’ sub-module under the compulsory ‘Environmental Studies’ UGC Module for undergraduate studies, implemented as per directive of Hon’ble Supreme Court of India, and needs further strengthening. Implications of climate-change related impacts and complications need to be integrated with increasing disasters incidences and losses especially with anthropogenic and industrial backgrounds.
- ◆ Key lessons learnt from major accidents in the country in different sectors are required to be compiled and shared. Community awareness is still a grey area. Mechanism should be created to provide information to the public throughout a year – prior, during and after the accident phase, which helps in avoiding panic and generating a culture for orderly and appropriate response by them.

It was highlighted that NDMA alone would not be able to cope up with the requirement of conducting drills in all Industrial areas. Hence, it was recommended that other

players/institutions in the country, who have experience and expertise, should be roped in for conducting such drills. Greater involvement of local government including of law & order, fire, medical, NGOs, local experts - geo-chemists, technical, information, legal, etc. need to be ensure throughout the mock exercise starting from planning, table-top, drill and evaluation stages.

Nuclear Emergencies

Concept Note

As human society has been beneficiary of advances of science and technology, it has also of late become victim of such advances due to their misuse in terrorist activities world over. In addition to the impacts of growing natural disasters mankind has become equally vulnerable to various man-made disasters. Nuclear and radiological emergencies are one such facet of the man-made disasters.

For improving the quality of life in the society, many countries in the world have embarked upon a large programme of using nuclear energy for generation of electricity. Further, the radioisotopes are utilized in a variety of applications in the non-power sector viz., in the field of industry, agriculture, medicine, research etc. Due to built in design features, inherent safety culture, the best safety practices and standards followed during various phases of construction and operation in these plants and effective regulation worldwide, the emissions of radioactive materials from routine operations of nuclear power plants does not normally require any protective actions on part of public. The radiation dose, to which the persons working in nuclear / radiation facilities are exposed to, is well within the permissible limits and risk of its impact in public domain is very low.

Although radiation releases from nuclear power-plant are very rare, but if they happen due to any reason, they can be devastating. Chernobyl is a good example. With modern reactor design, a catastrophic release of radiation is highly unlikely, but nevertheless, possible. This can happen due to factors beyond the control of the operating agencies e.g., human error, system failure, sabotage, earthquake, cyclone, flood, etc. In such situations, proper emergency preparedness plans must be in place so that there is minimum loss of life, livelihood, property and impact to the environment.

Any radiation incident resulting in or having a potential to result in exposure to and/or contamination of the workers or the public, in excess of the respective permissible limits can be termed as nuclear/radiological emergency. The longer a person is exposed to radiation, the greater the effect. A high exposure to radiation can cause serious illness or death.

The nuclear and radiological emergencies can be broadly classified in the following manner: i) An accident taking place in any nuclear facility of the nuclear fuel cycle including the nuclear reactor or in a facility using radioactive sources, leading to a large scale release of radioactivity in the environment. ii) A “criticality” accident in a nuclear fuel cycle facility where an uncontrolled nuclear chain reaction takes place inadvertently leading to bursts of neutrons and gamma radiations (as happened at Tokaimura, Japan), iii) An accident during the transportation of radioactive material. iv) A malevolent use of radioac-

tive material as Radiological Dispersal Device (RDD) by terrorists for dispersing radioactive material in the environment, v) A large-scale nuclear disaster, resulting from a nuclear weapon attack (as happened at Hiroshima and Nagasaki) which would lead to mass casualties and destruction of large area and property. Unlike a nuclear emergency, the impact of nuclear disaster is beyond the coping capability of the local authorities and such a scenario calls for handling at the national level. This topic is not within the scope of the congress.

Normally the nuclear or radiological emergencies arising in the nuclear installations are within the coping capability of the plant authorities. The nuclear emergency that can arise in nuclear fuel cycle facilities specially nuclear reactors and the radiological emergency due to malevolent acts of using RDDs are the two scenarios that are of major concern. In addition criticality accidents in Reprocessing plants and Transport accidents are two another areas of concern.

Because of their wide spread application, access to availability of radioactive sources has become easy. While their radioactive strength is in itself a deterrent to pilferage, the radioactive sources can still be stolen and used in a Radiological Dispersal Device (RDD) also known as Dirty Bomb.

Accidents during Transportation of Radioactive Materials are of low probability due to special design features of the containers involved and special safety and security measures which are laid down to be followed during actual transportation.

As regards vulnerability of various nuclear fuel cycle facilities to the terrorists attacks, these facilities have elaborate physical protection arrangements in place to ensure their security.

Driven by the requirement of ensuring all possible efforts to prevent any accident /emergency situation in the nuclear power plant, in the last 50 years power reactor design has undergone revolutionary changes in terms of improvement in fuel design, reactor design philosophy, instrumentation, safety considerations etc. In India, following 4 types of reactors are either in operation or under construction, therefore safety aspects of these reactors will be considered in particular by the Congress:

- ◆ Pressurised Heavy water Reactor (PHWR)
- ◆ Pressurised Water Reactor (PWR)
- ◆ Prototype Fast Breeder Reactor (PFBR)
- ◆ Advanced Heavy Water Reactor (AHWR)

The Nuclear Regulatory Authority in the country has the mandate to ensure that, while the beneficial aspects of nuclear programme and use of ionizing radiation are fully exploited, their use do not cause undue risk to public health and the environment. It has authority for issuance of licenses to nuclear and radiological facilities and ensuring compliance with the applicable standards and codes. It has powers, not only to license the operation of a facility but also to order partial or full shutdown of the facility that violates its guidelines.

The Atomic Energy Regulatory Board (AERB) in India, like all the regulator world over, requires that before a plant could be licensed to operate, the regulator must have “reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.” Emergency planning has been adopted as an added conser-

vatism to the “defense-in-depth” safety philosophy, where the safety systems are inbuilt with adequate redundancy and diverse working principles. Defence-in-depth is structured in various levels. Several levels of protection and multiple barriers prevent the release of radioactive material to the public domain.

Similarly to meet the radiological emergencies in public domain like transport accident, handling of orphan sources, explosion of RDD, concept of Emergency Response Centers (ERCs) has been established in India. These centres should be spread throughout the country. The task of these ERCs is to monitor and detect radiation sources, train the stakeholders, maintain adequate inventory of monitoring instruments and protective gears and provide technical advice to the first responders and local authorities.

The quality of the required emergency preparedness is maintained by periodic training courses for the on-site and off-site administrative personnel including the State Government officials and various other stakeholders. Also, the primary evaluation of the same is based on the periodic mock drills and exercises. The planning and preparedness for response to nuclear/ radiological emergency will be integrated in an all hazards approach with the planning for response to all types of conventional emergencies. The confidence level in the community to handle any nuclear/radiological emergency can be enhanced only through education and awareness generation and preparedness

The response to a nuclear/radiological emergency in a nuclear facility has many elements in common with the response to other man-made and natural disasters, in terms of services like medical, fire & emergency services, police, civil defence etc. However, some special features of nuclear emergency will need to be taken care of additionally.

The conference will also discuss various issues so that nuclear/radiological emergency management system can be put on a holistic platform. Besides the core issues involved in the various components of DM continuum, issues related to availability of trained manpower, monitoring instruments and personal protective gears, shelters, transport and roads, medical facilities and trained doctors, alternate sources of food and water, communication, public awareness, teams of paramilitary forces, Police, Civil Defence, Home Guards, emergency response centres, strengthening the regulatory aspects, help from armed forces etc. will also be discussed.

As per the recently released NDMA guidelines on handling of nuclear and radiological emergencies, a holistic and integrated approach to management of disasters should be adopted covering all components of the disaster continuum viz., prevention, mitigation, preparedness, response, relief, rehabilitation, reconstruction, recovery etc. This deals with the capacity development for coping with nuclear/



radiological emergency situations. This capacity needs to be enhanced at all levels; which calls for requisite financial, technical and infrastructural supports.

The National Vision is to prevent nuclear and radiological emergencies which are essentially man-made in nature. However, in rare cases of their occurrence, due to factors beyond human control, such emergencies will be so managed through certain pre-planned and established structural and non-structural measures by the various stakeholders, as to minimise risks to health, life and the environment.

Proceedings

B. Bhattacharjee, Hon'ble Member, NDMA, the chairman of the session highlighted that as per NDMA guidelines on handling of nuclear and radiological emergencies, a holistic and integrated approach to management of emergencies/disasters should be adopted covering all components of the disaster continuum viz., prevention, mitigation, preparedness, response, relief, rehabilitation, reconstruction, recovery etc. He mentioned that our National Vision is to prevent nuclear and radiological emergencies, however, in rare cases of their occurrence, such emergencies should be managed through certain pre-planned and established structural and non-structural measures by the various stakeholders, so as to minimise risks to life, health, livelihood and environment.

Mr. S. K. Chande, AERB gave a key note address on **“Safety Regulation in Nuclear Industry-Present Status and Challenges”**. He stated that nuclear industry uses high end technology with a high capital cost. Because of this there is always a pressure on production, which is not good for safety. There is a need for cooperation between the countries for ensuring global safety and security regime. It is well known that nuclear accident has an international impact, e.g. accidents at TMI and Chernobyl. However, public perception of risk as nuclear fields is disproportionate to reality and any small accident is blown out of proportion by the media. He elaborated some of the important functions of AERB with regard to safety review of nuclear facilities under design, construction; to issue license/authorization during sitting, construction, commissioning/operation, decommissioning; and to ensure compliance with the stipulated requirements. He further added that all nuclear and radiological facilities in the country except the ones at Bhaba Atomic Research Centre are under the regulatory control of AERB. The procedure of carrying out safety review of nuclear power projects as well as that of operating NPPs was described by him. He briefly touched upon the various documents prepared by AERB on emergency planning and preparedness.

He told that AERB works in close cooperation with International Atomic Energy Agency (IAEA) and keep contacts with the regulatory bodies of other countries. Since country is planning to increase nuclear power production many fold, it is likely that NPPs of various foreign designs will be introduced in our country. The various issues involved in regulating the plants based on different technologies were explained.

Mr. A.P Joshi, DAE in his talk on **“Nuclear and radiological emergencies-handling the challenges”** stated that the concern for radiation safety has increased in recent times. In nuclear programmes, safety is implemented at all stages of the plant i.e. design, construction,

commissioning, operation, maintenance and decommissioning. Defence of depth principle is applied all through. It was informed that emergency response system is always in place.

Our nuclear facilities are reasonably equipped to handle both on-site and off-site emergencies in public domain; however, main area of concern is emergencies at places other than the nuclear facilities.

In addition, DAE has set up a Crisis Management Group (CMS) that is activated during a radiation emergency in public domain. It has access to DAE's resources in terms of communication, radiation monitoring, decontamination, safety equipment, medical facilities etc. In case of any radiation emergency a definite role has been envisaged for the important agencies namely police, fire, transport, health, civil supplies, civil defence and radio, TV and print media.

He mentioned that in future there is going to be tremendous growth in the fields of nuclear power generation and in industrial and medical use of radioisotopes and at the same time the issues related to nuclear terrorism will be of major security concern. As such there is a need to enhance safety features and physical protection systems, so as to prevent both accidents in nuclear facilities and also the malevolent acts resulting in radiation exposure to public.

Mr. D. K. Goyal, NPCIL gave a talk on **“Nuclear Power Prospects-Plans and Challenges”**. He explained about the vision to development and deploy nuclear power in the early stages was to supplement electricity generation in short term. Subsequently its share will be augmented to a great extent. Now the aim is to achieve major share in long term. He told that in the initial years of the programme, main challenge was to develop nuclear power technology and develop human resource. Now capabilities has been developed in design, fabrication, construction, commissioning, operation & maintenance, in all stages of nuclear fuel cycle and have a vast pool of trained technical man-power. Three stages of nuclear power programme in India were explained. India intends to use Thorium as fuel in its future reactors because it does not have enough stock of Uranium. Presently 17 power reactor units are working in six places and six units are ready for commissioning. Defence in depth is main forte of safety programme.

India has achieved 305 reactor years of safe and accident free operation. During all these operations, radiation dose to both the occupational workers and the members of public is a very small fraction of the permissible limit. In conclusion, he mentioned that the biggest achievement of the Indian nuclear power programme so far has been the development of technology and creation of infrastructure in an international technology denial regime.

Mr. P.K. Bhatnagar, Defence Lab, Jodhpur made a presentation on **“Post Radiological & Nuclear Emergency Preparedness and Gaps”**. To deal with any emergency happening in our country due to peaceful applications of radioisotopes in industry, nuclear power production, medical, agriculture, satellite crash or during transportation of radioactive materials or terrorists created situation like explosion of a Radiological Dispersal Device (RDD), detailed Guidelines have been issued by the National Disaster Management Authority (NDMA). Presentation highlighted initiative and availability of early warning and post radiological and nuclear emergency/disaster preparedness in terms of detection,

protection, early warning, training of first responders, actions from Command and Control Centre, provision of nuclear shelters, decontamination, radiation injury treatment, communication and waste disposal. The role of police, fire services, civil defence, paramilitary forces and defence services in relief and response programme was also explained.

Mr. A.K. Atta, BEL, Talaja, Mumbai made a presentation on “**NBC Disaster Management Services: Efforts & Preparedness at BEL**”. Since ‘9/11’ India is the spectre of CBRN threat has been daunting afresh worldwide. He mentioned that because of no first use policy of nuclear weapons, special efforts are required to handle any CBRN disaster. Keeping this in view BEL has taken many initiatives in R&D and has developed in-house program towards CBRN preparedness. In this regard, he mentioned about a BEL-DRDO designed wristwatch type Radio Photo-Luminescent (RPL) Dosimeter having 2 major components i.e. RPL Glass & Pin diode for sensing Gamma and Neutron Radiation respectively in the range 01-1000 Rad. This equipment, unlike GM tube sensor would be resistant to EMP effect and will be operational in real N-scenario. BEL also developed a PUF Insulated Al-Shelter, Installation of state-of-the art Hot-press Bonding system used for manufacturing Al-PUF-Panels for shelter has enabled BEL to become the largest supplier of Al- Shelter in India. BEL also developed a Mobile Water Purification System for usages in CBRN Environments which can be used for purifying brackish water, dissolved solid content, inclusive of CBRN contaminants up to 5000 mg/liter.

Mr. S. K. Mishra, BARC gave a presentation on “**Role of Regulator in Control of Nuclear and Radiological Emergencies**”. It was explained that the nuclear facilities adopt a high level of ‘defence-in-depth’ concept in their design, and are operated within the safe operational limits and conditions, therefore, the probability of occurrence of any major accident is very low. To monitor degradation of components during operation, facilities follow a well established surveillance programme. However, despite the inherent and engineered safety features in the design and the measures taken during its operation, there are still possibilities of occurrence of an accident (event) resulting in the radioactive releases that can affect the plant, personnel, property, general public and environment. The International Nuclear Event Scale (INES) designed by the International Atomic Energy Agency (IAEA) is used for rating of the severity of nuclear events and for prompt communication, which is being followed by around 150 of its member states. However, the events rated below the INES, which are called Low Level Events and Near Misses are always monitored and analyzed as these are the key indicators or precursors of events.

The safety and regulatory review of the facilities in India is carried out by Atomic Energy Regulatory Board (AERB). These facilities are designed and maintained to meet the expected on-site emergencies and are less likely to encounter any off-site emergency.

Mr. Sameer Hajela, NPCIL gave a presentation on “**Emergency Preparedness in Indian Nuclear Power Plants (NPPs)**”. NPPs adopt fundamental safety design principle of defence-in-depth, which is centered around multiple levels of protection, including successive physical barriers thus preventing release of radioactivity into the environment in case of accidents. The main emphasis is always on prevention of incidents/accidents and at the same time to have mitigation measures in-place for any eventuality. All NPPs have

an exclusion zone (EZ) surrounding the power plant. The practice of verification of actual implementation of the emergency plans at NPPs is checked at defined periodicity at plant level as well as district administration level by carrying out emergency preparedness exercises. In addition, communication exercises are also held to ensure that all communication means will be functional at the time of emergency.

Mr. Rajesh Arora, INMAS, New Delhi gave a presentation on **“Leveraging Human Resource for Effective Management of CBRN Emergencies”**. Human resource (HR) is the most crucial factor for a well built disaster management (DM) system. There is an appalling shortage of highly skilled and trained human resource, which can play a proactive role prior to, during and after a disaster. Some strategies that need urgent attention include development of a comprehensive prevention, preparedness and mitigation plan in consonance with the HR capabilities. The Disaster Management cannot be the job of the Government alone, it should be integrated at the grassroots level in all curricula so that loss of both men and material can be minimized. Trained man-power for DM is essentially required in the areas encompassing emergency rescue, fire fighting skills, medical care etc. Civil authorities, paramilitary forces, army, medical personnel, paramedics, QRMTs, academia, students and children, volunteers, NGOs and organizations dealing with emergencies and contingency planning should all be considered as human resource for emergency management.

Mr. Rajeev Goel, INMAS, New Delhi spoke on **“Role of Medical First Responders in the Management of Nuclear/Radiological Emergencies (NREs)”**. The increasing probability of occurrence of any Nuclear/Radiological Emergency is directly related to the enhanced usage of radioisotopes in medicine, agriculture, industry and especially in generation of nuclear power as an important energy source. The enhanced threats of terrorism can also be visualized in view of the spate of recent attacks on civilians. Such threats have compounded the overall radiation risk to the community. New initiatives and preventive strategies are put in place to prevent any theft or misuse of radioactive material and blocking of the state-sponsored terror activities. The second line of defence is to be prepared to handle such emergencies. Such preparedness requires involvement of multiple emergency functionaries at a single platform so that they can respond effectively and promptly. The most important issue is medical preparedness and it includes training and equipping of Quick Response Medical Teams (QRMTs) or Medical First Responders (MFRs). The prime objectives of these teams are decontamination and medical management of the victims. Such teams should be task-oriented, well equipped, properly trained, self sustaining and ever-ready to act with time tested SOPs. MFRs are likely to play a major role in case of Nuclear/Radiological emergencies and it is our continuing endeavour to provide them with state-of-the-art products/technologies so that they can remain safe during operational missions and provide effective response.

Mr. Deepak Gopalani, Defence Lab, Jodhpur talked about **“Container based Nuclear Radioactivity Analysis Laboratory”**. In any nuclear emergency/disaster, large amount of radioactivity is released in the environment and deposited on the ground as well as on water bodies. The response actions namely decontamination, relocation and measurement

of radioactivity levels in food stuff will be carried out by the disaster management teams in the affected area. To carry out these actions, it is necessary to analyse the radioactivity in various environmental matrices for identification of radio nuclides, level of contamination and concentration. In common practice, the contaminated samples are transferred to a stationary nuclear analysis laboratory which is equipped with various types of nuclear measuring instruments. Only few laboratories of this type are available in the country and at times may be located far away from the incident site. Considering these problems, Defence Laboratory, Jodhpur has designed and developed a container based Nuclear Contamination Analysis Station (NUCAS) which can be transported to desired locations by air, road, train and ship. This laboratory is equipped with various measuring instruments so that it can carry out the complete analysis of the contaminants in field conditions in minimum time.

Dr. Pradeepkumar K.S., BARC gave a presentation on **“Nuclear and Radiological Emergencies: Requirement of State of the Art Systems and Methodologies for Impact Assessment and Response”**. He explained that the prevention and preparedness for response to nuclear and radiological emergencies involve identification of various accident and emergency scenarios that can lead to radiological consequences in public domain. The nuclear accidents at TMI and Chernobyl and radiological accident at Goiania led to serious concerns related to the contamination in public domain and made the world community understand and prepare for responding to such situations.

For an effective response to any major emergency, an Emergency Response Centre (ERC) having the facilities of, a) Environmental dose monitoring using both mobile and fixed units, b) meteorological station providing on-line data, c) generation of isodose curves in real time, d) monitoring methodologies for various routes etc are essential. 18 numbers of DAE - Emergency Response Centres (DAE-ERC) spread over the country are developed and kept in readiness to strengthen DAE's Preparedness for 'Quick Response to nuclear / radiological emergencies in the public domain. The DAE-ERCs will be also helping the CPMFs/Defence Forces in building up the “First Responders/Quick Response Teams” of their organizations to respond to any nuclear/radiological emergency in public domain.

Some of the important systems developed in BARC for this purpose are - Aerial Gamma Spectrometry system (AGSS) for aerial radiation monitoring, Compact Aerial Radiation Monitoring System (CARMS) for remote Aerial Monitoring using Unmanned Aerial Vehicles (UAVs), Portal Monitor and Limb Monitor and Vehicle monitor (for inspecting goods/scrap carried by vehicles).

Mr. C. K. G. Nair, BARC gave a presentation on **“National Network for Early Detection of Nuclear Emergency: Indian Environmental Radiation Monitoring Network (IERMON)”**. The Indian Environmental Radiation Monitoring Network (IERMON) was established across the country by Bhabha Atomic Research Centre for online detection of any nuclear emergency condition in public domain. The network is being expanded and upgraded in order to meet the different objectives of the monitoring programme. The latest version of the indigenously developed solar powered radiation monitoring system with GSM based data communication has been put to use now. The Central Station is linked to the emer-

gency response centres and control rooms through various communication links for on-line and real time access of data. The proposed local area wireless sensor networks which will be integrated with IERMON, for detection and tracking of dirty bombs was also described.

Recommendations

- ◆ Construction of Nuclear power plant is a high end technology and highly capital intensive. While maximizing the production of power care is to be taken to see that safety is not compromised at any stage.
- ◆ Although radioactive releases from nuclear power plant are very rare, but if they occur due to any reason, can be devastating. Therefore proper emergency preparedness plans must be in place so that in case of a major accident there is minimum loss of life, livelihood and property.
- ◆ To meet the radiological emergencies in public domain only eighteen numbers of DAE - Emergency Response Centres (DAE-ERC) have been established which is quite inadequate given the size of the country, therefore, these centres should be replicated in large number.

The capacity development for coping with nuclear/radiological emergency situations needs to be enhanced at all levels; which calls for requisite financial, technical and infra-structural support. The main issues are availability of trained manpower.

Road Accidents

Concept Note

Road Safety incorporates the development and management of road infrastructure, provision of safer vehicles, legislation and law enforcement, mobility planning, provision of health and hospital services, child safety, urban land use planning etc. Its ambit spans engineering aspects of both, roads and vehicles on one hand and the provision of health and hospital services for trauma cases (in post-crash scenario) on the other. Road safety is a shared, multi-Sectoral, responsibility of the government and a range of civil society stakeholders.

According to WHO statistics (year 2002) about 11.8 lakh people die every year in road accidents, the world over, of which 84,674 deaths are reported to take place in India. In 2004 the number of deaths had increased to 92,618. The mortality rate in India is 8.7 per hundred thousand population as compared to 5.6 in UK, 5.4 in Sweden, 5.0 in The Netherlands and 6.7 in Japan. In terms of mortality per 10,000 vehicles, the rate in India is as high as 14 as compared to less than two in developed countries. The cost of road crashes has been assessed at one to two per cent of GDP in developed countries. A study by the Planning Commission in 2002 estimated the social cost of road accidents in India at Rs.55000 crore annually (2000 prices), which constitutes about 3% of the GDP.

Context

There is an alarming increase in road accidents on Indian roads, at a rate of 8% per year while the population of the country has increased by only 2.1%. In fact, out of one lakh accidental deaths in India, road accidents, alone account for as many as 60,000 lives. The statistics for the country indicate that there is an alarming increase both in the number of deaths and those injured. The problem of Road Traffic Accident has assumed alarming proportion with ever increasing number of motor vehicles competing for the limited paved space. The resultant congestion in traffic is inevitable and the consequences are road accidents. Road safety, as a problem, has been analysed in many different ways. Prominent amongst them are the four basic elements; 1) Machine Factor, 2) Human Factor, 3) Engineering Factor and 4) Environment Factor.

Many countries including India have designed road safety strategies but the success of road safety strategies in all countries depends upon a broad base of support and common action from all stakeholders.

Thus, this session in the Disaster Management Congress would encompass various issues pertaining to Road Accidents and Road Safety. Session would also provide a platform for congregating the segregated research and initiative undertaken for road safety and awareness generation.

Proceedings

The Session on Road Accidents was chaired by Mr. S. Sunder, Distinguished Fellow, TERI, New Delhi.

In his opening remarks, the Chairman commented that although mortality rate due to road accidents are assuming disastrous proportions of an epidemic, yet, it does not find a place in disaster list. He stated that road is the most unsafe and complex mode of transport. He gave the statistics of deaths in road accidents and mentioned that every year around 1.2 million deaths occur due to road accidents all over the world, out of which, 80-85% deaths occur poor and developing countries and 70% of these deaths are of vulnerable group viz. pedestrians, cyclists and two wheeler riders. He expressed his agony that road accidents do not get



the same media attention as other disasters get. Speaking about accidents in India, he pointed out the alarming rise in death in road accidents leading the World table in number of road accidents with about 114 thousand deaths being reported. It was emphasized that the interventions made by developed countries like political commitment at highest level for reducing road accidents, policy and strategy formulation for looking at road safety issues as multi-dimensional and multi sectoral problem, legal and regulatory backing up of such policies and establishment of a lead agency with adequate power and funds to coordinate implementation of such policies and strategies, can also be adopted in developing countries. He informed about the recommendations to combat the menace of road accidents of the National Committee on Road safety and Traffic Management, it was pointed out that Government of India has yet to take decision on the recommendations of the Committee.

Prof. Dinesh Mohan, IIT Delhi while making a presentation on “**Perspective on Road Safety in India**”, highlighted the fact that despite large number of accidents taking place round the year, there has been no focus on maintaining database on accidents. While going into the reasons, he mentioned about the US standards & practices. It was stated that in USA an integrated approach (a combination of user and commonsense based approach and scientific and research based approach) has been adopted.



He then discussed about accidents rates in India. He said that accidents in night are mainly due to alcohol, conspicuity and high speed. He informed that studies show that culture is not a determining factor for accidents. While giving the similar speech it was mentioned that only 7 vehicles per 100 persons are available in India which was much less than other countries but the fatality rate per 1 lakh persons was as high as 9.5% which was much higher than other countries. He also mentioned that need of the hour is to focus on finding new solutions which can change the existing approach through studies and research. He concluded his presentation by stating that there is an urgent need to change the road design, enforcement of speed controls, provision of lane for pedestrians, random checks for alcohol intoxication ban on free left turns, compulsory road safety courses in all civil engineering departments, strict implementation of legal provisions and funding of research and scientific studies on reduction of road accidents resulting in deaths.

On replying to the question raised by Mr. Subramaniam on possibility of banning of free left turn on roads through regulations and changing of road designs without IRC regulation, Prof. Mohan said that IRC regulations are only recommendatory and hence the focus of road designs should be more to provide pedestrian rights than luxury to car owners as policy should be to reduce deaths than reduce traffic delays due to jams.

Prof. G. Gururaj, NIMHANS Bangalore made a presentation on **“Road crashes and deaths in India: Need for integrated policies and programmes”**. He mentioned that recent years have witnessed rapid motorisation, urbanisation, industrialisation, migration and other changes consequent to globalisation and liberalising economic policies of successive governments in India. An accompanying effect of these changes is the increasing road crashes and deaths due to lack of safety policies and programmes. The psychological suffering of individuals and families are hard to measure and are better realised with interaction of survivors. He highlighted various areas of concern for fatalities in Road accidents as delay in seeking care, medico-legal issues, lack of information, affordability of hospital care and lack of trauma audits. He stated that road crashes are predictable and preventable and can be controlled effectively, if safety of people on roads is given importance by government, professionals, vehicle manufacturers and the civil society and adequate changes are made in curriculum of Nursing and Medical education to include road safety and injury prevention. He emphasized about a Safe systems approach for making safe roads and safe vehicles to ensure road safety. He was of the view that if focus of all concerned, shifts to pre-hospital trauma care issues and acute hospital care facility provision, the deaths due to accidents can be reduced considerably. He suggested that in order to have a better trauma care facility, district hospitals can be transformed into



Integrated Trauma care centres. Dr. Gururaj also added that the entire issue of road traffic injury is closely linked to physiological limits of individuals. While comparing the practices in Europe etc., Prof. Dinesh Mohan mentioned that in Europe improvement in car designs had reduced the deaths due to road accidents however, in our country improvement in the design is not possible but at the same time by making vehicles satisfying a pedestrian impact standard, providing proper lighting facility for better visibility would surely reduce the mortality rate in road accidents. He further mentioned that awareness is the key for both reduction in deaths and for law enforcement.

Mr. Shaheriar B. Zaveri, Vadodara shared his views on “**Road accidents - The man made disasters**”. In his presentation, he mentioned that there is no provision in Motor Vehicles Act to curb wrong habits of driving such as wrong use of signals, misunderstand or ignore markings painted on road, give signal to be overtaken at wrong time and lack of knowledge of lane driving in case of 4 lane or 6 lane Highway or Express way. He also pointed out various lacunae/gaps in the present Motor Vehicle Act 1988. The gaps identified that, there are no specification of diseases which are a disqualification in obtaining the driving license and no provision of caution or prohibition of consumption of certain medicines before/during driving. In his view, ignorance about driving and overtaking, consumption of prohibited medicines and non-inclusion of road signs in the Motor vehicle Act, etc. seem to be some of the main reasons for road accidents.



Mr. Ranjan Mishra, Advanced Institute of Management, Udaipur, Rajasthan, made a presentation on “**Road Accidents Mitigation Program**”. He highlighted various reasons for an increase in the road accidents in recent past, such as timing, driving by minor, speed, poor visibility, poor maintenance of vehicles, stray cattle, lack of awareness, road designs, etc. In order to minimize the number and the impact of road accidents, he suggested that major focus should be on implementation of the recommendations of various committees and the provisions of law. He further suggested that the material used for construction of road dividers can be hard rubber, which will absorb the impact of collision of the vehicle with the divider. More funds should be allocated to improve road conditions and widening of roads on highways and also within city limits. He stated that this can be achieved through a dedicated road safety department and appropriate awareness campaigns.

Prof. Gururaj while commenting on the data used in the presentation, added that research is necessary before arriving at any conclusion about measures that are adopted for reduction in deaths for road accidents. Prof. Dinesh Mohan made an intervention and suggested that it is necessary to immediately implement those measures where data is not necessary,

such as, ban on free left turn, implementation of pedestrian rights, wearing of helmets, enforcement of speed limits, awareness about the dangers of drunken driving, improvement of road designs, proper lighting facilities on vehicles for better visibility. The ensuing discussion focused on fixation of maximum responsibility of death due to road accidents on drivers and provision of immediate compensation in such cases.

Mr. S. Satheesh, presented a case study on **“Road Accidents: A case study of ECR, Chennai”**. Mr. Satheesh informed that a study has been conducted on Traffic Accident Prevention on East Coast Road with an objective to identify various black spots all along the stretch of the study and recommend some remedial measures for reducing the number of accidents. He added that roads are the choicest mode of transport, which provides the best connectivity, as compared to the other modes. The developed economy and increased buying capacity of the common man has resulted in the increased automobile population and with a better quality road-network, there is an exponential growth of traffic along the roads, which in-turn is also the cause for increased Road Accidents. He informed the house that after the study few of the recommendations like use of reflective road signs, illuminated sign boards at night, spot speed data collection and Traffic volume data collection are in progress.

Recommendations

- ◆ Strict implementation of laws and measures for road safety.
- ◆ Special awareness drive on road safety issues among all stakeholders.
- ◆ Establishment of a Lead Agency for implementation of Policies and Strategies of road safety and funding research and scientific studies in the subject.
- ◆ Collection and Compilation of data base on Road accidents.
- ◆ Establishment of expertise in every place of learning.
- ◆ Induction of experts in decision making bodies.
- ◆ Introducing ‘Road accident courses’ as mandatory subject in all Civil engineering departments.
- ◆ Rectification of faulty road designs after carrying out scientific studies.
- ◆ Amendments in the provisions of Motor vehicle act.
- ◆ Adoption of a coordinated and integrated safe systems approach.
- ◆ Special Trauma care for patients.
- ◆ Establishing a dedicated Road safety department in each State.
- ◆ Use of reflective road signs, illuminated Sign boards.

Early Warning and Disaster Communication

Concept Note

Natural and technological hazards often result in disastrous events that can profoundly impact societies. Hazards such as Flood, Cyclone, Tsunami, Epidemics etc. or human made events such as industrial accidents, gas leakages, and terrorism etc. have not only caused huge loss of life but also resulted in large properties damages. Regardless of how or where a hazard originates, early warning are the means of reducing the risk of a disaster. The expression 'early warning' is often used to mean the provision of information on an emerging dangerous circumstance where that information can enable action in advance to reduce the risks involved. Early warning systems exist for natural geophysical and biological hazards, complex socio-political emergencies, industrial hazards, personal health risks and many other related risks. Nearly a million of people have been killed over the last decade in disasters caused by storms, drought, floods etc. While some material losses seem to be unavoidable especially in the case of large and complex disasters, in many cases the loss of life could have been avoided. This was amply evident during the Indian Ocean Tsunami 2004 which killed more than a quarter of million of people. In many cases such as Cyclone, Flood, Drought etc. elaborate early warning system have been in operation for long but in spite of that our societies continue to suffer huge losses of life and properties damage which emphasize the need of greater scrutiny of such system and identification of gaps to achieve more effectiveness. Issuance of an early warning is closely linked to timely communication of such warning to all vulnerable population at risk. One of the lessons learned globally during recent past is that in spite of the major advances in information and communication technologies in recent times, still large number of vulnerable people do not receive timely warning and often warning communication or dissemination to the most vulnerable population who are located in remote areas pose major challenges in disaster risk management. Also while evolving modern technologies are opening new opportunities for better warning communication at the same time local indigenous early warning practices play an important role and effective integration of such modern technologies with traditional and local warning system is essential for reducing disaster risk.

Recent studies have shown that receipt of an early warning do not necessarily translate to compliance behavior and vulnerable population often differ in their hazard risk perception, ability to take action and compliance pattern. Considering the goal of an early warning is ultimately prevention or minimizing loss of life and properties, greater understanding of public response process to early warning is a prerequisite to improve and ensure desired actions are taken.

The thematic session, Early Warning and Disaster Communication will cover early warning system for various hazards such as cyclone, flood, landslides etc. and relevant communication technologies to reach different user groups including public at risk and authorities who are in charge of disaster management. The session will also discuss public response to early warning, evacuation and compliances with recommended protective measures.

Some of the focus areas will be as follows

- ◆ New early warning mechanism for potential hazard risk
- ◆ Studies/researches which have implications for improvement of existing early warning system
- ◆ Early Warning communication technologies and new technological options for last mile connectivity
- ◆ Studies on indigenous early warning practices
- ◆ Studies on public response and perception to early warning

The broad objectives of the session are:

- ◆ To discuss and disseminate studies which have potential for making early warning system advancement and improving their effectiveness
- ◆ To analyze existing gaps in early warning and communication
- ◆ To encourage studies on indigenous early warning and their integration

Proceedings

AVM Dr. Ajit Tyagi, Director General, Indian Meteorological Department presented the lead talk entitled “**Strategies for Early Warning of Tropical Cyclones to maximize relevance and effectiveness over India**”, in which he underlined the risk of cyclone for India and strategies employed by IMD to communicate and disseminate cyclone warning to vulnerable population in a more effective manner. It was observed that a good tropical cyclone warning system should be simple, easy to understand, and able to trigger organized responses of the government and the public to minimize loss of lives and property. The design of a Tropical Cyclone warning system in IMD, takes into consideration of the prevailing state of the meteorological science, the available technological means of communication, the built-up environment such as dwellings, socio-economic conditions, appropriateness of protective actions, as well as, the expectations of the society. The forecast and warning operations and decision-making process is made by blending scientifically based conceptual models, meteorological datasets, technology and



expertise. He in his presentation analyzed various perspective of existing early warning system and provided an outline of the thrust areas of IMD which include improvement in scientific understanding, improvement in forecast techniques and warning generation & presentation, improvement in telecommunication measures and collaboration with research institutions. He concluded with an overview of various technological upgradation measures that IMD has undertaken with respect to tropical cyclones in its modernization programmes, which will eventually help in addressing the above mentioned thrust areas and requirements.

R. S. Dattatrayam, IMD talked on **“Real Time of Earthquake Monitoring for Early Warning of Tsunami”**. Underlining the crucial role of IMD in tsunami warning generation he informed that India Meteorological Department (IMD), is responsible for seismic monitoring in and around the country, maintaining a country-wide National Seismological Network consisting of 55 observatories, which includes 30 stations equipped with state-of-art digital broadband systems and facilities to transmit the data from field stations to a Central Receiving Station (CRS) at New Delhi through satellite communications and/telephone modem. The Center which is mandated to provide advance warnings on Tsunamis



likely to affect the coastal areas of the country and as part of this, a 17-station Real Time Seismic Monitoring Network (RTSMN) has been set up by IMD. The network is capable of monitoring and reporting, in least possible time, the occurrence of earthquakes capable of generating Tsunamis likely to affect the Indian coastal regions. The data from the 17 Broadband seismic field stations is transmitted simultaneously in real time through V-SAT communication facilities to the Central Receiving Stations (CRSs) located at IMD, New Delhi and INCOIS, Hyderabad for processing and interpretation. The system is capable of providing automatically, fault plane solutions through Moment Tensor (MT) and Centroid Moment Tensor (CMT) inversions for all significant events of magnitude more than 5.5 for the assessment of tsunamigenic potential. He remarked that the performance of the IMD system has been found to be satisfactory, particularly for large magnitude earthquakes.

Ms. Zeenat Rehena, Jadavpur University presented findings of her research work on suitable routing protocol for detection of forest fire using wireless network. She pointed out that Wireless Sensor Network is considered to be one of the key technologies of 21st century which have wide application in military application, forest fire, agriculture research etc. In the field of forest fire detection, she along with her co researchers carried out a simulation study of SPIN (Sensor Protocols for Information via Navigation) protocol to route the environmental data from the active region to the sink wirelessly. She informed that the

outcomes of the experiments are encouraging and are suitable for further application.

Ms. Natasha Udugama, USA in her paper on **“Implementing Inclusive ICTs: Mobile Cell Broadcasting for Public Warning in Maldives”**, argued that the initiative of cell broadcasting in Maldives has enabled public authorities to provide warning in quick times to vulnerable population regardless of geographic location and distribution. Cell broadcast is an integrated open system that allows emergency officials one-touch notification to cell phones with guarantee of covering all carriers, and this technology enables a government entity to securely transmit an emergency alert of natural or manmade disasters to cell phones in an affected area within two minutes, regardless of the size of the area and regardless of the subscriber’s carrier. Maldives has made some notable initiatives in emergency alert, including: emergency alert via broadcasting (EAB), and the use of bulk SMS on a mobile network, priority calling and national roaming, and the establishment of a national Emergency Operating Center. This paper explores ways in which an ideal environment can be provided for cell broadcasting to improve information dissemination, both hazard and general.

Prof. M. S. Ullah, Bangladesh presented his coauthored study on **“Cyclone Disaster Warning and the Broadcast Media: A study on Peoples response in the coastal region of Bangladesh”** He emphasized that media warning in Bangladesh do not initiate vulnerable population to take action as they follow a wait and watch policy which he argued is a result of poor awareness, in addition to, lack of guidelines for media on warning procedures. People’s response to broadcast media reaches at the most critical juncture, while media involve in disseminating information of cyclone warning and aim to bridge the gap between awareness and decision- making by disseminating warning signals from meteorological office to the public. But depending upon God’s mercy around 20 million population, throughout the 710 km coastal region in Bangladesh usually follow the ‘Wait and See’ practice in facing the impending cyclone and hardly pay heed to warning signals aired by broadcast media. In addition, a significant number of people who are unaware about cyclone related warning signals, fail to take due measures for preparation. He argued, broadcast media in Bangladesh face adversity in handling cyclonic disaster mitigation properly as people have less confidence in the media. The absence of adequate facilities for media access throughout the cyclone- prone coastal regions and the lack of due guidelines for media practitioners narrows the authenticity of media warning and create confusion. He provided the outcome of a baseline survey among several hundred coastal locales which focused on response to and perceived believability of information regarding preparedness measures during cyclonic disaster disseminated through the broadcast media.

The second part of the session was chaired by Dr. G. S. Mandal, NDMA and Mr. R. C. Bhatia, Former ADG, IMD as co chair. Mr. Pramod Sarpotdar, Former Communication Advisor (DRM) MHA made presentation on **“Last Mile Connectivity: Technological Options”** outlining options for one way connectivity and two way communication. He provided an overview of existing warning dissemination system and argued that existing system is not adequate to connect to last mile and there is a need for communication link of remotely located administration with the dynamic status of disaster situations. The various options for one way communication include, FM-RDS, DTH based system, Interactive

Voice Response System, Inmarsat satellite based system, Receive only satellite terminals etc. and such options for two way communication include HF/VHF, GSM etc. Each of these technology options has their own strengths and weaknesses and their suitability for specific locations and emphasized redundancy to be crucial for system reliability.

Mr. P. K. Srinivasan, ISRO presented his paper on **“Design and Development of GSM Abis interface over Satellite emulator to illustrate communication support for Disaster Management”**. The Global System for mobile communication (GSM) while has achieved wide popularity in developing countries with wide network availability, affordable handsets and variety of application, Abis interface defined between (Base Transceiver) BTS and (Base station controller) BSC of a GSM network becomes the prime victim during any natural disaster. The existing user handset even though operational cannot extend the communication during emergency period and under such scenario, the optimum solution is to restore a BTS with Abis interface over the satellite link and resume the communication link with the existing handsets rather than other options, such as extending a new communication terminal i.e. satellite phone. He observed that the Abis-satellite link can be restored with any location independent BSC in the network and the Abis – satellite interface provides maximum interoperability and flexibility between terrestrial and satellite scenario for the handset (MS). He provided an outline of their design of a PC based ‘Abis interface over satellite’ emulator to illustrate a quick and cost effective communication restoration and presented the performance evaluation of the Abis over satellite interface. He informed that the design has been experimented over the GSAT3 satellite with respect to call set up signaling procedure and the results have been compared with the performance of normal Abis interface. Mr Srinivasan expressed satisfaction of experimental progress of their design of PC based GSM Abis interface emulator and informed of further field trials of the design with the pico BTS terminals in the existing cellular network.

Prof. Chandan Mazumdar, Jadavpur University presented a paper entitled **“An architecture of rapidly deployable communication network for Disaster Management”** in which he underlined the need for a rapidly deployable communication network which is flexible, easily deployable and can use existing communication network. According to him such a deployable network should be based on computer mediated high capacity wireless link which can be deployed rapidly. Such a network can be used by administration, NGO and affected population. He presented the diagram of such a communication network specifying communication various communication technology and technology used for application development. He identified some of the software issues which face further development such as deployability on heterogeneous platforms, delay and disruption tolerant, software should be made of components based on usage requirement at different tiers, user friendly and low cognitive load etc.

Ms. Nihariaka Mohapatra, JNU presented her work entitled **“The Role of Social Network in Disaster Information and Management”** providing an analysis of crucial role that social network plays during early warning and after a disaster. Better understanding of such network is essential in developing effective communication strategies. She took the

case of 1999 Orissa super cyclone during which people of Orissa did not take the warning issued by the government seriously and even did not evacuate as was suggested in the warning. She argued that this was because the affected people did not find any difference from this warning with the earlier warnings of the past which was given twelve days before the cyclone and had affected only two districts of Orissa i.e. Ganjam and Gajapati. So many people were in doubt and stayed at home and the others who wanted to leave had no options as there were no adequate cyclone shelters. But on the other hand when warning information from the informal sources in the Orissa super cyclone such as the news from relatives, neighbours, and from the market places played a major role as people believed in it because of the trust on these networks. She observed that during the 2005 Hurricane Katrina in United States people did not give importance to official warning because of which many lives were lost. But when such information was passed from the informal sources of some trusted African American women-centered networks in New Orleans it carried more authority because of the networks of women that they were able to evacuate a number of individuals from the disaster. She observed that this shows how women played a major role in moving their networks to safety during the crisis situation.

Mr. Arup Patro, Focus Humanitarian Assistance, Pune made the presentation of his paper **“Setting up Multi Hazard Early Warning System: Relief to Development”** in which he provided an outline of the new initiative in Nagayalanka Mandal, Krishna District of Andhra Pradesh. He in the beginning provided an overview of the area, type of disaster faced and existing early warning communication network in the district. He provided an overview of the new initiative based on INSTA XX and VHF that can provide public warning more effectively during emergencies. He argued that the new system is found to be more effective for its system architecture and its sustainability for a range of hazards.

Recommendations

- ◆ There should be further strengthening of observation system for detection of environmental risk specifically of the Ocean and Himalayan region.
- ◆ More precise early warning with emphasis on specificity of vulnerability to be provided at a district/taluk level.
- ◆ More Public awareness has to be created and traditional social network should be integrated in early warning strategies.
- ◆ New initiatives as undertaken in Krishna district of Andhra Pradesh and cell broadcasting should be analyzed for replication.
- ◆ There should be more sensitization of media on early warning and suitable government policies may be considered for enactment for early warning.
- ◆ There is a need for dedicated weather channel.
- ◆ Allocation of specific frequency should be considered for disaster/ emergency communication

Geo-Information Systems

Concept Note

Geoinformation technologies include Geographic Information Systems (GIS), Spatial Decision Support Systems (SDSS), global positioning systems (GPS), and Remote Sensing (RS). This also includes object-relational database (ORD) or object-relational database management system (ORDBMS) and Geostatistics. Geoinformatics combines spatial analysis and modeling, development of spatial and temporal databases, information systems design, human-computer interaction and both wired and wireless networking technologies. Geoinformatics provides wider application ranging from collation and interpretation of data, managing large amount of information in form of maps and tables, providing comparability and overlaying of various spatial information and combining various geographical, socio-economic, environmental and administrative datasets.

Space-technology i.e. Remote sensing and Global positioning systems has added advantage of comparing various geo-environmental and man-made features on various time-scales and when combined with GIS, it helps in understanding changing hazards scenario, vulnerability and is rapid assessment of disaster related damages and losses. The advanced high-resolution and multispectral sensors has provided immense scope to the scientists for mapping and analysis of earth surface features. Hyper-spectral analysis helps in near accurate identification of various objects. With the help of Geographic Information Systems (GIS) it is now possible to model, develop scenario related to floods, drought, earthquake, landslides, coastal hazards and industrial/ chemical accidents, in an interactive manner that significantly helps planning and implementation process.

GIS can also integrate various other information systems, for example, bioinformatics and chemoinformatics as well. Spatial Decision support Systems are equally effective in pre-disaster risk assessments and post-disaster impact assessments, relief and recovery planning by facilitating effective decision support system at various levels, not only limited to scientists or technocrats but equally useful to the administrators and field level managers.

Context

Availability of readily accessible, 'easy-to-understand and use' form of information is key challenge in disaster management. Efficient decisions, accurate planning and organized response are the key functions in disaster management where Remote sensing, GIS and GPS offers a vital role for providing relevant, authentic and interpretable information in time and cost effective manner. Geospatial technology now is increasingly being used in managing disasters globally. Government of India has initiated various programmes

for promoting the applications of Geospatial technology in Disaster Management, notable amongst are Decision Support Centre at NRSC, National Agricultural Drought Assessment and Monitoring System (NADAMS), Indian Forest Fire Response and Assessment System (INFFRAS), National Database for Emergency Management (NDEM), GIS based Emergency Preparedness and Response Systems (GEPR) tool by National Informatics Centre for offsite emergency planning etc.

Basic information for disaster management i.e. technical studies, geographical data etc. exists, but is not readily available in a usable form to local authorities and other stakeholders. There is still a wide gap between the Geoinformatics and the disaster management functionaries at various levels. The technology has attained significant advances during the past decades but its applications in disaster management is limited due to lack of accessibility to real time information, awareness and skilled professionals at user level. The session on Geoinformation System is intended to bridge the gap between the geospatial community and disaster management functionaries.

Proceedings

The Session on Geoinformation Systems covered various applications of space technology, remote sensing, geographic information systems and decision support systems in disaster management. Geoinformatics technology has witnessed advances in recent time to address all phases of disaster management cycle i.e. risk assessment, early warning, monitoring, response and damage assessment. Elaborate presentations were made on various national and regional initiatives including Decision Support Systems, national database for Emergency Management, International Space Charter, GIS and MIS and Integration Issues. Various tools, techniques and methodology for data collection compilation, analysis and modeling were also discussed in detail. Besides natural disaster related applications case studies and applications on Industrial and Chemical Disasters and Fire disasters were also been presented during the workshop. Emphasis was given on the open source data, Open GIS standards and Open source softwares.

Dr. Ajai, Safe Application Centre, in his inaugural address stated that Geoinformation is the corner stone for any decision making. Since last 3-4 decades Geoinformatics tools and techniques have been increasingly used for collecting, analyzing and interpreting various forms of spatial and non-spatial information. Spatial information is increasing been used as crucial input of disaster management in all phases of disaster management cycle. Since LANSAT was launched in the year 1972, tremendous developments in this field have taken place. Space based data is now been used as a key input for



Geo-information. Remote sensing data of various spatial (ranging from km - few cm), spectral (panchromatic - multispectral) and temporal (hours - few months) resolution is now available. Monoscopic and stereoscopic data as well as microwave datasets also available for specific applications. Similarly GIS industry also witnessed considerable changes in terms of demands as well as expectations. Earlier GIS was only for technocrats and limited group of scientists and academicians. It was stressed that unless common standards are not followed there will be difficulties in integrating data from different sources. India has progressed substantially in the field and NNRMS standard for data management. With the introduction of web based GIS (e.g. Google Earth, Bhuwan etc.), spatial data is being used in all areas of life, e.g. telecommunication, navigation, tourism etc. It is further pointed out that now there is paradigm shift from proprietary software and data, to open source software, data and open standards. Interoperability has become a key word in today's context. More than 300 partners from all over the world from the industry get together and formed an open GIS consortium which has brought out open GIS standards and more and more geomatics professionals across the world are accepting these standards. Integrated GIS and Image Processing Software (IGiS) developed by Scanpoint Geomatics and ISRO was launched in July 2009. It is a Geomatics software which includes GIS, image processing and its integration with real time information using GPS. The software has been tested by scientists and experts at more than 12 centers of ISRO for over a year before it was formally released. There are lot of advancements in GPS Systems and Global Navigation Satellite Systems as well. Satellite navigation systems started with NAVSTAR system launched by USA. Geoinformatics system which comprises of databases, query, analysis tools and spatial data interface cost effectiveness as well as user friendliness. These are the issues to be address while adopting Geoinformatics for real life applications.

Dr. Diwakar, ISRO has initiated his address with the “**Application of Bhuwan, Internet Mapping Service**” developed by ISRO similar to Google earth and its applications in disaster management. He mentioned that in the pre-disaster phase, more efforts can be made in putting together the databases in OSG standards and make a repository which can be shared across the user community. Under the DSC initiative lot of data has been put together for different disaster prone disaster districts. While coming to the management of disasters Community, reliance is a key factor and it has to be assured. It is necessary to have community accessible Geo-information Systems such as Google Earth and Bhuwan, which are accessible worldwide. Bhuwan was designed with an objective of assuring transparency of spatial database to the community of India but now spread to other countries in the region. Data of various spatial resolutions from 50m to 54m are been integrated in Bhuwan. Resolution of Cartosat products (2.5 and 1m) are also in par with images of google but unfortunately the law of the land won't permit to make those images available in the public domain. India is having one of the best Tsunami warning systems in the world. Discussions are going on with INCOIS to integrate Indian Ocean Tsunami Warning System with Bhuwan. Such information systems can be used as multi purpose information systems e.g., watershed development, fisheries, etc. It is also proposed to bring Bhuwan to local language so that community can be trained to use them for real life applications

including disaster management. It is the high time to make the geospatial data accessible to community instead of just concentrating on tools and technology development. Under the ISRO initiative of Village Resource Centers, satellite technology and VSAT communication system were provided at the village level. Besides, GIS systems (open source) were customized in local language for the use of community. Through these systems villages can get advice from experts located in various expertise institutions. This kind of information systems and services will help in optimal utilization of Geo-spatial data and technology for disaster management.

Mr. V. Bhanumathy, NRSA in his presentation briefed the participants about the **“Operational applications of Geoinformation systems and DSC initiative set up under the DMS programme”**. He mentioned that data is the major component of all the decision support systems and models, whether probabilistic, empirical or stochastic. Type of data required depends upon the type of the disaster and phase, i.e. in the case of early warning of cyclones, a coarse resolution data of high temporal resolution is the requirement and for damage assessment a high resolution data is required, similarly, for crop monitoring a medium resolution data of AWIFS can be used. He has informed that Decision Support Centre (DSC) was established under disaster management support programme by Department of Space to use the space technology for better management of natural disasters. DSC is an operational service provider exploring the synergy and convergence of space and contemporary technologies in pre-disaster, during disaster and post-disaster phases. He has briefed about the uses of various data sets from different sensors and their specific applications in flood, drought, landslides, forest fires etc. Interfaces are also in the process of development for exchange of data / information from the concerned departments through well established protocols. Feasibility studies were also carried out to utilize the data from ALTM and airborne SAR and other future EO missions. The procedures for generation and transmission of the information was streamlined and automated to a significant extent for meeting the required performance, in terms of user-friendly format, information content and turn-around-time. DSC will respond to the disaster situation depending upon the nature of the disaster in providing timely information. It is envisaged that the DSC will be connected to National Emergency Operation Centre (NEOC), State Emergency Operation Centres, selected knowledge institutions and Shadnagar Earth station through satellite based Virtual Private Network (VPN). Thus, DSC will have online interface with these agencies to effectively use the ground observations and the data in conjunction with the space data to derive updated information on disaster events and provides decision support. Operations are generally been initiated once an alert been



issued by a nodal ministry or department. NRSC has developed web based applications for Puri district using web GIS. GPS applications also developed a PDA device where the live data flow in a real time bases to NRSC server. Right Information to Right People in Right team is TIP for using the technology for Disaster Management.

Mr. N. K. Srivastava, ISRO, emphasized the **“Importance of Space based Disaster Management System and its distinct advantage of providing unbiased, synoptic and timely information on the nature and impact of the disasters”**. International charter “Space and Major Disasters” is the maiden initiative of this kind, in which, space far-

ing nations formally participate to pool their space and ground segment resources and deliver data in emergency situations. The Charter is an International agreement among Space Agencies, implemented in year 2000 after UNISPACE III conference 1999, held at Geneva, to support relief efforts in the event of emergencies caused by major disasters(natural/man-made) anywhere in the world. It provides a unified system of space data acquisition and delivery.



A constellation of satellites, committed by member agencies, coordinated to ensure immediate access to EO data to support disaster-response (with maps) to organisations dealing with major disasters. Services are limited only for immediate disaster-response phase. The Charter is a simple mechanism with two key functions, (a) to task relevant satellites in response to an emergency (Fast data turn-around – priority acquisition – archive retrieval), (b) to supply Earth Observation (EO) data at no cost. Recognizing the importance of space based information 10 space agencies across the world come together and made a forum of international cooperation. ISRO is a signatory to the International charter “Space and Major Disasters”. They are the only few agencies/ bodies authorized to request the mobilization of the space resources of the member agencies to obtain data and information on a disaster occurrence. There is a pre-defined list of 42 user organizations that correspond to 36 countries. They represent the national Civil Protection Authorities (CPA) of the partner agencies. In addition, two specialized UN agencies can activate the Charter, UN OOSA, UNITAR/UNOSAT.

There are 3 modes of activation, (i) direct activation (mode 1); the only bodies authorized to directly request the services of the Charter are the authorized users (typically civil protections, governmental relief organisations, authorities with a mandate related to disaster management, etc) from the Charter Member countries, (ii) activation via ‘sponsor AU’ (mode 2); User organizations have a bilateral agreement with an authorized user, (iii) activation via the UN Agencies recognized by Charter as co-operating body (mode 3); users request assistance via UNOOSA and UNITAR/UNOSAT, authorized to request

activations. ISRO plays an active role as a lead agency. It is unique and successful case of International Cooperation. Charter has improved its resources substantially over the years and new Space Agencies joining as Charter partners, new satellites have been progressively integrated into the ‘Charter constellation’.

Mr. Sanjay S. Gahlout, National Informatics Centre demonstrated examples of two systems, “**Accident Informations System (CAIRS)**” and “**GEPR tool**”, where GIS has been used extensively. CAIRS has been developed to integrate accident reporting formats under various authorities and create a centralized data base which would facilitate specific generation of report/chart for facilitation of immediate and effective communication. Developed for chemical emergency, planning and response GEPR comprises of digitized maps and that of the industrial clusters/surroundings comprising major chemical industries identified



as MAH (Major Accident Hazard) units. This system incorporates data on first responders for chemical emergencies such as police, fire, medical and other emergency response agencies and services, resources available in the districts to combat such emergencies along with resources and location specific data. Web GIS for Emergency Planning & Response System (Phase III) is in continuation of the earlier work (GEPR phase I and II) to enhance the software capability with Web enabled technology, more powerful and accurate mapping. This system will be able to help response agencies, namely, Central Crisis Group (CCG), State Crisis Group (SCG), District Crisis Group (DCG) and Local Crisis Group (LCG).

Dr. P. Jyotimani, Vellore Institute of Technology gave a presentation on “**Customized GIS application developed for earthquake disaster Management using Arc GIS**”. Earthquake Risk Analysis Tool is a customized application, i.e. a decision support tool to give real time information reports as operational maps to prepare scenarios relevant to the interested territorial zones which enables faster decision making process for facilitating spatial data visualization & analysis. The information as per user needs includes, seismic hazard identification, potential risk zones, vulnerability analysis, population analysis, and building inventory (property) analysis with user-supplied inventory, Query shell development and capability and provision of user-friendly GUI Interface. After visualizing the entire spectrum of data requirement the four customized application modules on Earthquake Hazard Mapping, Potential Risk Zones, Loss Estimation and planning relief during / Post-earthquake logistics operations were developed. These modules were attempted with national level (India), State level (Gujarat), city level (Ahmedabad) and city ward level (Pondicherry) spatial data sets integrated for multiple sources available.

Mr. D. P. Kanungo, Central Building Research Institute demonstrated the “Applications

of multi-source land use land cover classification for landslide studies in hilly terrains of Darjeeling Himalayas”. The land use land cover information of an area is quite essential for proper planning, management and monitoring of natural resources. It is an important input for many geological, hydrological, ecological and agricultural models. In most of the cases the incidence of landslide is inversely related to the vegetation density. Topographic maps are used for generating the DEM, which along with its attributes, such as slope and aspect, provide the basis for multi-source classification. Furthermore, the derivatives of multi-spectral images like Principal Components Analysis (PCA) and Normalised Difference Vegetation Index (NDVI) was also used to improve the land use land cover classification from remote sensing data in hilly regions. In this study, the IRS-1C LISS-III data has been used as the primary data source, along with NDVI and DEM images as additional data layers, to implement multi-source land use land cover classification process. Separability analysis using transformed divergence is performed to examine the significance of various spectral bands in the classification process. Most widely used Maximum Likelihood Classifier (MLC) is used to perform the classification. The PAN image is used as the reference data for generating training and testing datasets. The results show a reasonable improvement in accuracy of classification on incorporation of NDVI and DEM as ancillary data over the classification performed solely on the basis of remote sensing data. The land use land cover map thus produced was used for landslide hazard study. High spatial resolution IRS-1C-PAN and PAN-sharpened LISS-III images were used to produce a landslide distribution map which was verified from field surveys. A total of 101 landslides showing areas occupied by sliding activity were identified. It is observed that agriculture and tea plantation categories have maximum incidence of landslides in comparison to other categories and water bodies and river sand categories are devoid of landslides. As far as the landslide density is concerned, it is observed that barren lands have the maximum density and is followed by agriculture land, habitated area, tea plantation area and forest covers. Water bodies and river sand categories are found to be devoid of landslides. These results reflect the real field conditions in hilly terrains. The relationship thus obtained can be used as one input data for landslide susceptibility mapping.

Mr. S. K. Katiyar, Maulana Azad National Institute of Technology, Bhopal, in his paper discussed about “**Accuracy aspects in the use of GPS technology for Geoinformation system**”. It was mentioned that US satellite system Global Positioning System (GPS) has revolutionized the positioning and navigation on land, sea, air and space and one can get millimeter level accuracy using this instrument. Different linear and aerial features in the Bhopal city area have been digitized using high accuracy of hand held L1 frequency GPS receiver. Accuracy of the above digitized features were determined by comparing the corresponding feature dimensions extracted from Indian Remote Sensing Satellite (IRS-P6), LISS-IV sensor images and Leica make total station based measurements. He has mentioned that map derived GCP coordinates should not be used for the geometric correction of modern age high-resolution images from IRS-1C/1D, IRS-P6 or any other high-resolution sensor. The GCP coordinates collected from hand held GPS receiver would suffice the sub-pixel accuracy requirements even for IRS, PAN sensor images. Averaging of a number of

repeated GPS observations on the same station using hand held GPS receiver provided the accuracy in the range of 3 to 6 meters and this is appropriate for so many applications in the development of Geoinformation system database. However, by using GPS data, availability of transformation parameters between WGS-84 to Indian datum is a big problem at least for civilian users. Even a single frequency hand-held GPS receiver is best alternative for the base map if a user has good understanding of various sources of errors in the GPS measurements and computations. So it is advisable to use GPS data for geo-referencing the high resolution satellite images in the place of SOI toposheets to reduce the inherent errors.

Mr. Niroj K. Sarkar, Geological Survey of India, Kolkata gave a presentation on “**GIS-Based Slope Stability Evaluation of a Landslide Complex for Paglajhora Landslide of Darjeeling Himalayas**”. Geological mapping of a large and complex landslide carried out in Darjeeling Himalaya (Paglajhora) revealing various critical slope parameters and relevant geological characteristics, which were subsequently used for the evaluation of the slide and applied as a vital input for the GIS-based stability assessment of the slide complex. The study has been done under various saturation conditions. Geological mapping of the affected slope was carried out as a first step towards stability assessment which provides fundamental inputs about slope parameters such as morphometry, type and nature of slope forming material (both rock and overburden), geometry of probable failure surface, past landslide movements, their failure modes/ mechanisms, hydrological situation, anthropogenic interferences and land cover, etc. Through detailed geological mapping, probable causal mechanisms involved during the temporal evolution of the slope are ascertained. These thematic maps and related information are used by the planners/geotechnical engineers to understand the slides and design appropriate protective structures in consultation with geologists. Deterministic slope stability models are primarily based on shear parameters of potentially-failing material and calculation of Factor of Safety or F_s using an insitu hydrological model (van Asch, 1992). Such mathematically complex 3-D deterministic technique has inherent limitation to use in a 2-D GIS environment. The models require a number cost-intensive and time consuming boundary physical parameters. The stability calculation is preferred outside the GIS environment, but reproducing the results again onto a 2-D distributed map sometimes is problematic due to incompatibility in the data formats. One-dimensional infinite slope model was applied and predictive F_s maps were generated under three hypothetical ground saturation. F_s calculations are done in GIS using boundary conditions and some basic assumptions. Limitations of the model are (i) simple translational failures are only considered (ii) failures plane assumed at shallower depth along the rock-overburden contact (iii) overburden thickness map is interpretative and considered as the depth of possible failure surfaces (Z). (iv) Shear parameters (c , γ and ϕ) determined from 10 nos. of insitu samples considered to represent the whole area. (v) Minimum overburden thickness (0.2 – 0.5 m) and highest shearing resistance parameters are considered for competent bedrock-covered areas. Pixel-wise factor of safety (F_s) under three hypothetical saturation conditions were calculated using slope parameters from map and determined shear parameters of representative insitu slope-material. The above stability model confirmed substantial portion of stable slopes ($F_s > 1.7$) under dry condition

becoming unstable ($F_s < 1.0$) under various increasing saturation conditions. Under dry condition, only 25% of slope was potentially unstable, which increased up to 51% and 65%, respectively, under intermediate and total saturation conditions. This stability modeling could be more effective with use of measured depth-to-failure surface, pore-water condition, and larger spatial variability of the determined shear parameters.

Mr. A. K. Sharma, Delhi Fire Service, demonstrated a case study of the **“Fire Management System Developed using GIS”**. Mission of fire service is to protect life, property, and natural resources from fire and other emergencies. Key Challenges in Fire Management in a City like Delhi are High rise buildings, Markets/shops in congested areas, Transport godowns/warehouses, Commercial and residential buildings, Industries, multiplexes, malls, & JJ clusters (slums), Metro, Airport & Railway station, Traffic (numbers, Slow moving, parking etc.), obstructions and encroachments and movement of chlorine/flammable containers. Risk management, preparedness, and mitigation have attained new importance in light of challenges faced and effective response cannot be continually achieved without adequate planning and preparedness.



Historically, first responders have relied on experience, good equipment, communication, and teamwork to achieve successful management of emergency situation. When a fire occurs, any delay in responding fire crew can make a huge impact on- rescue of occupants versus serious injury or death. Fast access to critical information is essential. With increasing demand, fire service must utilize the best tools, techniques, and training methods to meet public expectations in saving life and property. The model was able to analyze and display information of various fire safety parameters of the affected building, calculating point to point distances and the nearest feature of interest with respect to the affected area. Only for one building the scenario has been developed, which can be replicated to other buildings. The system can be upgraded to develop scenarios and models for better decision making.

Mr. G. Prasad Babu, RMSI Pvt. Ltd., Noida shared the **“Web-based visualization tool profiler for Insurance Exposure and Risk”** (PIER) an interactive of web-based application for risk assessment, developed using open source GIS in India. Open source data and software has gained popularity with the rise of the internet, which provided access to diverse production models, communication paths, and interactive communities. PIER has comprehensive nation-wide database upto the Pincode Level with Interactive web-based visualization tool with hazard data overlaid on Google Maps which provided information on earthquake, cyclone and flood hazard layers and comprehensive hazard risk profile report for each pincode in India. Key features of PIER are; integration with existing IT

systems; integrate with DRR/ risk inspection workflow systems; open source; no need of software licenses; web architecture which provides easy access to DRR/Disaster Managers and no need for any client application. Although the application has been developed for insurance sector, this will be extremely useful for Disaster Managers and Administrators for various phases of DM planning.



Mr. Manjush Koshy, CESS, gave his presentation on “**Application of GIS and Remote Sensing for Disaster Prone Areas-a case study of Coastal Kerala**”. A study along the coastal belt of Alleppey district, in central Kerala, has been carried out to understand the effectiveness of the tools of geo-informatics in disaster management. With the help of QuickBird images of 0.6m spatial resolution, high geospatial resolution inventorying and mapping of tsunami disaster vulnerability of the coastal settlements in Alleppey municipality was attempted. Ability of GIS as

a mapping tool enhances the depiction of geographical trend and spatial pattern of a natural disaster like tsunami. The vulnerability mapping of the area includes identification of the coastal locations in terms of its nature and human settlements. Appropriate tracking of evacuation routes and modes of evacuation is done in a spatial context. Vulnerability of lowlands and inland water bodies that are connected by creeks



that are tidally active proximal to the coast line are mapped. Using ArcGIS software, thematic layers are overlaid, queried and geographically analyzed to derive meaningful information on hazard proneness of the coastal settlements in the area. Resultant maps provide information on the vulnerability of areas, rescue routes and shelters for likely scenarios of tsunami affected locations. A shortest evacuation route finder was developed in Map Objects and VB.NET that will help the first responders to help people reach the nearest shelter quickly. There is a need for the implementation of Public Participatory Geographic Information System (PPGIS) for community preparedness and mitigation activities at local level using Open Source Geographic Information Systems (OSGIS).

Mr. K. S. A. Dinesh Kumar, NITTTTR, Chennai gave his presentation on “**Applications of GIS in predicting Seismic Vulnerable Zone**”. He mentioned that the main objective

of this study is to analyze the seismic hazard and vulnerability of various structures of Chennai city using Geo-informatics to serve for seismic disaster mitigation. In the study, different maps like landuse, geology, geomorphology, drainage density, slope and soil are being prepared with the help of satellite imagery to predict the vulnerable zones. Parameters considered for the generation of compatible building type classifications are roof type, structures, presence of cracks, maintenance, building shape, number of stories, year of construction etc. Based on Indian condition, a damage probability matrix is prepared to evaluate what will happen to buildings during earthquake of various intensities. Finally, amount of vulnerability related to various buildings are calculated. This conceptual model has been developed into an interactive, GIS-based decision support system (DSS) for the region, which has more earthquake vulnerability. The final guideline document developed using the study can be used by the Government agencies, universities and private organizations to carryout necessary actions to increase awareness of the earthquake threat and to reduce loss of life and property in future shocks.



Mr. Kiran Jalem, SKIPA has illustrated the “**Application of utility mapping for disaster information systems a case study of Ranchi**”. Ranchi Utility Information System was developed by Jharkhand Space Application Centre. Utility maps are essential for all stages of the disaster management cycle: prevention, mitigation, preparedness, response and recovery. In the recent years, after the launch of high resolution satellite such as Cartosat 1 and 2 with 2.5m and 1 m spatial resolution from Indian Remote Sensing (IRS) satellite series, and quick bird satellite with 0.65 m, the use of remote sensing for rural and urban development activities and Disaster Management has increased in many folds. Utility services is one of the important discipline where information derived through satellite based remote sensing data geographical information system were found extremely useful in image processing and integrating spatial data with non spatial information. RUIS is developed using QUICK BIRD data, covering 175.3 sq km of Ranchi Municipal Corporation. RUIS will facilitate the near real-time data required for assess-



ment of existing utility services, development for future growth, management for better service facilities, updating of data and analysis for better decision-making for Disaster Management Planning and Emergency Response.

Recommendations

- ◆ Although technology is capable of addressing the needs of Disaster Management Community, there is huge gap between the Geoinformatics community and users.
- ◆ Availability of data and facilities at community level / user level.
- ◆ National database has to be made available to all the concerned departments and few cases studies/ processed data should be made available to the users at various levels.
- ◆ Web-GIS and Open Source GIS has to be promoted at various levels.
- ◆ Capacity building initiatives at various levels needs to be strengthened.

Gender and Disaster

Concept Note

In the recent years, the upsurge of knowledge and research on ‘Gender and Disaster’, has highlighted the way in which a significant proportion of disaster planning, management and research overlooks gender, despite recognition within the social sciences that there exists a ‘gendered dimension’ to the responses to any social event. Failure to acknowledge this not only runs the risk of overlooking obvious and more subtle needs and priorities that can make all the difference between life and death, but can also diminish the efficiency of disaster responses.

Disasters and their aftermaths mirror the preexisting social inequalities of caste, class, ethnicity, sexualities, disability and age with gender cutting across in all of them. In wake of a disaster, gender relations and issues are generally considered to be irreverent or as a luxury. The differential impact of disasters on men/boys and women/girls and transgender community is not taken into account while responding to the disaster. Resource distribution in a post disaster scenario, which are intended for the entire population of a disaster-affected area, rely on the existing structures of distribution that reflect the patriarchal structure of society, and hence women/girls are marginalized in their access to such resources. Meanwhile, the potential contributions that women can offer to disaster risk reduction around the world are often overlooked and their leadership in building community resilience to disasters is hardly highlighted. This is reflected in the lack of a platform for women in formal disaster management organizations

for sharing their needs, experiences and priorities. Gender stereotypes also places stress on men to assume greater responsibilities on account of gendered norms and expectations. Masculinity norms may encourage risky and heroic action during the search and rescue period, debris removal, and reconstruction, and deter men from approaching agencies for assistance and or seeking counseling later. Hence, the differential

needs, vulnerabilities and capacities of men/boys and women/ girls need to be taken into account while designing any intervention in the pre as well as post disaster scenario.



Context

For the past one decade, research on gender dimensions of disasters, has pointed out the need for looking into the root causes of gender based vulnerabilities of women and men, especially of women, because they are more disadvantaged due to patriarchal social structures, which affects them adversely in both development and disaster contexts. Research has also pointed out the significant gap in integrating gender perspectives in planning, implementation and evaluation of the disaster management processes. Mainstreaming gender in disaster management allows for a more accurate understanding of the post disaster scenario ensuring that the disaster survivors are acknowledged, their needs and capacities are taken into account, thereby, facilitating the design of more appropriate and effective disaster response and mitigation. The attention has also been drawn to the silence on women's capacities and resourcefulness beyond her traditional role in the domestic domain. It is now recognized that the shift from the concept of vulnerability of women, to the causes which make women vulnerable and focus on their capacities offers opportunities to integrate gender perspectives in disaster management policies and practices at both macro and micro levels.

The Second India Disaster Management Congress is providing a platform where researchers and practitioners shall discuss gender related issues and challenges, deliberate on the gap between theory and practice, illustrate gender mainstreaming strategies and lay a road map for the future.

Proceedings

The thematic session on “Gender and Disaster” was chaired by Ms. Chaman Pincha. The session started by an invited talk by Dr. Susanna Hoffman titled **“From Victim to Victor: Gender and Disaster around the Globe Accomplishments and Challenges”**. Dr. Susanna pointed out that it is only recently that recovery programs had recognized the repercussions of disasters on women and sought to rectify them. Referring to antiquity and the many mythological beliefs in which women were seen as both the goddesses of creation and destruction. She pointed out how the imagery about the planet Earth as a mother stood in contradiction with that of monster, unknowable, untamable, and despoiling, when disaster struck. (To protect female from danger, societies, including governments and aid groups, also perceive women as weak, ineffective, and lowly.) The thought pattern spilled over to the public and private domain with the result that women are reduced to the private arena of reconstituting households. The prevailing ideology was further reflected in the represen-



tation of women in a disaster as frail and only emotional. Susanna concluded her talk with a strong appeal to continue to push efforts not just on the practical plane, but the cultural one as well.

Ms Sarah Bradshaw delivered a talk on *“Men, Masculinities and Disasters”*. She provided an overview of how in the 80s, there was a tendency in academic literature to focus primarily on women and it was later followed by an increase in studies which included men and women from mid 90s. There was an increased interest in incorporating men into ‘Gender and Development’ approach. The emergence of this idea to focus on masculinities aimed to stabilize marginalized men by addressing their claims of being marginalized by development and allowed interventions to work with, rather than against them. She referred to the studies which show that men due to economic crisis recognized women’s rights, but it was more like something that has to be accepted rather than something that is actually desired and advanced in itself as a right. Doing this would imply empowering men to disempower themselves.

A focus on masculinities could offer a re-positioning of the notion of ‘gender’ to demonstrate that it is as much as about power and understanding, how power is played out its meaning for men and women. Perhaps the most important thing to draw from the masculinities debate was to try and avoid constructing gender relations as all times oppositional. ‘Masculinity as risk factor’ during this time manifested itself by men reasserting their questioned masculinity through displays of masculine behaviour –through drinking and refusing to display weakness and seek help for trauma, and towards women through aggression. What was important to note here was that the focus was still on women as victims of male crisis, rather than men as the problem and the solution.

The speaker made a case to move past ‘masculinity as risk factor’ and seek to understand the range of roles adopted and responses chosen by men and women through their multiple gendered realities and their consequences. While a focus on women may result in a crisis of masculinity, alternatively, men may actually benefit from women’s involvement. Thus it was more likely to cause crisis for women who assume new roles but gain little change in relations or power from this new ‘feminisation of responsibility’.

Mr. Harikrishna’s talk on *Gender Mainstreaming: Humane Gaps in Humanitarian Assistance* focused on the process that humanitarian organizations, both donor agencies and partner organizations go through in mainstreaming gender in the DRR. In spite of gender policies in almost all donor agencies, and some partner organizations, major gaps still exist in integrating gender concerns. Some of the reasons for this gap were inability to understand and empathize with those who suffer due to absence of gender mainstreaming, inadequate research/patience to understand socio-cultural roots/strengths in gender relations and lack of commitment to apply gender prescriptions within the organization. These gaps could be fulfilled if the humanitarian organizations look into the process of recruitment of the staff, the tools which are used to assess gender sensitive attitude and aptitude in recruitment and performance appraisal. The speaker concluded with several recommendations to mainstream gender within the humanitarian organizations which included carrying out consistent and local specific research for better understanding of gender power

relations within the communities, NGOs and the government, and making gender sensitive approaches and practices key criteria in annual performance objectives.

The invited talks were followed by nine paper presentations. Ms Yoko Saito, Hyogo Office, Japan talked on “***Gendered Community Based Disaster Risk Management in the context of Regional Development***”, which was launched to reduce community vulnerabilities and strengthen their capacities through community participation including men and women. The project aimed at implementing Hyogo Framework for Action, which reaffirmed that “a gender perspective should be integrated into all disaster risk management policies, plans and decision-making processes, including those related to risk assessment, early warning, information management, and education and training”, and to achieve Millennium Development Goal (MDG) by 2015. The paper described the process of implementation of the project in four project countries, especially focusing on the case studies of Sri Lanka and Bangladesh including action research, which pursued opportunities to analyze and integrate gender dimensions and strategies to empower women as well as men in disaster management and further implementing disaster management trainings in communities.



Ms. Simin Saedi, University of Tehran, Iran presented the second paper titled “***Bam Earthquake through the Gender lens***”. She informed that though, Iran was a disaster prone country, gender considerations were hardly applied as a fundamental principle in policy and framework development. Infact, gender did not figure anywhere in the disaster management system and was ignored under the other priority objectives in the Bam earthquake. Her paper viewed gender sensitive areas in three aspects namely; risk mitigation and preparedness prior to disaster, disaster relief immediately following the event, and long term post-disaster recovery and reconstruction phase in Bam earthquake. It also focused on using gender analytical tools such as gender analysis and policy map to highlight gender issues in Bam earthquake.

Ms Saedi ended her presentation by highlighting the need to overcome legal and institutional impediments for incorporating gender concerns in disaster recovery and reconstruction activities



Ms. Shalini Mitra, Asian Institute of Technology, Thailand presented her research work ***“Role of Caste and Gender in the Context of a Natural Disaster: A Case Study of Super Cyclone in Jagatapada, Orissa”*** which analyzed as to how the discriminated lower caste women who had had less stringent shackles regarding the private-public divide, were able to behave, respond and cope with the Super Cyclone from a more empowered platform than higher caste women of the village. The paper highlighted that by strongly challenging or loosening all pre existing gender and caste hierarchies, the catastrophe of the 1999 Super Cyclone had created a brotherhood of pain in Jagatapada, by sharing solidarity of loss between the women and men of different caste communities. As the village slowly traversed in the recovery period with the assistance of the humanitarian organizations, some notable permanent shifts took place in the age old gender and caste practices of the village and the 1999 Super Cyclone acted as a catalyst for these cultural shifts.

Ms Minakshi made a presentation on ***“The Ideal vs. Actual of Domestic Violence in Post-Disaster Situation: The Efficacy of Questionnaire as a Tool”***. The presentation was based on the study conducted in the Kosi flood affected areas of Birpur in Supaul district of Bihar. The experience of the women in the aftermath of disaster including the way they perceived the risk of domestic violence, the response of women towards it, and finally their coping mechanism were explored in the study. In this connection, the effectiveness of questionnaire as a research tool to study the phenomenon of domestic violence from the insider’s perspective was examined. Ms Minakshi in her research found that women were generally reluctant to share information on domestic violence and in fact would vouch-safe for the good conduct of their husbands in a survey situation. However, a contrasting picture emerged in the non-survey focus group discussion and key informant interview context where the same women reported the case of domestic violence. It was seen that only survey was not sufficient to measure domestic violence as it resulted in a lot of under-reporting. The presentation ended by making a recommendation that survey on domestic violence should be supplemented by qualitatively derived information by means of using focus group discussion and key informant interview.

Mr. Jorge Caravotta, United Nations Children’s Fund made a presentation on ***“Reproductive Health Rights of Women: A Case for Maternity huts for Pregnant Women in Relief Camps”***. The paper presented a model disaster response strategy to decrease morbidity and mortality in pregnant women, which UNICEF had successfully implemented in Bihar in the aftermath of Kosi floods in 2008. It also elaborated on the effective partnership between UNICEF and the government of Bihar to advance the reproductive health rights of pregnant women by providing essential maternal health services to the displaced populations .It addressed the reproductive health needs of pregnant women by relying on effective use of the existing health resources such as public health centers, and the government policy of offering financial incentives under ‘Janai Suraksha Yojana’ to all the women availing this delivery service as well as to the girl child born in the maternity hut.

Ms. Smita Kadam, Sarista Foundation presented a paper on ***“Empowering and Mainstreaming Women for reducing risks from disasters and climate change: A Case Study of Mumbai Slums”***. She initiated her presentation by highlighting that women and disas-

ter risk reduction were cross-cutting development issues. To achieve sustainable development, it was an important option for governments and other stakeholders to mainstream women perspectives into Disaster Risk reduction. The paper analyzed two projects which were implemented by Saritsa Foundation in slum areas of Mumbai. The project not only focused on the vulnerability and impact of climate change and disasters on women, but also aimed to empowering them for dealing with issues. Ms Smita ended her presentation by highlighting that the projects were good practices and could be replicated for many such vulnerable women in rural and urban India.

Ms. Nibedita Ray-Bennet, Northumbria University, UK made the penultimate presentation on the *topic “Gender & Disaster: Towards a Feminist Approach”*. She mentioned that gender mainstreaming in disasters was at best, apolitical due to its gender neutral approach, and had created more illusion than conceptual clarity. Currently the mainstreaming approaches in the context of South Asia were insufficient to characterize the needs of women, their coping mechanisms, and the potential for reconstruction in the post-disaster phase. The presenter stated that subjective disaster experiences were shaped by the intersection of gender relations, class, caste, history, location and time. Ms Bennett contended a feminist approach was crucial to seek answers to these questions and theorise disaster experiences. With this in mind, a contextualized assessment from India and Bangladesh and discussion of the mainstream gender approaches were presented using feminist theory. She concluded by suggesting that concrete steps should be incorporated towards the successful achievement of gender equality in disaster risk reduction in South Asia and beyond to exert policy change.

The last presentation was made by Prof. Samir Das Gupta, Kalyani University on the topic *“Gendered ways of Combating Disasters: Role of Grassroots Women”*. He contended that though, women have contributed significantly in every work of life and in spite of many constitutional guarantees and legislative measures they were still depicted as backward, docile and passive. He further stated that without appreciation of local cultural practices and institutions, some projects unexpectedly contributed not to women’s empowerment but to the loss of traditional sources of status and power..

The deliberations in the thematic session hovered around various aspects including cultural ideologies which are loaded against women, masculine identities as a risk factor for men and women, contextualizing gender mainstreaming in Disaster Risk Reduction, violence against women in disasters, use of appropriate research methodologies for conducting gender based research in disaster management, addressing of strategic interests of women etc.

Recommendations

- ◆ Build perspectives among all stakeholders on Gender and Disaster Risk Reduction so that gender is not equated with women alone.
- ◆ Recognizing masculine identities as a risk factor for both men and women
- ◆ Educating both men and boys on the gendered impact of disasters, including increased alcoholism, aggression and violence against women
- ◆ Expose and target cultural ideologies which are loaded against women and girl children.

- ◆ Commission multi-disciplinary research to find out how gender mainstreaming can be contextualized in disaster risk reduction.
- ◆ Commission substantial research on how feminization of responsibilities has affected both women and men in the course of disasters and aftermath.
- ◆ Initiate academic and action research to understand how gender intersects with caste class and ethnicity in increasing or decreasing men/women's vulnerability.
- ◆ Document experiences at grassroots level in the context of DRR to share lessons learned.
- ◆ Violence against women, both in public and private spheres needs to be addressed. Focus should be to prevent gender based violence including policy induced violence on the one hand, and socio-culturally induced violence on the other.
- ◆ Gender perspective in livelihood also needs to look into the detrimental spending pattern, responsible for pushing households into secondary poverty.
- ◆ To build collective assets on every scale for women, as it would secure them.
- ◆ Ensure that women benefit from economic recovery and income support programs, e.g., access, fair wages, non traditional occupational skills, training, child care and social support.
- ◆ To make gender analysis imperative to plan for full and equitable recovery and focus on collection of gender specific data.
- ◆ To prioritize social services, children's support systems with women sensitive timings, women's centers, women's corners in camps and other safe spaces.
- ◆ To address the issues of socio-economic justice and equity so as to protect the strategic interests of women.
- ◆ Address issues related to sexual and reproductive health and rights of women in disaster management policies and programs.
- ◆ Mainstreaming of transgender population in the in all stages of disaster management.

Children and Disaster

Concept Note

Children differ from adults in physical, emotional and cognitive capacities, physiologic status, disease susceptibility and disease expression, and the types of supplies and equipment required to care for them. Therefore, their vulnerability and diverse needs in a disaster situation require knowledge of child health and child development as well as an understanding that the child exists in the context of the family. Disasters disrupt the sense of well-being by destroying normal predictable and consistent life routines of children thus, deeply hamper the process of healthy psychological and personality development. Since damage at this stage often cannot be overcome later and children constitute one of the largest segments of the vulnerable populations their vulnerability needs to be addressed adequately and appropriately. Disasters have a severe impact on the health and well being of the children. The impact of disasters can be categorized as follows:

Lack of adequate food and nutrition during disasters may lead to malnutrition and undernourishment in children and especially infants. Moreover, the strenuous condition of the disaster may lead to stress on the pregnant and lactating women. This may lead to increase in the cases of complications and premature delivery amongst women. Consequently children born are also physically weak.

Children may experience trauma and exhibit psychological reactions like fear, anxiety, childish or regressive behavior, and difficulty in sleeping and concentrating.

The schools buildings may be destroyed during disasters or they may be shut down because of the emergency situation. Sometimes the schools are also used as shelters. The education of the children is discontinued. The girl children may be forced to drop out to take care of the siblings at home or help in the household chores to deal with the emergency situation.

The widely reported social impacts of disasters include problems such as increased cases of child abuse, child labour, child trafficking, domestic violence, which may have an adverse impact on the psyche of the child.

Context

The International Federation of the Red Cross and Red Crescent Societies in the World Disaster Report, 2001 states that, on average, 242 million people were affected by natural disasters or armed conflict, each year, between 1991 to 2000. Of this number, at least 76.5 million were children under the age of 15 and the vast majority i.e. 75 million lived in developing countries. The data of human and economic loss due to disasters in this current decade is much more alarming than this particularly in Asian region.

However, there is little global data on the breakdown of affected populations by age, though media reports shows that children form one of the largest segments of populations affected by the recent few horrifying natural and man-made disasters. Research studies and good practices on how to address children’s capacities and vulnerabilities in times of disaster are very few in number when compared to the number of children affected. Many examples of disaster reports (Gujarat earthquake and Bangladesh flood, SPHERE Project, etc) hardly mention on these issues of children in their reports, although the social dimension of vulnerability assessment has been emphasizing on the vulnerability of children along with women. Disaster literature confines them to three areas: i) they are part of studies on women, ii) they are treated as the cohorts of psychiatric or psychological studies, and iii) they become “icons” of suffering and sign of perilous plight (Marten, 2001). In the eventuality of the recent tsunami, many media reports stated about the danger of sexual abuse and exploitation of children in many affected countries. Any disaster planning and measure need to look at children as a separate category of victims in any disaster as they represent more than 50% of the populations of many countries in developing world, thus represent a sizeable proportion of individuals affected by all types of disasters.

However, irrespective of the type and severity of any natural and manmade disaster, or the equation between a child and a disaster, or existence of child segregated disaster statistics, what is more important is that we should understand how children who have experienced disaster would be processing the information and what sort of reactions they show as a result of such experiences. Since children have limited capacities to process information their sense of what happened is often not realistic and they are not able to comprehend the totality of the situation, they extra care and comfort to check the adverse effects of disasters on their growing body and developing personality.

Proceedings

The thematic session on “Children and Disaster” was chaired by Mr. A.K Gopal, Director, NIPCCD. The session started with the chairperson highlighting the need for focusing on the needs and vulnerability of children in a disaster scenario. A total number of nine presentations were made in the session.

The first presentation was made by Mr. Bharat Kumar, NIPCCD which was titled “*Child Care & Protection and Disasters*”. He argued that Child-centric Approach to Disaster Management (CADM) was required not only to address the needs of children but also to take care of family members and the community at large. The basis of this postulate was that (a) children constituted a sizable percentage of



our population, (b) they were on the lowest rung of the vulnerability ladder, (c) working for children could generate a special sense of purpose, commitment, attainment and intrinsic satisfaction among the helping profession in general, the family, community and also amongst the relief and rescue (RR) teams, (d) the thrust on children ensured that all children were accounted for while preventing problems such as abuse, trafficking, abduction etc. And lastly, (e) children helped was family helped and consequently community helped. He ended his presentation by reiterating that a child-centric disaster management approach may be adopted to address various concerns of children associated with disasters.

Mr. Gerry Pinto, UNICEF made a presentation on the topic *“A Rights Based Approach to Children in Disaster”*. He provided an overview of a programme initiated by Butterflies in tsunami affected Andaman & Nicobar Islands. The objective of the program was to empower children for protecting rights and their participation in developmental activities. The presenter further stated that funding agencies came with their own preconceived models and approaches of working, which were often dictated to them by their headquarters located in developed countries miles away from the physical location of action. In situations where they find it difficult to get staff, the easy option followed is to take the staff of their own partner NGOs by paying the local much more than what the grassroot NGOs pay. It became all the more tragic when many funding agencies do not have a well drawn out exit policies. As the Government does not set standards for operations by external agencies it was almost free for all in terms of where one chose to work – places which were easily accessible from the main road, what they chose to do – visibility in distributing goods and their delivery style. The presenter highlighted that distribution of relief with pressure of offloading created unhealthy dependency among the affected people; uncoordinated efforts in relief and rehabilitation resulted in wastage of resources, duplication, misuse and creating unnecessary undesirable habits. There was a need to be cautious in distributing “cash for work” and building capacities within local communities and beneficiaries themselves was important rather than “importing outside personnel” except for very critical jobs where skills are not available locally. The presentation ended with the recommendation that it was important that any agency that gets involved with relief must have a long term perspective and a development orientation and definitely a well defined exit policy understood clearly by the local administration, local community and local staff.

Ms. Sandhya Krishanan gave a presentation on *“Child Centered and Community Based Disaster Risk Reduction – CC CB DRR: Children play a major role in DRR”*. She examined and demonstrated the experiences of effective Child Centred Community Based Disaster Risk Reduction, primarily drawing on case studies of Save the Children **Bal Raksha Bharat’s** (SC BR) work on CC CB DRR in hazard /conflict prone / disaster intensive areas. The collaboration between government, NGOs and CBOs ensured children’s right to participation and safety as critical to the process and practice of Child Centred Community Based Disaster Risk Reduction. She informed the delegates that on the basis of their projects, the panchayats of Prathabaramapuram, Kameshwaram and Vizhunthamavadi of Keelaiyur block had endorsed the inclusion of children in its disaster management committees (DMCs) and this was ratified by the grama sabha recently. Each DMC consisted of two

to three children represented from the village Task Force Group (TFG). The village TFGs function at hamlet level and was constituted by 60 per cent of children trained in disaster risk reduction (DRR). The presentation ended by highlighting the objective of the initiative which was to recognize children, who were generally categorized as the most affected in any disaster, as potential contributors of disaster management.

Mr. Yudhistir Panigrahi talked on ***“Strengthening Primary education and psychosocial resilience of children in flood affected area of North Bihar: case study from Bihar”***. The paper presenter highlighted the intervention made by SAVE the Children in the aftermath of Kosi floods in Bihar. Children were badly affected as all the schools in flood affected areas were closed for three months and they were displaced to temporary shelter. The children were exposed to varied health hazards. Shortage of appropriate food hampered their physical growth along with the experience of trauma and fear due to the calamity. The need and importance of creating child friendly spaces in a disaster scenario was highlighted. The case study of Kosi floods in Bihar, demonstrated the non-formal and creative environment created through Child Safe Spaces provided children with protected environment in which they could participate in organized activities to play, socialize, learn, and express themselves as they rebuilt their lives. Parents could leave their children in these supervised environments while they were busy collecting the relief materials and searching for the new livelihood option. Education in this case became all inclusive where young girls began to experience equity and dignity. The presentation concluded by highlighting the benefit of creation of child friendly spaces as risk reduction measures were realized through flood resistant water and sanitation interventions with principles of gender equity and technical humanitarian standards.

Mr. Mohammad Aftab talked on ***“Child Protection in Emergency”***. The presentation started with the examination of key principles, policies and experiences of effective child protection in emergencies, drawing on the case studies of Save the Children Bal Raksha Bharat’s work on child protection in conflict areas, post-disaster child trafficking, and children’s nutrition, education and protection needs in the aftermath of disasters including conflict. It was stated that twenty years of unrest in Jammu and Kashmir had caused immense damage to the lives of children, affecting their survival, protection, development and orphaning some 100,000 children. Further, the volatile situation had rendered many social institutions and traditional security mechanisms dysfunctional, thus reducing the support available for children at risk. ‘Save the Children’ had established and trained a network of Child Protection Committees (CPCs) and Children’s Groups to ensure that all orphans and children of underprivileged families were protected and monitored within their villages. Senior officials in the state government had reacted very positively to the work, and had adopted the Quality Standards for Care in orphanages. The presenter ended by informing the delegates that the Jammu & Kashmir Government’s Department of Social Welfare along with Save the Children Bal Raksha Bharat and other partners were working together in partnership towards the development of a child protection policy for the state of Jammu & Kashmir.

Mr. Manavendra Ray made a presentation on ***“Child Trafficking following Cyclone Aila”***. An overview of the damage caused by Cyclone Aila in West Bengal was given. The

presenter informed that Cyclone Aila hit the Sunderbans region of West Bengal on 25 May 2009, bringing catastrophe to some 6.6 million people. In the post disaster scenario, exceptional levels of migration were reported and the long-term damage to household livelihoods significantly increased the vulnerability of children to trafficking and exploitation. Save the Children Bal Raksha Bharat (SC BR) supported the communities to run Child-Friendly Spaces (CFS) and Bridge Course Centers (BCC) to protect vulnerable children. Participation of pregnant and lactating women in the CFS ensured that the teams and volunteers were able to cater to the needs of the new-born children as well as unborn children. The project also helped the adolescents who had been trafficked to reintegrate themselves into school or normal life. While concluding, it was recommended that negotiations should be done with Panchayats to provide space and infrastructural support for reconstructing the BCC's which were destroyed as a result of the cyclone; and further dialogue should be carried about allocating a space for CFS in the event of future emergencies

Dr. Manju Dhaundiyal, NIPCCD presented on ***“Exploring the Potential of ICDS in mitigating the effects of disaster on children”***. She argued that the network of ICDS should be expanded as it had a strong grass root level presence in taking care of children from 0-6 years from lower socio-economic strata. She supported her argument by saying that ICDS was perhaps best equipped to build a safety net for physical and emotional safety of children and an additional training input into the already child sensitive and child friendly work force would yield great results. Moreover, disaster preparedness and education visa-a-vis children could be included in the curriculum of all training programmes of ICDS functionaries. Since, ICDS had the potential to restore social cohesion through the constitution of multi-level Child Support Groups (CSG) comprising select Supervisors, Anganwadi Workers, SHG members and counselors known for their child sensitivity, the presenter recommended that ICDS could be pressed into action in any emergency in every neighborhood. Additional financial monthly incentive to each of the members of the support group could be given as it would be a wise investment for being in a state of readiness in any eventually.

Ms. Nirali Mehta, ECCD Plan talked on ***“Child Centeredness in Disaster Response”***. She mentioned that interventions to ensure the survival of children after a disaster were necessary, but not sufficient to ensure that the disaster does not hinder their overall development. She gave an overview of Plan International's project of Child led Social Equity Audit (CLSEA), which was rooted in the firm belief in child participation. Plan India, in line with its child centered community development approach, created a niche role for children in the post-disaster communities through a process of child led social equity auditing. The presenter also gave an overview of another project 'Amazing kids' which they had initiated with 'One World South Asia' after the tsunami to create skills and opportunities for communication at the grassroots level for children through various media like radio, camera, cartoons, computer training and traditional Villupattu (folk songs sung while playing a traditional bow). The organization had also established childcare and activity centers within the communities/camps with the objective of providing safe spaces for all children to help them recover from the trauma of disaster. She concluded by reiterating that in any post disaster situation children are not merely the victims but were important actors who could contribute in rebuilding

the lives. And for this to happen, it was critical to mainstream child centeredness in all stages of disaster- preparedness, rescue, relief, recovery and rehabilitation.

Mr. Sanjeev Bhanja gave a presentation on **“Bihar Kosi Flood 2008 and Its Impact on Children”**. He detailed out the interventions made by EFFICOR in the aftermath of Kosi Floods in Bihar which included four major tasks. Primarily community mobilization and capacity building, focusing on child’s right and safety was done by providing informed choices on rights of flood victims to access government compensation and more so the restoration of services for women and children. Secondly, children were mobilized and life skill education was imparted to them so that they could manage the disasters through skill, knowledge and attitude building. Thirdly, child resource package consisting of educational material such as books, bag, stationeries and school uniform were provided with motivational campaign to retain their education and avoid dropping out. Finally, liaising with ICDS centers for appropriate function and support to children who are enlisted in the centre was taken up. EFICOR also provided nutrition packages for extremely poor families who were left out from the purview of ICDS. Mr. Sanjeev Bhanja ended his presentation by stating that the project worked towards sensitizing family members on Child rights as per UN Child Rights convention 1989 and DRR strategies were integrated to mainstream development processes by imparting knowledge to the community and developing institutions for building resilient towards hazards.



The deliberations in the thematic session hovered around various aspects including weaving of family needs with childrens’ needs, contextualising of standards of child centric disaster risk reduction, need for inculcating gender sensitivity in all interventions related to children, building of capacity at varied levels, importance of coining the word “child led initiative”, documentation & dissemination of good practices, creation of safe places for children in disasters, need to stop child trafficking etc.

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Recommendations

- ◆ There was a need for working on partnerships for strategizing protection of children during disasters by disseminating successful efforts and practicing handholding at different phases of experience.
- ◆ The set up of family needs to be weaved into all programs reaching out to children in disaster.
- ◆ Disaster response and risk reduction need to be child-centered and driven by the rights approach.

- ◆ Gender sensitivity in all interventions need to be audited.
- ◆ Capacity should be built at all levels of involvement be it children, adults in the community, official machinery or the social organizations.
- ◆ Adequate participation of children should be ensured.
- ◆ An environment of readiness to learn from experiences generated globally and the implementation with local flavour should be developed.
- ◆ Exit policy of assistance to be worked upon and shared in a conscious manner.
- ◆ Framework for sustainable development to be built into all projects at the inception stage itself.
- ◆ Minimum standards of care and protection needs to be adhered to. An indigenous framework in this regard needs to be worked upon with the guidance from prevailing international instruments.
- ◆ There should be effective coordination between outsiders and insiders - the dichotomy should be bridged amicably.
- ◆ Early interventions in trauma management can be tailored with involvement of non-mental health professionals too.
- ◆ Participation of children in adult bodies should be ensured.
- ◆ Since the issues of children are invariably interlaced with those of women, the operational hours of all the services for children in disaster should be women sensitive.
- ◆ The usage of the term “child led initiative” needs to be re coined so as to display the field level reality where children are facilitated by concerned adults to do so.
- ◆ Success stories/models of Public-Private-Partnership equipping the system to address the issue of children in times of disaster need to be disseminated /framed.
- ◆ Best practices/innovations could be documented to generate further ideas on reaching out to children in difficult circumstances.
- ◆ Efforts need to be specially tailored to augment foster care in the light of the shifting emphasis from institutionalization to non-institutionalization.
- ◆ Body of knowledge and practice needs to be developed to handle children in conflict situations.

Mainstreaming DRR & Financing Disaster Management

Concept Note

Disaster is an issue for development. When disaster strikes it creates severe impact on the development process. People get deprived of the outcomes of development. People lose their lives and livelihood and get marginalized in the whole process of development. Poor and marginalised sections of the people are further pushed to traumatic, voicelessness and high poverty situation. The depth of poverty further gets deepened. Development, then become meaningless for whom development is intended for. Over the years it has been observed that natural as well as human induced disasters create tremendous impacts on the development process. Annual global economic losses associated with such disasters averaged US\$ 75.5 billion in the 1960s, US\$ 138.4 billion in the 1970s, US\$ 213.9 billion in the 1980s and US\$ 659.9 billion in the 1990s (UNDP Report, 2008) Disasters triggered by natural hazards put development gains at risk. At the same time, the development choices made by individuals, communities and nations can pave the way for unequal distributions of disaster risk.

Today, 85 percent of the Global population exposed to earthquakes, tropical cyclones, floods and droughts live in countries having either medium or low human development. Natural disaster is intimately connected to the processes of human development. Natural disasters exert an enormous toll on development and doing so, they pose a significant threat to prospects for achieving the Millennium Development Goals in particular, the overarching target of halving extreme poverty by 2015.

The rush for growth can trigger haphazard development that increases risks of large-scale fatalities during a disaster. The Destruction of infrastructure, erosion of livelihoods, damage to the integrity of ecosystems and architectural heritage, injury, illness and death are direct outcomes of disaster. And, such disaster losses may set back social investments aiming to ameliorate poverty and hunger, provide access to education, health services, safe housing, drinking water and sanitation. to protect the environment as well as economic investments.

Context

Until the 1970s a dominant view prevailed that natural disasters were synonymous with natural events such as earthquakes, volcanic eruptions and cyclones.. From the 1970s onwards, technical professionals, such as engineers and architects, began to focus on the fact that the same natural hazard had a varying impact on different kinds of structures,

such as buildings. The characteristics of a disaster became more associated with its physical impact than with the natural hazard. Interest grew in the design and implementation of ways to mitigate losses through physical and structural measures to reduce hazards (for example, through building levees and flood defences) or to increase the resistance of structures. Unfortunately, the cost of physical mitigation meant that in many countries efforts to reduce risks by these means have been minimal.

In the 1980s and 1990s, researchers from the social sciences and humanities have argued that the impact of a natural hazard depends not only on the physical resistance of a structure, but on the capacity of people to absorb the impact and recover from loss or damage. The focus of attention moved to social and economic vulnerability, with mounting evidence that natural hazards had widely varying impacts on different social groups and on different countries. The causal factors of disaster thus shifted from natural events towards development processes that generated different levels of vulnerability.

By the end of the 1990s, it was clear that development processes were not only generating different patterns of vulnerability, but were also altering and magnifying patterns of hazard — an argument that has gained increasing currency as evidence mounts regarding the impact of global climate change. Risk management and reduction has been advanced as an integral paradigm that builds on and incorporates all the previous strategies from the perspective that all development activities have the potential to increase or reduce risks.

Not much literature is available showing relationship of development and various facets of disasters. Now the time has come to collate our learning over the years and contribute with more research, documentation and literature as a regular feature of disaster development planning. The positivity and negativity of development planning then may be appreciated in the context of development per se, disaster and climate change related issues in particular. This would enable development practitioners to integrate their thinking and make development much safe and sustainable.

Proceedings on Mainstreaming DRR

The session was chaired by Dr. P. K. Mishra, Chairman, Gujarat Electricity Regulatory Commission, Ahmadabad. Key Note Address was given by Dr. Sanjeeva Mishra, Member, 13th Finance Commission, Govt. of India.

Development is not simply growth but it also results something more i.e quality of life of the people and that too with the security and safety. In order to understand that how safety and security could be the integral plan of development initiatives a session was dedicated in the congress to invite different ideas from practicenors, academia



and planners. The session was combined with the session on financing disaster management in the country.

Maitreyee Chatterjee presented a talk on **“Reduction of Poverty- An Important key to Mitigation”** stated that poor people have less flexibility in protecting their livelihoods and homes against disaster due to lack of financial and material resources. Poverty forces people to live in risk-prone areas, thus increasing their vulnerability. When disaster strikes, assets bought with loans (for example, a cow) may get instantly destroyed. This makes the poor more poor. Poverty in its multiple dimensions has a strong influence on people’s vulnerability to disaster, and vice versa. Finally, identifying the problems and thereby reducing the vulnerability of poor can become a key mitigation measure reducing potential losses from future disasters.

Dr. Pavan Kumar Singh & Dr. S. K. Jena presented a talk on **“Mainstreaming Disaster Management into developmental Efforts”**. It was mentioned that disasters disrupt progress and destroy the hard-earned fruits of painstaking developmental efforts, often taking nations decades backward in their quest for progress. At the national level, India has put into action a paradigm shift, from the erstwhile relief-centric syndrome to a proactive prevention, mitigation and preparedness-driven approach to Disaster Management. The mainstreaming of DM concerns into the overall developmental effort. This essentially means looking critically at each developmental activity from the perspective of reducing disaster vulnerability in its plan as well as implementation.

Dr. Narottam Sahoo & Dr. Bindu Nair presented a talk on **“Learning to live with disaster”** and stated that nature is always changing and moving. Human beings are a part of the nature and our quality of life depends on all the living things that share this planet with us. There is a need to take care of the mother nature, because the human well being is directly related with it. Earthquake, floods, fires, volcanic eruptions, tropical storms, tornadoes, landslides, droughts, plagues and other phenomenon such as El-Nino and La-Nina are a part of nature, just like the sun and the rain. The natural phenomena cannot be stopped from happening, but efforts can made to make them less damaging, if we understand better why they happen and what can be done to prevent or mitigate them. There is a greater role for the younger generation in understanding about various natural catastrophes and to orient the family and the community to meet the challenge of the situation.

Syedun Nisa presented a talk on **“Disaster Management: Key Concerns and Prevention Measures”**. This paper aims at discussing some of the pressing key concerns in India related to disaster occurrence & management. It also discusses useful prevention measures that may help in overcoming the disaster. The paper briefly outlines the Indian experience of disasters, discusses



infrastructural, institutional and financial arrangements available for disaster management and the response towards these in the country. The paper concludes by suggesting some strategic measures to be taken after the occurrence of disaster in order to formulate safer environment for the country.

Mr. Bijan Yavar & Mr. Maisam Mirtaheri presented a talk on **“Lessons Learnt from Chabaha Free Trade and Industrial Zone Disaster Management Master Plan as a Sustainable Development Framework”**. He mentioned that experience obtained through different disasters reveals that sustainability and especially sustainable development needs a safe and secured environment through which the activities can flourish. This environment will be more important when economical, commercial and trading action and activities should take part in that. The activities undertaken in the Chabaha Free Industrial Zone (CFZO) for Disaster Management and Master plan and programs was discussed with facts and key lessons learnt.

Dr. Sanjay Srivastava, Mr. Vinod Shakya and Mr. Ranjan Kumar jointly submitted the paper which was presented by Mr. Ranjan Kumar on **“Is Indigenous Knowledge enough to live with floods: An Assessment in Indo-Nepal Flood Plains”**. The diverse communities in perennially hazard zones Indo-Nepal floodplains, since centuries, have learnt to live, cope with and reduce their disaster risks through the inherited indigenous knowledge. Originated within communities - based on local needs and specific to the locale culture and context, this vast knowledge resource has withstood the test of time. It is important to recognize the value of indigenous knowledge and create the enabling mechanisms wherein this could be integrated better in disaster risk reduction. The paper also examines a variety of applications emanating from the case studies drawn from perennially flood-prone regions of Indo-Nepal boarder. The knowledge that is generated integration of indigenous and explicit knowledge forms the value chains for the community at risk.

Prof. Utpal Sharma and Prof. Madhu presented a talk on **“Disaster as opportunity for Development: Social Impact Assessment of Gujarat Emergency Eq Reconstruction”**. It was mentioned that the Gujarat Earthquake Emergency Programme (GEERP) was launched with the State Government funding as well as assistance from Government of India, various Multilateral Funding Agencies like ADB, World Bank and others. The paper is an outcome of study carried for assessing the implementation, processes and social impacts of GEERP program on different stakeholders, covering both positive and negative impacts. Situational analysis of towns to form the basic premise to begin the Social Impact Assessment Study has been carried out in the paper.

Shakti Kumar presented a talk on **“Empowering Panchayati Raj Institutions for Disaster Risk Reduction”**. As per Disaster Management Act-2005, a local authority shall ensure that its officers and employees are trained for disaster management. The local authority may take such other measures as may be necessary for the disaster management. Panchayat Samities are to focus on planning, implementation, coordination and monitoring. Gram Panchayats have to play a leading role in execution of disaster prevention, mitigation, response, rehabilitation and developmental activities with the participation of local

people. There is a capacity gap between different levels of institutions. This paper elaborate that what are these capacity gaps and how Panchayati Raj Institutions would be capacitated in the areas of disaster prevention, preparedness, mitigation, resource mobilization, rescue, relief, restoration, rehabilitation, reconstruction and development.

Nisheeth Kumar presented a talk on **“Mainstreaming DRR in Development in India: Incentives, Instruments and Measures”**. This paper deals with some basic questions such as what constitutes mainstreaming DRR in development, how it works and with what results, how can the results be measured etc. The paper further examines the nature and efficacy of instruments of mainstreaming DRR in development in India. This is done in terms of, (a) the incentives for mainstreaming, i.e. who wants to mainstream and with what interests, (b) choice of the instrument/s of mainstreaming and factors determining that choice, (c) the efficacy of the instrument used in terms of enabling disaster resilient development from a long term perspective. The core contention of the paper is that integration of disaster risk (both micro and macro) reduction elements in mainstream development initiatives calls for major policy and institutional shifts, accompanied with need based capacity development interventions at various levels. This is a challenge that is worth taking in order to make the rhetoric of disaster resilient development a reality.

Dr. Sunita Reddy presented a talk on **“Disaster and development: An anthropological enquiry from policy to Practice”**. The focus on disaster is more of physical and geographical compared to socio-economic and political. The term ‘disaster’ is often misused in common parlance and in academic discourse it has undergone a number of reformulations. The recent definitions are more social oriented definitions, clearly and fortunately replaced the very early referents in almost solely physical terms. Disasters are undoubtedly social phenomenon yet,



anthropology had not explored much in to this area though it can contribute immensely to the disaster discourse due to its inherent multi-dimensional and methodological rigor.

V. Thirupugazh presented a talk on **“Mainstreaming DRR: Reconstruction to Development – A case study of Gujarat”**. It was stated that post-disaster situations are said to open a window of opportunity not only for building a better and long-term disaster risk reduction. Reconstruction undertaken in the aftermath of catastrophic disasters aims at vulnerability reduction of the built environment through hazard resistant construction. This presentation highlights how the post-disaster reconstruction opportunity was effectively used in Gujarat to mainstream some of the risk reduction initiatives. It was argued that based on Gujarat experience, a realistic understanding of the limits to mainstreaming is essentially required to prioritize the interventions.

Recommendations

- ◆ Development programme impact/schemes should be revisited so as to examine minimize its potential to disaster risk/vulnerability.
- ◆ Development plan of a ministry/department should incorporate elements of disaster risk impact assessment and risk reduction.
- ◆ There is a need to have research / case studies on how a disaster creates differential impact on the people and their livelihood depending on development choice in different disaster type situations.
- ◆ There is a need to develop indicators for resilient development which can give clear picture of safe development at policy levels as well as indicators at the community level, different economic tools for understanding the cost benefit of the mainstreaming DRR projects and also provide support to the research and development institution engaged in the sector.
- ◆ Poverty reduction is the key and should be the central theme for reducing vulnerability of the poor people from various disasters. Hence, the entire poverty alleviation programme should have special focus on DRR issues indicating how the assistance given to them is actually helping in risk reduction also. Govt. Schemes such as NERGA/JNURM/IAY may be revisited from this perspective as risk auditing of the project.
- ◆ Traditional knowledge has helped in building the community resilience and enhancing their coping mechanisms. It is important to recognize the value of indigenous knowledge and create enabling mechanisms wherein this could be integrated in disaster risk reduction measures especially at the community level.
- ◆ The traditional knowledge needs to be effectively synergized with the scientific knowledge and disseminated in the form and manner that a community acts upon with the greater sense of empowerment especially in the context of disaster risk reduction.
- ◆ Strengthening of the Panchayati Raj Institutions capacity for better disaster risk reduction.
- ◆ The research – practice interface is important. The focus so far is on, emergency and relief, the most neglected phase ‘rehabilitation’ calls for ethnographic, longitudinal research to understand the process and interface of disaster and development.
- ◆ A realistic understanding of the limits to mainstreaming is essential to prioritize the interventions.
- ◆ There is a need for the creation of ex-ante funding for disaster risk reduction at all the levels from community to the national levels.
- ◆ The ex-post funding is largely available in the form of CRF/ NCCF for relief. There is need to have a mechanism for disaster recovery and reconstruction fund. This will reduce the dependency on multi-lateral support.
- ◆ Insurance market can be utilized for risk transfer mechanisms and insurers should be encouraged to come with more products which are affordable and suitable for the people who are exposed to various risks.
- ◆ Micro finance and micro insurance can help reducing vulnerability of the poor. Institutional support and flexible norms should be developed for these institutions in the hazard prone areas.

Proceedings on Financing Disaster Management

Pavan Kumar Singh & Nawal Prakash presented a talk on **“Financial arrangements for Disaster Management”**. It was stated that the economy of India is the third largest in the world as measured by purchasing power parity (PPP). When measured in USD exchange-rate terms, it is the twelfth largest in the world. After independence, India opted for a centrally planned economy model to achieve an effective and equitable allocation of national resources and balanced economic development. The process of formulation and direction of the Five-Year Plans is carried out by the Planning Commission, headed by the Prime Minister of India as



its chairperson. This paper examines various available funding mechanisms for disaster risk reduction and also funding post disaster reconstruction and recovery plans.

Rupalee Ruchismita, Javed Hazarika and Mangesh Patankar presented a talk on **“Financing Disaster Management in India: Possible Innovations”**. It was mentioned that various types of catastrophes which are prevalent in India, particularly focusing on nature of the risk, risk specific financing mechanisms etc. experiences about financial risk management solutions from other nations. It was also discussed that the Scope for risk specific replication of financial measures of disaster risk management and its viability both ex-ante (Insurance, Reinsurance, Capital markets, Government relief, International funds and other measures) and ex-post. (Detailed risk specific analysis of possible mechanisms like mobilization of relief funds , CRF, NCCF, Loan, Grants etc

Bibhuti Mahapatra in her talk on **“Disaster Management and Commercial”** stated that banks, Commercial banks, touching lives of billions of people worldwide need to maintain their services 24 X 7, so that the world doesn't come to a halt because of some disaster or the other. This has been emphasized he more by acts of terrorism, outbreaks of pandemics, and various widespread natural disasters. In 2004, the Financial Stability Forum and the Bank of England co-hosted a symposium on business continuity issues. A formal working group of the Joint Forum constituted after the symposium developed a set of high-level principles for business continuity, which could apply across the financial system globally. The current paper examines the importance of banking in post disaster funding with special focus on business continuity plan and financial sector demand.

Dr. George E Thomas presented a talk on **“Insurance Mechanism and the Funding of Post-Disaster Relief”** and mentioned that disaster management involves a multi-pronged approach. It was stated that ex-post approaches include mitigation, response, relief, rehabilitation and the expenditure on all these activities, and ex-ante measures include disaster prevention, planning and preparedness for facing and mitigating the consequences of disas-

ter and more than anything else, providing for the funds for meeting the costs of rolling the conditions back to normal and all related activities. Insurance contracts can cover a large section of physical losses like costs of repairing or reconstructing buildings, repairing or replacing contents thereof, repairing or replacing damaged or lost property/ vehicles/ personal belongings etc. Insurance contracts can also provide agreed compensations towards loss of life, loss of wages to workmen, operating losses of factories, loss of crop; as well as reimburse accident related medical costs.

Sanjay Srivastava submitted a paper on “**Funding Drought Risk in developing Countries: A Perspective Based on the Use of Products and Services from earth Observation Satellites**” the paper was presented by Mr. Ranjan Kumar. It was mentioned that Agricultural insurance, aims at insuring farmers against production and price risks, which is a new paradigm. The scheme envisages seeing the government giving a premium subsidy and guaranteeing farmers a minimum income to reduce their vulnerability. The key advantage of this kind of insurance is that payouts are based on the occurrence of a weather event, rather than on actual crop losses. Success of crop insurance initiatives of insurance companies/banks lies in strong and dynamic ‘Areas Specific’ crop and weather statistics, for which awareness needs to be built upon.

Recommendations

- ◆ Insurance should be popularized as a disaster funding as disaster risk transfer mechanism, starting with select zones.
- ◆ Insurers should primarily focus on products covering- lives, houses, crop, cattle and debt etc. due to death of the bread-winner.
- ◆ Simple products covering these risks at affordable prices should be designed on long-term basis, preferably, for terms of 10 years or more.
- ◆ The immediate objective should be to provide basic relief than comprehensive coverage.
- ◆ Products should be simple to administer at minimal management costs and provide for fast-track claim settlements in times of disaster.
- ◆ People who can afford insurance should get the product they need at reasonable prices. For people who cannot afford to pay the premium for an initial ten-year period may be funded/ subsidized by the government.
- ◆ Houses reconstructed with governmental/ humanitarian aid/ bank loans should be mandatorily insured.
- ◆ The approach may be modeled on the lines of the Universal Health Insurance Scheme designed for people in the lower income brackets and subsidized by the Government in respect of families below the poverty line.
- ◆ As disaster related products would be of a non-commercial nature in the initial years, the Government may think of giving appropriate incentives to the insurers for popularizing insurance products and increasing insurance penetration.

Involving Communities, Civil Society and NGOs in Disaster Management

Concept Note

A session on “Involving Communities, Civil Society, and NGOs in Disaster Management” during the second IDMC to lead discussions on disaster, development, and governance issues is planned to be held with a panel of 14 individuals from NGOs, universities, and training institutions and research organizations. The topic is at the center of civil society organization’s work in India with vulnerable communities and government institutions, including UN and international organizations. Experiences from past disasters have revealed the importance of involving local communities and civil society organizations for effective knowledge management and use of India’s DRR resources to prepare generation next. A similar thematic session on “Disaster Management and Role of NGOs” during the First IDMC, held during the November 29-30, 2009. Under this thematic session, more than 21 papers were prepared, presented, and analyzed with concrete recommendations to support the national disaster management framework, and implementation of the 2005 Disaster Management Act and the Hyogo Framework for Action 2005-2015.

Context

The First India Disaster Management Congress (IDMC), hosted by the National Institute of Disaster Management from November 29-30, 2006 in New Delhi, is a major step in recognition that disasters pose a serious challenge to human security in India”¹. In the last several years there have been significant developments related to national commitments for DRR, including development of National Disaster Management Framework, the enforcement of the Disaster Management Act in 2005, establishment of National Authority for Disaster Management (NDMA) and State level authorities, and a range of DRR research, networking, and capacity development initiatives by the National Institute of Disaster Management (NIDM) and United Nations supporting the Hyogo Framework for Action 2005-2015. Similarly, a wide range of CSO initiatives have led local DRR actions and concrete knowledge building initiatives, including recovery support to disaster hit communities in different parts of India. While these important strides are being made on DRR policies and actions in India, it is important that the wider civil society organizations and vulnerable communities are involved in these processes.

Proceedings

Mr. Mihir R. Bhatt, All India Disaster Mitigation Institute (AIDMI), Ahmedabad chaired the session.

Zenaida Delica-Willison, UNDP in her opening keynote address traced the history of UN system and the governments recognizing the importance of decentralization of activities and highlighted the importance of linking disaster to development and ownership. She mentioned that in early and mid90's very few organizations were sharing their CBDRR experiences in events such as this and very less money was allocated to civil society



organizations to mobilize community support for risk reduction. In last decade or so, the entire approach for reducing risk has been changed. Even national governments and UN systems are now shaping and implementing one of the largest community based risk reduction projects across the globe. She mentioned that we need to try much harder to increase community ownership is risk reduction initiatives. The involvement of community in her view is very crucial and critical for transpiring vulnerable communities into resilient communities. She highlighted the importance of South-South linkages for effective risk reduction in the poor and vulnerable countries of Asia.



Dr. Arul Aram, Anna University in his presentation on **“Stakeholder participation in managing coastal disaster”** highlighted the importance of cyclone early warning devices by the community of fishermen and advocated community participation through NGOs. The influences of NGOs in disaster management is multi-fold and there are other government agencies like the Coast Guard and the Fire Service that are running disaster management programmes with ample support of the NGOs. He was of the view that more nation-wide research studies should be initiated to identify most effective technologies and appropriate disaster risk communication approaches.

Dr. Surya Prakash, NIDM in his presentation on **“People’s methodology for community based disaster risk management- An experience from Uttarakhand”**, advocated the community based multi-hazard vulnerability assessment for integrated risk management in

Uttarakhand. An attempt was made to translate research concepts like risks, vulnerability and capacity to local terms. Community was encouraged to be involved in the risk analysis followed by preparing them to be involved in preventive and mitigation analysis. It was mentioned that community to community learning approaches could be developed for enhancing community level learning. It was also informed that the outcome of such an endeavour in



Rudraprayad of Uttarakhand was extremely successful but there is a problem of attaining sustainability in such efforts, a point which needs to be carefully looked into.

Mr. Vishal Pathak, AIDMI in his presentation on **“School based disaster risk reduction: lessons from Child’s right to safer school campaign”**, highlighted that the unsafe schools are particularly vulnerable to fire, floods, earthquakes, cyclone, pollution, food poisoning, stampede, etc. It is an unfortunate reality that not enough has been done to mitigate risk faced by the children at school. A recent school safety audit revealed that school safety is not a high priority for either public or corporate officials. It was stressed that the participation of children in Disaster Risk Reduction activities is very important. Schools can work with the local communities in a partnership module and more emphasis on practical training should be given for school safety. He also highlighted that teachers have a high level of interest in school safety but there is a lack platform to address the issue. Therefore, it was recommended that inter-financial institutions, ISDR, government, insurance companies and civil society organizations should be involved in school safety.

Ms. Jesu Rethinam, SNEHA in her presentation on **“Involvement of community, NGOs and civil society in Disaster Management”**, stated that SNEHA, an NGO has suffered loss of members, workers and income and development gains that were made over years, due to Tsunami. SNEHA’s recovery programme is one of the most important women lead tsunami recovery in South India, and it is an example of the recovery made by a local and a victim organization reaching out to a large number of its members through relief and recovery project and as well as advocacy activities to access relief, rehabilitation and recovery resources from the state and other donors in favour of women and excluded groups. It was informed that SNEHA is now in the process of taking the existing achievements forward through deepening, spreading and multiplying the outputs and outcomes and that SNEHA’s experiences of working with the fisher women are unique and must be captured and disseminated to share lessons on community resilience.

Ms. Rakhi Bhavnani, AIDMI in her presentation on **“Findings from 2009 regional disaster micro-insurance evaluation: Overview”**, highlighted that globally there has been a general reference to the benefit of micro-insurance for reducing disaster impact for

the poor, however, the real impact of such schemes and its complexities at the implementation level has remained largely unstudied in a rigorous and quantitative fashion. In order to bridge this gap, ProVention consortium, funded a study to examine the impact of disaster micro-insurance in the South Asia region. She mentioned that the findings of the study are relevant to the most developing countries of Asia and Africa and those with interest in promoting risk transfer mechanisms can join AIDMI in this endeavor.

Mr. S. K. Singh, CIRDAP in his presentation on **“Community based disaster management- the case of Bangladesh”** stated that centralized system of disaster management is defective and sustainability can be ensured only if disaster management is decentralized. It was informed that in Bangladesh, people volunteer to work in disaster preparedness programme. Institutional mechanism in Bangladesh is from village to the central level. Each village preparedness plan for vulnerability reduction included local level wisdom and indigenous knowledge. As a result the disaster preparedness has brought down the casualty in Bangladesh to a considerable extent. The paper briefly deals with the approaches and modus operandi of Bangladesh cyclone preparedness program. It is a unique, remarkable and successful experiment in the sub-continent.

Mr. Colin Fernandes, ActionAid in his presentation on **“Community based disaster risk reduction in Myanmar- A fellowship approach”**, reviewed the experience of Action Aid Myanmar’s disaster risk reduction work with communities affected by cyclone Nargis in May 2008. He demonstrated the effective implementation of the community based disaster preparedness intervention through fellowship program. Through this approach, the fellows have been able to catalyze analysis and action planning by communities which has led to volunteerism from communities. The approach takes seriously people’s agency and actively avoids intervention which can create passivity and dependency. The approach has been able to demonstrate that an intensive engagement with communities and at a suitable pace results in sustainability of the program.

Col. N.M. Verma, Saritsa Foundation in his presentation on **“People’s partnership power to respond to disaster- A mobile campaign by saritsa foundation across 12 states of India from Kanyakumari Tamilnadu to Twang, Arunachal Pradesh- A case study”**, said that a review of the ongoing process of disaster management are not encouraging as was expected and projected at various levels. Disaster management at various levels has to be more thoughtful, sensitive and sensible. Global Network of Civil Society Organizations for Disaster Reduction in its report presents a clear picture of progress at local level for disaster risk reduction. In its core recommendation the survey finds gaps in state policies and guidelines at lowest levels. Saritsa foundation has been a partner in this



survey and has recognized these concerns in the states of Meghalaya, Maharashtra, Assam and Madhya Pradesh.

Mr. K. Arup Kumar Patro, Focus Humanitarian Assistance in his presentation on **“Andhra Pradesh relief to development program initiative of community preparedness for emergencies response”**, informed about the Andhra Pradesh post Tsunami relief to development program implemented by Agha Khan Development Foundation. A total of 14,784 persons are being addressed to enhance the state disaster resilience and preparedness among coastal communities affected by the Tsunami. The objectives of the programme are- strengthening the capacity of the community, reducing vulnerability, establishing linkage with stake holders and enhanced gender equality.

Ms. Annie George, Building and Enabling Disaster Resilience of Coastal Communities in her presentation on **“Building local capacity for disaster response and vulnerability reduction- A study on community resilience”**, talked about the idea mooted by OXFAM America for doing a study on ‘Building local capacities’. As a study it was a perfect solution as it tried to understand the approaches that capacitated the local leadership without trying to point fingers on the rightness or wrongness of approaches or organizations. This study has been instrumental in bringing to light the inherent survival instinct and coping mechanism that prevail in such vulnerable communities, which needs to be identified and strengthened rather than eroded.



Recommendations

- ◆ There should be continuity in organizing of such session and congress like IDMC. In fact, there should be Third IDMC and in CSO session in the next congress, there should be an effort to invite community members to share, debate, and learn the disaster related issues with each other and CSOs.
- ◆ Government and businesses from India should increase stakes in the NGO partnership, especially community based disaster risk reduction initiatives, by investing more resources.
- ◆ The mechanism of CBDRR does not include only the use of participatory tools and the session witnessed to the paradigm shift in the approach of CBDRR to include critically important sectors and issues such as micro-insurance and governance.
- ◆ CBDRR is a good and wise investment and this fact needs to be effectively communicated to the governments at all levels, especially at local level. So that CSOs can work with and for local governments to promote DRR.
- ◆ We must also think of innovative approaches and processes that can help strengthen the South-South cooperation for disaster risk reduction and sharing valuable community resilience experiences by and with CSOs. India can lead this process.
- ◆ There is an urgent need for shaping some concrete activities between the 2nd and 3rd Disaster Management Congress so that the momentum is not lost and sharing experiences through networking becomes a more systematic process.
- ◆ In order to strengthen South-South links, Community to Community learning initiatives such as Local Development Academy should be supported and sustained for renewing our knowledge on community resilience.

Education, Training and Capacity Building for Disaster Management

Concept Note

Capacities of the community and government to understand the risk causes, prevention, mitigation and emergency response helps by reducing vulnerability and occurrence of hazards or containing them from realisation as disasters. Disasters impact on life, property and environment, on a scale that threatens short-term and long-term sustainability of life support system, resources, livelihood and overall well-being, is of direct concern in disaster management. Impacts may be in form of direct damages or indirect or intangible or chain-in secondary or tertiary effects or losses.

Disaster risk management is broad subject rooted in environmental systems, community action, and wisdom tools and is management centric, whereas emergency response mainly stems with well-tested command system and is operation centric. Capacity to manage disaster risks and emergencies require knowledge, skills, resources, motivation and attitude at different levels. It includes training, education, guidelines and legislation, policy support for actions, and systemic accountability. Legislative framework on disaster management in India emerged with focus on industrial and chemical disasters, primarily with Environmental Protection Act 1986 and Rules therein and later evolved a holistic disaster framework on multi-hazard vulnerability with High Power Committee report, UN-Disaster Risk Management project and Disaster Management Act 2005.

DM Rules and DM Policy are yet to take up emergence. Besides these, various strategic initiatives, for example, policy statement of conservation; abatement of pollution; notifications on Dhanu, Coastal regulation zone, Doon-valley, Environmental Impact Assessment, public hearing, site clearance; national strategy on climate-change; agriculture policy, water policy, land-use guidelines/policy, national environment policy, forest policy, etc. give ways to interventions for hazard and vulnerability reduction for disaster management aimed at sustainable development. Programmes like National Natural Resource Data Management Systems, River Conservation Directorate, Land-use Boards, Waste-land Development, Rain-fed Area Authority, Drought Prone Area Programme, Wetland Conservation, Climate-change Adaptation, Livelihood Diversification and Agro-forestry, JN Urban Renewal Mission, etc.

Context

Parallel to the Crisis groups at national, state and district level (as under Emergency Planning, Prepared and Response Rules, 1996) now the framework on disaster management is

being installed. Major lacunae is to quote, environmental management has no organized framework of authority despite of well realized need. DM framework provides opportunity for integration of various facets of sustainable development that help delineate the capacities for disaster risk management and emergency response. Need of capacity assessment, resource mobilization, training, education and information, is therefore, core agenda for in-making paradigm on disaster management. Higher education and research/innovation capacities are the basic requirements for evolution of discipline from theories to practical solutions, development of professional expertise, trained professionals, and soundness in decisions and actions. Organizations and re-organisation of systems, framework, tools, mandate, accountability and authorities at various levels also form part in the capacity building for the sustainability of efforts.

Proceedings

Dr. Vinod K. Sharma, Indian Institute of Public Administration and Dr. Pradeep Sahni, Indira Gandhi National Open University, New Delhi, Chaired the session.

Prof. Pradeep Sahni while delivering the opening address focussed on the ‘Interdisciplinary’ nature of disaster management as a discipline of studies and practice. It was mentioned that the subject of ‘disaster management’ has grown significantly from field experiences and practice to academic advances and training. Undoubtedly, the impact of Agenda-21 adapted at UN Conference at Rio, World Summit on Sustainable Development (Rio+10), Hyogo Framework of Action (HFA), and the national brainstorming under the aegis of tasks of High-Power Committee on Disaster Management constituted by Government of India, and the enlightened policy skeleton provided by various environmental laws – on environment, conservation,



wastes, water, land-use, agriculture, especially their economic and social aspects in planning for regional and sustainable development have brought in a broad framework of disaster risk management and response. Disaster Management is multidisciplinary subject and capacity building of various stakeholders has been a key challenge in strengthening the risk reduction and emergency response related actions at various levels, now also envisaged under the Disaster Management Act of 2005 and various national guidelines or plans related to a disaster management. The demand is huge and the resources scanty with poor network. Need of human resource capacities - education and training can not be met fully by classroom and full-time courses, be short-term or long-term – formal or non-formal programmes. Continuing, distance and online education programmes offer great support in this line to help fill the gap in this demand and supply. IGNOU started a certificate programme now success-

fully upgraded to a Diploma course on Disaster Management. There are various other institutions and Universities that now offer courses on disaster management and environment. Disaster management seeks broader range of inputs be it ‘Disaster Science’ – Disasterology as a discipline of environmental science, or ‘Disasteronomics’ – a discipline of economics, or administration, geography or sociology, it has to be promoted and motivated for developing strong capacities of hazard and vulnerability reduction for achieving the broader aims of sustainable development.

Prof. V. K. Sharma, IIPA highlighted the journey of disaster management training and capacity building in India, in the light of international development and national experiences. Addressing matters of disaster management challenges and opportunities through education, training and capacity building in a forum of eminence is a matter of significant but a great challenge as well. It was concern of agriculture, broadly to say – natural resources and human environment that gave ways to realise and acknowledge the concept of sustainable development, of which the ‘disaster management’ is an implicit requirement. Journey started in Stockholm and through various stages of UN Conferences resulting in national and regional initiatives, joined the pace of addressing the human-made challenge of climate-



change impacts which is now known to cause more or aggravate the hazards and vulnerabilities leading to more catastrophic disasters. High Power Committee in India suggested a framework of action that resulted in Disaster Management Act, creation of institutions like National Institute of Disaster Management and Authorities on Disaster Management at National, State and District levels. Enhancing the knowledge and sharpening the skills in an environment of right attitudes and motivations – requires great investments in education, training and awareness. National Centre for Disaster Management, established by Ministry of Agriculture, was upgraded as National Institute to function under Ministry of Home Affairs, with now a Central Sector Scheme of Disaster Management Centres located in various States and UTs, some of them in Administrative Training Institutes, Universities, etc. ‘Disaster Management’ has been a module in environmental science curriculum in various Universities Masters and Graduate courses and need to be strengthened with greater emphasis on practical, planning and implementation oriented interventions along enhancing knowledge on science and management of various natural and man-made disasters. Documentation of indigenous knowledge and course contents based on live experiences shall be more effective. Governance of various natural resources and environment has direct impact on hazards and disasters, and thus need to be understood while delineating disaster risk management and emergency strategies. Prof. Sharma pointed out that a national consortium

may be established either by National Disaster Management Authority or by Ministry of Environment to involve interdisciplinary environmental experts working on various aspects of disaster management – risk assessment, remediation, early warning, modelling, environmental economics and eco-sociology, environmental epidemiology, earth scientists, biologists, ecologists, agronomists, to regularly share their knowledge and experiences that will be a significant contribution to various policies and planning at different levels.

“School Disaster Management: Lessons from Community-Wide Drills” paper was presented by Dr. Marla Petal, Risk-Red, Geneva. In California, annual community-wide “ShakeOut” earthquake drills are attracting involvement of thousands of schools and millions of children. This opportunity to think about risk reduction, and practice response skills is a significant long-term method for sustaining and improving preparedness. Risk RED, Western Washington University Resilience Center, and the Coalition for Global School Safety and Disaster Prevention Education teamed up with Earthquake Country Alliance in California to study school readiness and resilience, and the impacts of these annual drills. The results of literature review of 75 years of school disaster management advocacy, and surveys of readiness and resilience indicated that while California has come a long way in terms of school structural safety, non-structural mitigation, and response preparedness training, there are still significant challenges ahead. Tangible progress in safety comes about a result of the willingness of school communities to address disaster risk reduction through ongoing assessment and planning, structural and non-structural safety measures, and response capacity development. Parent education is also the key. Good practices in school disaster management emphasize a strong grasp of response functionality and flexibility. Community-wide drills are important in stimulating awareness, reflection, and problem-solving, as well as for rehearsal.

Mr. Mehboob Ali Ajani, FOCUS Team, Mumdar presented a paper on **“Multi-hazard Risk Model: Innovative Tool for Assessing the Degree of Risk within School based DRR”**. The Multi Hazard Risk Model and its Application in School Safety, based on an algorithmic model that identifies and numerically represents the level of threat through a quantified risk score referred to as the “Risk Index” was discussed. A procedure of hazard identification and the criteria of selection of indicators have been delineated within the project design. Indicators included hazard indicators, vulnerability indicators and coping capacity indicators. Local geology and environmental settings, industrial and developmental profile of the region Digital elevation models that help generate the scenarios for planning and exercising preparedness. The project covered 254 schools wherein 25 were identified as most vulnerable. The model enables the risk assessment and risk management planning system for school environments, so as to create the appropriate kind of preparedness, planning and exercise based preparedness.

“Networking Higher Education Institutions for Climate and Ecosystem Change” paper by Mr. Srikantha Herath, United Nations University, Japan, focussed on the recent initiative of coordinated approach of environmental research and education to address capacity building needs of climate change mitigation and adaptation for environment and disaster management. Dr Surjan highlighted the significance to develop a mechanism of exchange

of knowledge and experiences of higher education on climate and ecosystem management aspects. It also focussed on integration of natural environmental sciences and social science disciplines looking to the very cross-cutting nature of climate-change adaptation issues. The design of the network also included UNESCO institutions, business enterprises and University departments. 21 Universities from 14 countries have been networked for the purpose. Ecosystem-vulnerability related studies and interventions shall address the disaster risk of hydro-meteorological hazards like floods, drought, landslide, etc. and will help understand the mitigation needs and strategies at various levels involving multi-stakeholder approach.

Dr. Khanindra Pathak, IIT Kharagru presented a paper on **“Role of Engineering Education for Management of Natural and Man-made Disasters”**. He discussed the need assessment of “safety and risk management” education within engineering and technology sector in India. Present engineering, technology or environmental science or management courses at Graduate or Masters level in Universities or IITs, do not have modules on safety risks management and emergency response that is a basic need not only as a requirement of the post-qualification of the expected nature of jobs but also as the science & engineering ethics as well. Modules on safety and environmental risk management, disaster management and emergency response, have to be designed as infused modules and some optional specializations. Dr. Pathak suggested a model design of a certificate course on safety and risk management for engineering graduates/science post-graduates with interdisciplinary inputs and also blend of ethics education to inculcate the culture of responsibility and accountability in the upcoming generation of engineers, ecologists, scientists and disaster managers.

Dr. Satyanarayan Hota, IRCS, Bhubaneshwar presented his Paper **“Disaster Management in Ten Vulnerable Secondary Schools of Subarnpur District in KBK region of Orissa: A Societal Need”**. He initiated his presentation by providing an overview of the vulnerability of the state as well as the district. The vulnerable schools had introduced non structural safety measures concepts through orientation and training of nodal teachers of the schools. Mock drills were also conducted as a part of school safety measure. Different organizations were working with the community in the area of school safety and detailed studies were also being carried out. Hota concluded his presentation by accentuating that children play a vital role in the process of disaster management. He highlighted integration of disaster education with the environment and science curriculum and also within the value education systems at various levels of school curriculum.

Dr. Anil K. Gupta, NIDM talked on **“Multi-to-Interdisciplinary Disaster Management Paradigm in Higher Education, Research and Communication: Infusion Models”**. Distinguishing ‘inter-disciplinary’ from ‘multi-disciplinary’ need a look at blend of a subject that offers blend of natural sciences – geology, chemistry, biology, physics, with humanities, natural resource management, modern tools and application of technology. ‘Environmental Science’ is only discipline that offers desired ‘truest interdisciplinarity’, over alternatives – economics, public administration and management science. He suggested ‘infusion models’ over ‘imposed’ models of disaster management education and training especially for developing nations. Integration of disaster management with environmental science and natural resource management is now well understood and voiced but lacks strategic framework of implementation.

Mr. Amir Ali Khan, NIDM in his paper on **“Child Rights to Disaster Safe Education – Case Study of School Safety Programme in Delhi”** enumerated various earthquake events of the past and their damages to buildings and structures including schools buildings. Earthquake resistance in school buildings is crucial in school safety disaster management. Rebuilding school structures is a costly and time consuming situation. Schools provide tremendous opportunity in developing culture of preparedness and prevention against hazards like fire and earthquakes. Government of Delhi is making attempt to reduce school vulnerability by taking structural and non-structural measures. Non-structural measures are less costly investments with good returns. Mr Khan enlisted various non-structural measures related to earthquake safety in schools and related structures. Among various rights, children have right to safe, healthy and conducive environment in education, he concluded.

Discussion followed the oral presentations and brought in numerous issues for further focus and recognition while interrogating or planning education, training or capacity investments for disaster management. Dr. Akhilesh Gangwar, Centre for Environment Education (CEE-Himalaya & NE) stressed the need to mainstream Paryavaran Vahini at District Levels, National Green Corps (NGC project of Govt of India), Eco-clubs (under various schemes of WWF, MoEF, etc.), Joint Forest Management Committees and Watershed Projects, in disaster management is need of the time. He added that the school curriculum of ‘Environmental Education’ at various levels must include a Chapter devoted on ‘natural and man-made’ disasters and emergency preparedness and a culture of prevention must be made a part of value/moral education as environmental-health plays great role in disaster response, relief and controlling post-disaster impacts.

Various students from University Departments of anthropology, environmental sciences, economics attending the session demanded that various environmental policies related to natural resources – land, water, forests, minerals, air, waste, agriculture must be screened for their provisions for disaster management as these offer guidelines for risk reduction. Delegates suggested that greater involvement of EDU-SAT mode of education involving various educational institutes, IGNOU, other open universities, NCERT, Open Schooling, etc., may be promoted to focus on disaster management as integral part of developmental, environmental and health programmes.

Dr. Rajni Srivastava, Pandit Deen Dayal Upadhyaya Govt. P. G. College, Uttar Pradesh urged the Central Government to take immediate steps towards ensuring disaster management as a discipline in the higher education curriculum at post-graduate levels and in faculty training courses. It was discussed that Environmental Impact Assessments being a potential tool, but less respect due to being used as a ‘jus-



tification tool' by consultants, has to be revamped with greater ethics and transparency in data and interpretations, as it offers great potentials of disaster risk reduction and response planning supports with a pro-active mode. Role of NGOs in disaster management and emergency response is diverse and need to be highlighted in district level planning and decisions.

Recommendations

- ◆ Capacity development has to be understood freshly with broader sense to include; knowledge, skills, resources, motivation and attitude in an integrated manner for education, professional development, governance and community. Research and education has to be given due priority with adequate support.
- ◆ The capacity plan and integrated approach for disaster management inclusive of risk mitigation and emergency response has to focus on “interdisciplinary guiding force” than the multi-disciplinary segregation within governance, involving (a) economic and welfare (b) environment and natural resources (c) industrial safety and health (d) public governance and policy
- ◆ National Institutions like NIDM, IIMs and IITs/IISc/IISERS may take a lead role in designing specified curriculum designs and modules for education and training courses at various levels and may extend guidance/support to Universities/Training Institutes in their courses, research programmes and professional development.
- ◆ UGC may be asked to mobilise the Universities and Colleges to integrate the modules of disaster management within the relevant disciplines or initiate new certificate or specialization in their interdisciplinary courses at Post-graduate and research levels.
- ◆ Various existing training networks like the master-trainers of National Green Corps (NGC), National Service Scheme (NSS), NCC and Eco-clubs, Paryavaran Vahini, Krishak Vikas Kendra (KVK), Civil Defense, Rural Development, PRIs, besides training institutions for environment, rural development, forestry, watershed, agriculture, disaster management, safety, at state, district and local levels have to be integrated by developing an inventory network and launching an organised mission of knowledge propagation through the channel of master trainers and management. Modules must be developed with region-specific challenges and strategies and adaptive with the need of the time.
- ◆ There is need to develop integration of disaster management infusion along the training and education network for environment and development programmes, especially in the regions.
- ◆ There need to focus on developing case studies for different environment types and economies in order to under the hazards and vulnerability, enabling to evolve region-specific strategies of disaster management training and education. Disaster Resilient Development models – urban, industrial, agriculture, forestry models, with regional specificity must be promoted through research degree programmes, collaborative projects and student's projects.
- ◆ School safety is a very important subject. The aspects of laboratory safety, electrical, chemical safety is a major gaps in the present school programmes and may be included to make the school safety programme holistic.

- ◆ Training must focus on multi-tier, multi-sector, multi-layer approach – targeting (a) professional and research development (b) policy analysis and decision making (c) planning and deliveries (d) educators and trainers (e) primary responders and receptors. A disaster management training policy must be formulated to guide the training need analysis, design, module development and human resource planning and different levels.
- ◆ Refresher courses and research programmes in disaster management for the University/college teachers of environmental sciences or environmental management may be promoted by UGC and other departments.
- ◆ Database of research initiatives and outcomes including Masters thesis and Ph.D. projects and research publications on disaster related issues may be developed and maintained under ENVIS programme of Ministry of Environment & Forests. NIDM may establish a dedicated information system in collaboration with MoEF, DST-NSTMIS, Earth Science and TIFAC to maintain environmental and natural resource database and maps on all-hazards basis for disaster management related research and training.

Role of Armed Forces, NDRF, Police & Civil Defence

Concept Note

Disasters continue to strike unabated and without notice and are perceived to be on the increase in their magnitude, complexity, frequency and economic impact. Disasters strike in varying intensities - sometimes at will and other time after due warning and time frame. Civil Administration is development oriented and at best can tackle low and moderate intensity emergencies depending upon the resources at their disposal and capabilities permitting. Civil police, although first agency to be informed, due to their limited numbers, are rarely capable of surmounting the disaster.

From times immemorial, the Indian Armed Forces and Paramilitary forces have always done a commendable job, when called to aid civil authorities, especially, in the wake of natural calamities or man-made disasters. Although, the armed forces are supposed to be called upon to intervene and take on specific tasks only when the situation is beyond the capability of civil administration, in practice, they have been the “core of the government response capacity” in a major disaster. The Armed Forces are trained to react in emergencies, and are the biggest rescue and succor providing organizations, capable of moving swiftly to any part of the country, in the shortest possible time. The ability to react in the emergencies and work against time is built in their training schedule. Both the government and the public repose tremendous faith in the armed forces and believe that all emergencies and crises can be handled by the armed forces.

In the past decade, the country has witnessed frequent and intense Natural Disaster leading to large scale of destruction, death, disability, diseases, panic and fear among the people at risk. The growing tendency of over ensuring, and not having faith in own civil set-up to deal with emergencies, has led to frequent deployment of the armed forces sometimes, unjustified.

Over the years there is a paradigm shift in government approach from response, relief and rehabilitation to mitigation, prevention, and preparedness. The Government of India has enacted Disaster Management Act 2005 and set in motion a number of initiatives for concerted efforts to manage Disaster in holistic and integrated manner. The government has felt the necessity of capacity building for rapid professional response to disasters. In that process, National Disaster Response Force (NDRF) has been constituted with advanced training, equipments, communication and mobility to respond to any type of natural or man made disasters including nuclear, chemical and biological disasters. The effectiveness of this force has been demonstrated during the recent flood in Bihar which affected nearly 3

million people, but the casualties were restricted to less than 100.

The Government of India, considering the changing global geo-political scenario, reducing the chances and occurrence of traditional wars, and steadily increasing threats from natural and man-made disasters, has envisaged greater role on the part of the Civil Defence (CD) from merely hostile act-centric responsibility to a holistic role in all the facets of Disaster Management in the country. The Civil Defence being a community-based voluntary organization can, in addition to rescue, relief and rehabilitation, also play a stellar role in the field of community capacity building and public awareness to face any disaster situation, as is being done by Civil Defence set-ups in many other countries. In addition to the role assigned under the Civil Defence Act 1968, The Civil Defence set up can play a major role in assisting the District Disaster Management Authority, (DDMA) with the help of its volunteers at grass roots level, in different phases of disaster, particularly in pre-disaster (public awareness, community capacity building and community preparedness) and mid-disaster phases (response and relief) phases.

Context

The frequency and intensity of natural and manmade disaster have increased in recent years. Though the Government paradigm shift from response & relief centric to preparedness, prevention and mitigation is in pipeline and yet to take its proper shape, the changing role of the various Response Agencies has to be reviewed and redefined and trained accordingly. The increasing propensity on the part of the civil administration to requisition Armed forces and Para military forces, need to carry out reappraisal of the role of the armed forces, especially in contingencies relating to disaster management . Sequential deployment of rescue and relief resources or a graduated response by various entities to emergencies is fraught with the dangers of delay, and the situation going beyond control.

Ideally, comprehensive assessment of the required response to a disaster or impending disaster is needed.

This will facilitate deployment of the necessary resources i.e. Civil Defence, National disaster Response Force, Para Military Forces and the Armed Forces, without loss of time, to limit the damage and losses to a minimum.

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Mr. Arjun Katoch, UNOCHA in his key note address apprised about the role of the Armed Forces in Disaster Management all over the world and the role of UNOCHA in disaster. He emphasized that due to increase in population and search of livelihood, population density in urban areas has increased. Therefore, the urban areas with increased population remains vulnerable to disasters and the necessity of improved, professional Disaster Response Force need attention. He emphasized as to how the climate change is likely to influence the range, severity and frequency of these disasters .Global statistics highlights the increasing numbers of the people affected by hydro meteorological disasters as 1/3 of the population lives near sea. He further explained how the democratization of Information reaching millions in well timed speed has increased the accountability of the Government. He empha-

sized the importance of Integrated Response in Crisis, and explained how the integrated approach by all the response force leads to effective and coordinated response. The Armed forces should do Planning, preparation, early warning and carry out regular rehearsals. He advocated the effective early warning system and quick evacuation drills. The effective community response should be based on a bottom up approach and not top down approach.



Mr. R K Bhatia, Director General, NDRF & Civil Defence talked about the **“Role of Civil Defence in Disaster Management”** with specific emphasis on the revamping of CD in India with specific role in pre disaster and post disaster scenario. He discussed the inception of Civil Defence in India and the important role played by the civil defence volunteers during various wars and recurrent disasters since inception.

He explained how with help of volunteers at grass root level the Civil Defence set up can play a major role in assisting the authorities in different phases of disaster, particularly, in pre-disaster by public awareness, community capacity building & community preparedness and mid disaster phases (response and relief) phases).He also spoke about integrating Civil Defence organization with various youth organizations, namely, NCC, NSS and NYKS.



Mr. Mukul Goyal, NDRF talked about **“Origin and inception of NDRF”**. On enactment of Disaster Management Act 2005, the process for creation of National Disaster Response Force (NDRF) started. He informed that at present there are fully trained and equipped eight battalions of NDRF and are performing effectively in disasters and have earned laurels in particular Kosi Floods.

Mr. Alok Avasthy, NDRF, Pune gave a presentation on **“Role and responsibility of NDRF”**. As per the DM Act, 2005(sec-44) NDRF is a specialist Force. He informed that NDRF comprises of eight units of CPME, two each from CRPF, CISF, ITBP and BSF. While explaining the organisation of NDRF he informed that each battalion of NDRF has 18 self- contained specialist search and rescue teams of 45 personnel. Each team has CBRN emergency responders, search and rescue element, engineers, technicians’ electri-

cians, and paramedics. Out of these eight battalions four battalions have the capacity to respond to CBRN emergencies. He also informed the location of NDRF units i.e. at Pune, Ghandinagar, Guwahati, Arakkonam, Mundali, Bhatinda and Gr. Nodia. NDRF become a highly skilled force for rescue and relief operations and has executed 67 disaster response operations in 13 states of the country and have saved 1,31,870 lives and retrieved 202 dead bodies. NDRF has also worked in many disasters like, Cyclone Aila in 2009, Kosi Flood in 2008, Flood in Karnataka and Andhra Pradesh, 2009.

Mr. Rakesh Kr. Sinha, NDMA gave a presentation on **“Role of Police in Disaster Management”**. He stated that although there is no defined role of police in disaster management but Police is always the first to reach Disaster site to provide Security and maintain law and order at disaster location and to prevent commission of cognizable offences against life, property and public tranquility. He spoke of the advantages of police system in disaster management which has well developed communication system, wider reach, familiarity with local terrain and area and awareness about people’s sensitivities. He emphasized the need for capacity building of police at grass root level, as central assistance takes time to reach. He stressed that the State Disaster Response Force be raised and be trained in collapsed structures search and rescue (CSSR), Medical First Response (MFR) and Flood Rescue Training (FRT). He concluded that states has to follow the guidelines laid down by NDMA for raising, training, infrastructures and equipping the SDRF Battalions.

Dr. Amarjeet Kaur, GGSIP University made a presentation on **“Role of Armed Forces in Disaster Management”**. The inherent strength of armed forces such as discipline, resources, quick decision making, Speedy dissemination of information and versatile capabilities makes army highly capable to respond to a disaster situation in a better and effective way. Army’s neutral, impartial and humane approach is an added asset in handling such situations.

Mr. Dhiren Vandara, College of Rural Studies gave a presentation on **“NCC Cadet can do better in Disaster Management”**. Over the 60 years, the NCC has evolved into a highly disciplined youth organization. This organization has been installing high sense of discipline, Commitment and enthusiasm among the youth. “Unity and Discipline”, the motto of the NCC, symbolized the role played by the corps in grooming the future generation. The service of the youth workforce has been commendable during national calamities and communal strike. He said that the NCC cadets have rendered services in Traffic management, First Aid, Evacuation of rescued people, setting up and helping in administration of relief camps, collection, loading and dispatch of medical aid material, food, and other articles of relief, distribution of relief material. He concluded by saying that involvement of NCC in disaster relief will provide an avenue to the youth in showing its commitment to the society and will result in growth and improved self image of the cadets.

Recommendation

- ◆ Co-ordinated response by the armed forces, NDRF, Police and trained youth organizations like NCC, NSS and NYKS is the need of the hour in disaster.

Incident Command System

Concept Note

The Incident Command System (ICS) is a management system. It is an on-scene, all-hazard, flexible modular system adaptable to any scale of natural disasters as well as man-made emergency/incidents. ICS was developed by United States Forest Service (USFS) in 1970's for managing a series of forest and urban fires. Over the years ICS has evolved as a single management system for multi-jurisdictional incidents, is modular and allows expansion and contraction depending on the size and complexity of the incident. ICS is often misunderstood merely as an organizational structure; however it is more than just an organizational structure and has a number of attributes or system features which make it flexible and adaptable to all types and scales of incidents and events.

ICS was introduced in India during 2003 in order to professionalize the emergency/disaster response management system in the country by the adoption of the System as practiced by the USFS. It seeks to strengthen the existing disaster response management system by ensuring that the designated controlling/responsible authorities at different levels are backed by trained Incident Command Teams (ICTs), whose members have been trained in the different facets of emergency/disaster response management. Onsite disaster response is a highly complex, challenging and stupendous task. The critical components of disaster response management are clarity of roles & responsibilities of the designated authorities, effective communication & coordination among the authorities/agencies, the optimal mobilization and deployment of resources, periodic evaluation and regular monitoring. It is often found that onsite disaster response is mounted without any appropriate plan. The coordinating agencies/authorities do not have clarity of their roles and responsibilities and there is duplication and overlapping of efforts, resulting in excessive costs and some time delay in the response itself. The authorities which have to plan and coordinate and get into the nitty-gritty of managing all aspects during immediate response phase particularly in cases of rapid onset disasters, where there is hardly any lead time for making incident actions plans for response. In addition to designated government agencies, the role of voluntary organization in providing logistical support for disaster response is often neglected.

A professional in disaster response management demands a well trained team to be in position with different team members trained in planning, operations, logistics, personal administration, communication, liaison and safety etc. Application of ICS therefore is a step towards professionalizing disaster response management.

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Mr. J.K. Sinha, Hon'ble Member, NDMA. Mr. J.K. Sinha, Member, chaired the session.

Supdt. Brian J. Graham of NSWRFSS, Australia made a presentation on **“Adaptation of the Incident Command System in Australia; evolution of ICS lessons learnt & best practices”**. He gave an overview on Incident Command System and briefly described the evolution of ICS in US its introduction in 1993 and integration in Australia as part of the Australian Inter Service Incident Management System (AIIMS) wherein all emergency response agencies have reached an agreement on the use and interpretation of ICS terminology.



He apprised about the situation in Australia in managing incident prior to introduction of ICS which included large number of agencies working without leader, territorial and status disputes between agencies, no clear chain of command, overlapping and duplication of tasks, poor coordination, communication and information flow, unclear roles and responsibilities and waste of resources. He informed that while introducing ICS in Australia a number of adaptations have been made to suit local conditions. ICS has been adapted to suit small and medium incidents as well as large incidents. Pre incident planning and standard operating procedures have been made integral part of ICS. There is an elaborate mechanism for training and certification in the NSWRFSS, Australia. Volunteer fire fighters as well as Government functionaries are trained in ICS in every aspects. The focus is on how to implement ICS on ground, familiarity with pre incident planning and SOPs, agreement to determining ICS structure acceptance of multi training & exercising etc. Supdt. Brian also discussed about the fire incident which took place in February, 2009 in State of Victoria in Australia. Since the State of Victoria does not have legislation to bring multi-agency together under one umbrella of ICS, during emergency situation, it was found that multiple incident management teams were working.

Dr. B. Ashok, LBSNAA, Mussoorie gave a presentation on **“Functioning of bureaucratic system during emergencies”**. The bureaucratic structure which is often found very robust however, has certain limitations in terms of lack of flexibility of organization to cope effectively with volatility and complexity of situation. ICS has inbuilt features which enable the bureaucratic structures to attain remarkable flexibility and reliability under broad range of working conditions which is often found in incident scenario. ICS could be more reliable tool for handling extreme conditions and emergencies. Dr. Ashok also discussed about the introduction of ICS in India through cooperative and consultative process. The idea was to strengthen the existing structures at the District Division and State levels by trained incident managing teams to be drawn from the existing functionar-

ies that would be trained in different facet of emergency/ disaster response management. ICS in India comprised of two broad components namely; Incident Response and System institutionalization. Incident Response component included coordination, Incident Command Team and Specialized Resources. While introducing ICS in India four tier training initiative was taken. The first tier training included training of core groups of trainers, the second tier included trainers from regional training Institute, the third tier included training of State lever master trainers and the fourth tier included training of district functionaries and responders. While summarizing his presentation Dr. Ashok mentioned that ICS provides management backbone to the most of the solution in disaster/ emergency response and provides some model for command, control and coordination during an emergency. The ongoing training and adaptation activities in India would ultimately result in institutionalization of ICS.

Mr. P. N. Rai, IG Police, Patna made a presentation on “**Applications of ICS in response to Kosi Flood, 2008**”.

He gave an overview of the magnitude and complexity of the unprecedented flood situation in Bihar. A large scale relief operation was carried out wherein about 362 relief camps were set up for accommodating over 4 lakh people. This included 35 megha relief camp having population of more than 5000 in each of the camp. ICS was not fully implemented however, some of the features of ICS were used in managing the relief



camps and carrying out relief operations. He shared his experience that the traditional system of disaster response was able to manage the situation, nonetheless professional trained teams are required for better results. He discussed as to how various elements of ICS practiced during Kosi response though ICS was not practiced fully for want of adequate number of officials trained in ICS. Even limited applications of ICS such as development of operational plans resulted in greater efficiency and effectiveness.

Dr. M. Bhaskar Rao, DR, MCR HRDI, Hyderabad made a presentation on “**Institutionalization of ICS in India**”. He shared his experiences of the piloting process in Nellore district, Andhra PradeMr. It was brought out that the principles and features of ICS are its major strength and integrating ICS within the existing bureaucratic structure would be the major challenge. Indian States have different administrative structure, systems and practices for emergency response and local adaptation would be required. ICS provides an opportunity to improve upon the existing system of response by training and exercising and putting in place a mechanism wherein team can be constituted from among trained officials and could be deployed for incident management. It was mentioned that shortage of ICS trainers and resource persons, shortage of full time faculty

members in training institutions were hampering quick integration of ICS. In addition due to frequent transfers implementation of ICS had been delayed.

Col. AKS Parmer, DMI, Bhopal made a presentation on **“Institutionalization of ICS for effective emergency response management”**. He discussed about the various dif-

iculties and bottlenecks in the response system which pertained to communications, coordination, resource mobilization, assessment of situation, lack of professional trained teams etc. He further outlined the recent initiatives taken by the Government of India in improving the response system and creation of specialized units and agencies for quick effective and response. He made a comparative analysis of ICS used in the US and response system



and practices in India and highlighted on some of the basic principles and features of ICS. ICS application during a pilot exercise in the state of Gujarat, Assam and Andhra Pradesh in some of the isolated events was discussed. It was further suggested that policy level interventions, issuance of Indian version of ICS manual, appropriate strategy for training and financial resources flow would be necessary for institutionalization of ICS.

Dr. Kamal Lochan Mishra, OSDMA made a presentation on **“Allocation of ICS in Orissa”**. He discussed the existing administration structure in districts and sub-divisions that are responsible for emergency management OSDMA has operationalized embedded

ICS during flood relief operation wherein the command structure and planning, decision making and operationalisation of emergency response was set in motion and included resource management, logistics and carrying out evacuation and search rescue operations. He highlighted the lessons learnt from application of ICS in managing the floods in Orissa, where the operation section, was organized on functional branches and geographical division including, air operation branch. In



addition, planning, logistics, finance and administration sections were activated. He concluded that the application of ICS in flood relief operation in Balasore district was found highly effective.

Col. V. N. Supanekar, YASHA-DA, Pune made a presentation on **“Implementation of ICS in Management of Religious Events in Maharashtra”**. He informed that during October- November, 2008 the Tri-Centenary celebration at Nanded where in about 20 lakh pilgrims visited from India and abroad an Emergency Management Plan was developed for managing the event using ICS. Under this plan, a hazard, vulnerability, risk analysis was conducted and various preventive and mitigation measures were made part of the disaster management plan. The Disaster Management Plan was formulated on the basis of ICS and coordination and command functions were structured accordingly. Emergency operation Centres were activated and made integral part of ICS. The planning and implementation of the major task of the event which included routing of the pilgrims, vehicular traffic, VIP movements etc were arranged. The city of Nanded and adjoining areas were divided into nine sectors and was managed by putting ICS structure Collector, Nanded was the Incident Commander. All operations were organized through geographical sectors and operation was found highly successful. Col. Supanekar was of the view that change of attitude of the Government functionaries particularly in middle and lower level needs to be re-oriented for making ICS a successful tool and that the ICS should be used in planned events for smooth integration into response system.



Mr. Debaprasad Misra, Assam Administrative Staff College, Guwahati gave an overview on **“ICS Piloting Process in Assam”**. He gave a brief background of the ICS piloting process and highlighted the importance of the process of implementing a pilot project which included wider consultation, emergence of a leader, constitution of steering committee, selection of districts, developing a roadmap for completing pilot process to selected districts etc. The objective of the pilot process was to equip disaster managers of the select districts with knowledge and skills of ICS, help examine existing disaster response tools, test ICS knowledge and skills in ground situation with the help of simulation exercise and finally to evaluate the value additions which ICS could make in strengthening the existing response mechanism. Mr. Mishra focused on the simulation



exercise and various parameters of conducting the exercise so as to assess the learning outcomes. He gave status on the progress made in the ICS training and simulation exercise in the two selected districts of Assam i.e. Cachar and Kamrup Metro. Regarding adaptation of ICS Mr. Mishra stated that the Head of district administration should be made Responsible Official and his immediate subordinate should be Incident Commander. For institutionalization, sensitization and orientation of the apex level, policy support, creation of trainers bank, dedicated training facilities, constitution of incident management teams and systematic and comprehensive training of the IMT members leading to simulation and full scale exercises on regular interval, adequate financial and infrastructural support etc would be required. Mr. Mishra also suggested that systematic Training Need Assessment (TNA) should be undertaken for ICS training & institutionalization.

Mr. Himadri Banerjee, Previsstar made a presentation on **“ICS Experience on Hurricane Katrina in New Orleans, US”**. Mr. Banerjee discussed about the pre- Katrina preparedness in New Orleans in terms

of assessment of risks, planning for evacuation, sheltering, mass care. He stated that incident plans were not structured in ICS pattern and there was lack of vision to operationalize the plan. He gave a first hand view of the situation that ICS was being used for fire incident and by the Fire Department only. Other Departments were not trained in ICS. He highlighted that ICS must be accepted and used by all agencies

to make it a successful tool. Elected officials must endorse that system of standardization is necessary to avoid confusion when outside support arrive. IT solutions can add a lot of value in the emergency response management particularly in managing process and disseminating function and provide support in decision making.

Mr. J. K. Sinha, Hon’ble member NDMA made a presentation on **“ICS adaptation and Institutionalization in India”**. He gave a background of ICS inception in the country and various training and adaptation initiatives undertaken by the Government. He highlighted the consultative process for developing the Indian version of ICS manual and informed that after thorough consultation with all stakeholders,



the draft ICS manual has been finalized and submitted to the Government for approval. A comparative analysis was made of ICS as practiced in United States and Australia and highlighted the need for customization and local adaptation as per local needs particularly in the view that we have a different administrative system. He elaborated the manner in which ICS would be integrated in Indian system of disaster/emergency response. The various management principles followed under ICS which otherwise are not seriously followed were also discussed. ICS provides clarity of roles and responsibilities of the officials become very important during emergencies. A short film on integration of EOC and ICS at the district, State and national level developed by NDMA was screened. It highlighted the flow of information, flow of communication, coordination among agencies, response mobilization and deployment during initial response to an incident.

Recommendations

- ◆ ICS should be adapted with the Indian system of administration at all levels.
- ◆ Relief Management is an important function in the Indian situation and should be integrated into the ICS structure.
- ◆ ICS should be included the line departments connected with disaster management at all levels by developing suitable training modules.
- ◆ Core Group and State Master Trainers in India should be expanded.
- ◆ ICS should be integrated into induction training of All India Service/State Civil Service/Line Departments.
- ◆ ICS training should be decentralized at district and sub-district levels.
- ◆ Provision should be made for dedicated funding support for training and institutionalization of ICS.
- ◆ Course materials should be customized for India and translated into Hindi and other vernacular languages.
- ◆ Trainer's development programme should be launched.
- ◆ Simulation exercises and Mock Drills using ICS should be conducted regularly.

Public Health Emergencies & Mass-Casualty Management

Concept Note

India's unique geo-climatic conditions make it vulnerable to natural disaster like floods, drought, cyclones, earthquakes, and outbreak of diseases leading to a sizable number of human casualties and various forms of disabilities. The super cyclone in Orissa in October 2009 caused more than 9,000 deaths, the Bhuj earthquake in January 2001 resulted in 14000 deaths, while the Tsunami in December 2004 left behind 15,000 dead in India. The Bhopal Gas tragedy of 1984 accounted for more than 15,000 deaths over a period of more than two decades. The above events underline the public health emergency threats and mass casualty potential of natural and man-made disasters.

Peripheral emergencies such as mass casualty incidents due to road, rail and air accidents, fire, drowning, stampede, and epidemic outbreaks also occur more frequently than natural disasters. The deaths and disabilities due to man-made disasters, between 2001-03 were nearly 12 times higher than those caused by natural calamities. This establishes the importance of setting up an institutionalized mechanism for medical preparedness across the nation. The analysis of mortality data of the last decade also revealed more than 1,20,000 deaths with economic losses of approximately Rs.1,50,000 crore. Disasters which are small in shapes and sizes impact a small number of people and put intense demands on the health system for a short period, while other mega disasters may involve a large number of casualties but reach a plateau only after a latent period, placing heavy continuing demands on the health system.

For one reason or the other, disasters have been contributing to the outbreak of some specific public health emergencies as the disease transmission risk factors increase when a disaster hits a particular geographic area. Lack of clean water and the suspension of public health programmes, all health illnesses, such as cholera or dengue or malaria to multiply after natural disasters. Often these illnesses can be more deadly than the original disaster. Rapid changes in the human environment, and health may occur also as a result of natural disasters or acts of war or of other man made circumstances including major industrial accident. However, health problems arising out of the disasters may vary in types and degrees depending upon particular type of a disaster.

The increased man-vector contact in shelters and temporary camps and the disruption of control activities may be more important causes for epidemics after disasters are caused by natural hazards, in particular. More importantly, disasters caused by natural hazards

(floods, earthquakes, cyclones and volcanic eruptions) can contribute to the transmission of some diseases, provided the causative agent is already in the environment. Although major health epidemics are rare in the aftermath of these disasters, but some disasters are so great that large numbers of the population are displaced, creating perfect conditions for the spread of disease.

While earthquakes, avalanches, and landslides may result in enteric epidemics due to improper water supply and sanitation; volcanic eruption can lead to respiratory epidemic; unprecedented amounts of rain leading to disastrous flooding and flash floods, and cyclone can result in pneumonia as well as other waterborne/ communicable diseases. In the period immediately following a cyclone, the risk of acquiring malaria, dengue or encephalitis may decrease as a result of the destruction of breeding places of the local vectors. Similarly, industrial accidents can cause respiratory problems. Viral agents during the time of nuclear, biological and chemical warfare can cause diseases like Anthrax, vibrio cholera, and plague requiring immediate treatment.

However, it is important to remember that epidemics do not spontaneously occur after a natural disaster. The more likely cause of disease is the lack of potable water and adequate sanitation. In country like India where cholera is prevalent, general assumption is that disease will spread after any disaster affecting water supply, food quality and sanitation. However, the health problems in natural as well as man-made disasters could be due to one or many such factors.

Disasters can contribute to the transmission of some diseases triggering an epidemic in three ways:

- ◆ By increasing transmission of local pathogens
- ◆ By changing the susceptibility of the population
- ◆ By introducing a new pathogen into the environment

The epidemiologic factors that determine the potential of communicable disease transmission is influenced by six types of adverse changes during disasters:

- ◆ Changes in pre-existence levels of disease
- ◆ Ecological changes as a result of disaster
- ◆ Population displacement
- ◆ Changes in population density
- ◆ Disruption of public utilities
- ◆ Interruption of basic public health services

Nevertheless, the essential fallout of any public health emergency or mass casualty incident could be very overwhelming for the health care facilities. Hospitals and other health care facilities are essential life line service providers. And emergency response and mass casualty management is a distinctive stage of disaster management activity at the hospitals. Quick response is one of the key objectives and a significant yardstick of success of effective mass casualty management during pre and hospital phase of disaster management. This requires special attention due to the vital function hospitals and emergency

responders perform. Planning for quick and effective mass casualty management is aimed to include core dimensions such as field and hospital triage, triage principles and methods, pre-hospital emergency care, emergency room management, hospital mass casualty plan, dealing with special mass casualty issues, Basic Life Support and psychological triage.

The hospital preparedness for disasters is a dynamic process and plays crucial role in easy mobilization of the staff, bed, equipments and supplies in a safe environment during any mass casualty or mass gathering incident. These occasions could happen due to terrorism, bomb blast, festival gathering, natural disasters such as earthquakes, major vehicular accidents, communal riots, etc. Therefore, strengthening the capacity of casualty medical officers, hospital managers and surgeons on basics of mass casualty management is essential for any hospital's better disaster preparedness and effective response to the patients to avoid the situation of a secondary disaster.

While responding to a mass casualty event, the goal of the health and medical response is to save as many lives as possible. Rather than doing everything possible to save every life, it will be necessary to allocate limited resources in a modified manner to save as many lives as possible.

Context

Disasters and other emergencies create unique ethical challenges of resource allocation, triage, incapacity, privacy, expenditure, human resource planning and so on. The cardinal virtues of effective teamwork in emergency and disaster medicine can help meet these multifaceted and unpredictable challenges long before they arise in clinical practice. In disaster situations, time exigencies do not allow for protracted moral reflection and ethical deliberation; thus preventive measures and policies that amplify virtue and ensure ethical practice are warranted. For example, disaster preparedness drills and related exercises most include opportunities for character and team building as well as ensure optimal distribution of scarce medical resources. Fostering virtue proactively may be thought of as a kind of moral vaccination against the ethical pitfalls inherent in emergency medical service provision. Seven virtues that express the qualities, dispositions, and uniqueness of the ideal emergency health-care team member are offered: prudence, non-judgment, self-effacement, compassion, trustworthiness, resilience and communication. Truly realized, these virtues can transform emergency and disaster workers from a state of mere competence to a state of sheer excellence. Prior to 1950 in the West and in many developing countries today, the responsibility for health care was and is largely assumed by the family. As the delivery of health care has become increasingly institutionalized and complex, the various health professions that emerged, including emergency medicine, began to recognize their interdependence. As specialization increased, and the variety of roles and professions in health care grew, the need for the coordination of health care became evident. A team of health professionals has come to replace the family while providing a useful mechanism for delivery of quality care. To instill the institutionalized and best coordinated MCM, the National Disaster Management Authority has recently issued comprehensive guidelines for Medical Preparedness and Mass Casualty Management following natural or manmade

disasters. Training and capacity building of doctors and paramedical staff is an important component of the national guidelines towards this goal.

As India experiences a rapid health transition, it is confronted both by an unfinished agenda of infectious diseases, nutritional deficiencies and unsafe pregnancies as well as the challenge of escalating epidemics of non-communicable diseases. This composite threat to the nation's health and development needs a concerted public health response that can ensure efficient delivery of cost-effective interventions for health promotion, disease prevention and affordable diagnostic and therapeutic health care.

Need for appropriate capacity building in Public Health Emergencies and mass casualty management needs appropriate attention in India. In one hand Public Health Emergencies addresses the need to develop capacities to manage health risks of emergencies while the focus is on prevention through rigorous surveillance, reporting and community strengths. Mass Casualty Management addresses issue of skill installation and up-gradation of the service providers and well equipped facilities for limiting the fatalities and disabilities, thus focusing on quick and effective response through appropriate and adequate preparedness. Capacity building in any form is aimed to reduce the impact of disaster on communities through preparing health services and by raising awareness and enhancing knowledge and skills, strengthening sustainable institutional mechanisms and facilitating exchange of information, experience and expertise.

Proceedings

Prof. M. C. Misra provided an overview on mass casualty incidents.

Dr. Dnyaneshwar Shelke explained the modus operandi of the emergency number 108, the process of its operation and the technology involved in the activities of Emergency Response Centre. He illustrated the state of art equipments featured and placed in modern contextualized ambulance that is used in transporting the survivors to the hospitals. He described various ambulance equipments such as stretchers and extrication tools, and medical equipments such as suction apparatus and automated external defibrillator. The research, training and partnership mechanisms operating at EMRI with a focus on training on MMS professionals was explained. He then moved on to the lucid illustration of everyday emergencies at GVK EMRI and elaborated the mock drills conducted in Hyderabad. The role of this centre in May 2007 bomb blasts in Hyderabad, 2008 Kosi floods in Bihar and Andhra Pradesh floods in 2009 was highlighted by the presenter. He concluded his presentation with a positive hope to introduce an Incident Command System, to develop Public Health Assessment Teams and to strengthen the integrated ambulance



network with highly sophisticated communication technology.

Dr. Ranjit Mankeswar spoke on **“Public Health Response after Heavy Rains in Mumbai”**. The speaker began with a contextualized view of epidemic susceptibility of India and past public health emergencies occurred in various disasters caused by natural hazards. An overview of onset and progress of 2005 Mumbai floods and its impact on the public health components of the affected areas was highlighted. He mentioned that a total of 134 teams (from nearby districts) comprising of 2 doctors and one para-medical staff from more than 20 key hospitals were mobilized and also the coordination with various private medical institutions. The reporting mechanism that was adopted during the incident time for generating a comprehensive and consolidated data sheet on the public health response profile was explained. He emphasized the fact that the rapid deployment of medical teams and hard work of these teams controlled disease outbreak despite the gravity of the situation. The key lessons mentioned by him included the special focus on disease surveillance activities, epidemiologic training and some mechanism of reinforcement of the doctors provided services during the grave situation. While summarizing he accentuated the need of strengthening the coordination between various agencies and re-emphasized on the fact that a fully operational surveillance system is the cornerstone for prevention of infectious diseases.

Ms. Jasmine Mini, IRCS gave a presentation on **“Importance of Community Health Assessment through Community Based Approach in Post Disaster Period”**. She informed about Community Based Health and First Aid popularly (CBHFA), which was initiated in Kanyakumari district after December 2004 Tsunami. She described the health need assessment tools used by the trained Red Cross volunteers to identify the priority health issues in the community. While unfolding the main public health threats perceived by the community people she mentioned that although malaria and diarrhea were the impending threats the people did not know the primary prevention techniques at personal and at community level. She concluded her presentation by emphasizing the importance of participatory approach to identify priority health issues in a community so that the results of health care service interventions are more result oriented.

The presentation on **“Preparedness of Delhi Hospitals against Mass Casualties Management with Preference to Commonwealth Games 2010”** was delivered by Dr. Ratna Sood. As she mentioned this study attempted to identify the level of MCI preparedness at the major hospitals of Delhi and a total of 60 hospital administrators, emergency personnel, nursing staff from these key hospitals were included in the study. She outlined few recommendations on the basis of her study and urged the hospitals



of Delhi to consider hospital accreditation, BLS and ACLS training of staff, and better patient transportation system as priority areas for any eventuality of MCI during the CWG, 2010.

Mr. Rajagopal, Software Development Engineer Intel Technology India Pvt. Ltd. gave a presentation on **“Information Communication Technology Facilitate Better Response to Public Health Emergencies?”**. He highlighted the importance of ICT as a speed and mass impact medium not only to connect the rescue and relief agencies for decreasing the response time but also to provide timely and accurate advice to the public and stakeholders. He mentioned this as a low investment and high impact technology and described how it was helpful in connecting communities and service provision agencies to coordinate for a quick and most effective response and relief distribution.

Mr. Pradeep, RedR deliberated a talk on **“Improving Quality Of Life-Line Services to Achieve DRR”**. He mentioned about the huge number of diverse training courses the organization conducts and outlined various dimensions of total health care including WASH, shelter, food & nutrition, mental health, curative health and public health care. He concluded by saying that good linkages with appropriate authorities are needed for improving quality services to people during pre-disaster time and to sustain these services during any disasters.



Prof. P. C. Joshi, Delhi University talked about **“Impacts of Floods on Health under Five Children: A Study on Diarrhea in Bahraich District, Uttar Pradesh”**. He emphasized that diarrhea being the major cause of mortality among the under-five children in India the study was very relevant in the context of recurrent floods. He shared his key findings of the study by mentioning that prevalence of diarrhea was associated with children from families that received loans, children who suffered from Acute Respiratory Infections, and children between ages of 6-17 months. In addition, he mentioned that night blindness was associated with increased prevalence of diarrhea in both exposed and unexposed groups. The findings described how disasters aggravate the gravity of situation.

Mr. K. Rajasekhar, NIC Hyderabad gave a presentation on **“Role of ICT in Emergency Health Management-H1N1 Pandemic Preparedness & Response”**. He highlighted the significance of cost-effective reporting through the use of mobile SMS and explained the advantages of messaging over the traditional system of reporting which heavily depend upon electricity and other huge infrastructure or cost involvement. SMS can be used to update health events, alert hospitals deal with pandemic outbreaks, alert investigation results, track missing persons, track dead bodies, indent medicines and consumables,

update the stock piling, report relief operations, monitor water quality, etc.

Dr. Sahil Pall, WHO spoke on **“Kosi River Floods”** and **“Collateral Benefits of Polio Eradication Infrastructure”**. He narrated the Kosi floods in details as a background to the topic and then moved on to the strategic utilization of Polio infrastructure to coordinate other response and relief mechanism. He focused mainly on the information and planning aspects of the strategy which incorporated the use of existing trained human resource, linkages with government and other partners, topographical mapping, enumeration of households covered under pulse polio scheme, and medical relief planning.

Dr. J. P. Dadhich, National Coordinator of Breast Feeding Networks, India presented a very crucial aspect of disaster health care management in his talk on **“Policies and Programmes Addressing Preparedness for Appropriate Infant Feeding Practices during Disasters in South Asian Countries”**. He re-established the importance of child survival and infant feeding issues during any disaster. He described the global trends in breast feeding and detailed out WHO Infant and Young Child feeding tool for assessment of policies, practices and programmes. It was surprising to know that out of 15 quantitative and qualitative indicators India scores zero in all sub indicators as compared to other South Asian Countries. He also identified the gaps and reasoned out why India is placed at the last of the list of these countries particularly in this area.

Mr. Srikrishna S. Ramachandran, Indian Institute of Public Health, Hyderabad gave a presentation on **“A Strategy to Promote Risk Reduction in Public Health Emergencies”**. He enumerated the functions of his institute in terms of enhancing knowledge, building networks, and improving skills. While discussing capacity building he emphasized on the importance of competence based education, e-learning, research and training, and advocacy related issues.

Disaster Psychosocial Care & Mental Health

Concept Note

Disaster-affected people experience various psychological reactions, which may follow the disaster event in reaction to the immediate and long-term multifaceted impacts of devastation caused by the disaster. These emotional reactions among the survivors may appear immediately or come as delayed response to the disaster. The nature, type and severity of reactions may vary from survivor to survivor and these also usually undergo change over the time depending upon the coping capacity and socio-economic life condition of that affected community. To reduce the stress reactions and other short-term and long psychological and psychiatric complications and associated disabling conditions need-based, culturally appropriate and flexible post-disaster psychological, psychosocial and psychiatric services should be provided.

Psychosocial support refers to comprehensive interventions aimed to address a wide range of psychosocial problems arising in the aftermath of a disaster, which help individuals, families and groups to restore social cohesion and infrastructure along with maintaining their independence and dignity. It helps in reducing the level of actual and perceived stress that may prevent adverse psychological and social consequences among disaster affected people. Disaster Mental Health Services refer to the interventions for identification and treatment of manifested stress related psychological signs/ symptoms or of the mental disorders among disaster affected persons. In addition, interventions aimed at mental health promotion and prevention of psychological symptoms among disaster affected population are also included under disaster mental health services. The Psycho-Social Support and Mental Health Services (PSSMHS) should be considered as a continuum of the interventions in disaster situations. While psychosocial support will comprise of the general interventions related to the larger issues of relief work needs, social relationships and harmony to promote or protect psychosocial well-being, the mental health services will comprise of interventions aimed at prevention or treatment of psychological symptoms or disorders.

Context

There is adequate research evidence at national and international level regarding the mental health and psychosocial consequences of disasters. It has been recognized that most of the disaster affected persons experience stress and emotional reactions after disaster as a 'normal response to an abnormal situation', and are able to cope well with a little psychosocial support. However, a significant proportion of people are not able to cope effectively with the situation in the absence of appropriate/ adequate support system and experience

significant signs and symptoms requiring psychosocial support and mental health services. The symptoms are directly related to trauma experience. The greater the trauma, the more severe is the response if other factors are same. The trauma and subsequent experiences due to the major disasters like earthquake and Tsunami may be most severe for majority of the people while trauma in minor or peripheral disasters may be less severe. There is some evidence that human made disasters like riots and conflicts may have more distressing consequences. Statistics indicate that at the end of the first year, over two-thirds of the affected population recover, leaving one-thirds having significant symptoms that disable them. There is strong evidence that the experiences of the people subsequent to the disaster have direct relevance to recovery. The more the problems and life difficulties, the survivors experience during the recovery phase, the more persistent will be their emotional reactions. The importance of mental health and psychosocial interventions after disasters has been increasingly recognized globally and locally. While conditions and disorders such as stress reactions, generalized anxiety, depression, co-morbid conditions, PTSD are commonly discussed issues after a disaster, condition of survivors with existing mentally illness also drawing more attention. This warrants appropriate interventions in accordance with the phase of recovery of the affected population with the diminished social supports being built up for speedy recovery.

A review of Indian work on psychosocial and mental health aspects of disasters in India in terms of service delivery, training and research activities carried out during last more than two decades reveals a progressive shift in the nature and scope of services, the focus and objectives of training activities and in the issues pursued in the research activities. The developments in the area of service, training and research have been occurring parallel to each other as well as following a combined approach. The available Institutional mechanisms for psychosocial support and mental health services are currently limited in the country. The trained mental health personnel is highly inadequate to deal with the magnitude of mental health problems in the country even during normal/non-disaster situations. A well integrated PSSMHS with relief and rehabilitation support along with various training and research activities involving different departments of Government and N.G.O. sector is essential for optimum utilization of limited resources.

Proceedings

Dr. K. Sekar, Professor in Psychiatric Social Work, NIMHANS delivered the welcome address.

Dr. D. Nagaraja, Director and Vice-Chancellor of NIMHANS, Chairperson of the session explained the gravity of disasters and their enormous impact on the population affected in Asia in general and India in particular. He provided an overview of the staggering economic costs of these disasters and how these incidents take away the entire development process to the backseat. He then oriented the participants regarding NIMHANS role in psychosocial care in disasters and its journey from 1981 onwards. He stated that now NIMHANS has been involved in the recent Karnataka floods which affected millions of people in 15 districts.

Gen. Dr. J. R. Bharadwaj, NDMA in his key note address highlighted the role of NIMHANS not only in service delivery but also in policy making and also upgrading capacity building of human resource. He shared his vast experience of war soldiers and their illness and referred to the genesis of his interest in this particular subject of PSSMHS. He informed the audience that 70% of the day to day problems of the soldiers was psychological in nature. Dr. Bharadwaj mentioned that complete health is strongly associated with work effectiveness. He added PSSMHS has been a neglected subject for quite a long time and NDMA with its hammering actions has been successfully sensitized thousands of people at higher level on the significance of psychosocial health in ensuring complete health.



He informed the participants regarding the status of the National Guidelines on PSSMHS. Various facets of psychosocial care needs of disaster affected rural as well as urban communities was extensively covered. He expressed his concerns on the disintegrated social support networks in urban areas and urged that NGOs and outside agencies to play a major role in providing PSSMHS in urban areas and active participation and support from all stakeholders for creation of disaster resilient communities was advocated. The hon'ble member concluded his speech by highlighting the significance of the key recommendations of this session which are to be duly incorporated in the forthcoming national guidelines on PSSMHS.

Dr. Allen R. Dyer, International Medical Corps applauded the significant contributions of India to the World on disaster management progress. Differential vulnerability profile of USA and India was brought out and also then shared some the experiences of great Sichuan Earthquake in the Asian region. The concept and stages of grief of disaster affected people was elaborated with reference to the steps to reconciliation process. It was really interesting to listen that while appreciating Indian system of service delivery in this field he focused on the community based disaster psychosocial care model followed in India and few Asian countries. He moved on to the psychiatric aspects of disasters and expressed his views on PTSD, its course, symptoms and treatment modalities. The dynamics of stress, immune system and illness relationship was elaborated to signify how these psychosocial care services are significant to maintain the balance of the mind in any traumatic situation.

Dr. Jay Kumar C., NDMA provided an overview of the salient features of the DM Act of Govt. of India, mandate of NDMA, various guidelines issued by the NDMA on Psychosocial Support and Mental Health Services in Disasters. He emphasized on the diversity of needs that disaster affected population had in past few disasters in India and also emphatically mentioned that disaster planning and preparedness clearly need to mention about how

various issues could be adequately addressed. He mentioned about the detail mechanisms about how the guidelines deal with different crucial aspects of this service provision such as various levels of service provision, roles of mental health personnel, cultural practices in different chapters.

The next session on **“Strengthening Communities and Recovery through Psychosocial Support”** was delivered by Dr. Subhasis Bhadra and Ms. C. M. Pratheepa. Dr. Bhadra started with psychosocial support from the Red Cross point of view and defined the term psychosocial as the dynamic relationship between the psychological and social dimension of a person. He elaborated the concept by saying that psychological dimension includes internal, emotional thought process, feelings, and reactions, while the sociological dimension includes relationship, family and community networks, social values and cultural practices and shared experiences of one of the crucial projects implemented by Red Cross on community strengthening and facilitating long-term recovery in the southern India. Various components of the Integrated Recovery Project such as cascading capacity building model, community interventions and school interventions was elaborated including that methodology being used. He also mentioned that the entire project was done with a gender sensitive approach in a clear participatory mode and how it was a successful model in building a hierarchy of support within the community.

Dr. Jaykumar C., NDMA gave a presentation on **“Impact of Events among the Community Level Workers in Disaster Rehabilitation Services”**. It was a wonderful sensitization and overview of the role and functions of community level workers in a community based disaster psychosocial care model, which was very successfully implemented in disaster affected areas of India. Equal emphasis was also laid on the impact of these disasters on the CLWs who also relives the experiences of suffers many time during the service provision. Empirical studies carried out on this theme, which indicated that CLWs are greatly affected by the post-disaster activities were detailed. The main concerns that emerged from his presentation were mental health risks for community level workers to be affected by the gravity of the situations. He concluded by accentuating the need for addressing the issues of care of caregivers in an integrated manner during different phases of disaster management.

Prof. L. S. Gandhi Doss, State Disaster Management Authority gave a presentation on **“Holistic Approach to Disaster Management-Lessons from the Past for Future Directions”**. He discussed the paradigm shift in the global approach from a relief driven ad-hoc management to a more proactive professional disaster management. He mentioned that holistic approach to disaster management demands integration of all systems of governance and citizen participation, laid equal focus on prevention, mitigation and response, and calls for professional approach for effective and efficient disaster management. This needs convergence of various programmes for relief, rehabilitation and long-term recovery with a stipulated time frame and capacity building with target focused need assessment and appropriate methodology. The need of special care of more vulnerable groups such as women, children, disabled and elderly has to be mainstreamed with the general relief, rehabilitation and recovery.

Ms. Nidhi Maheswari, Defence Institute of Psychological Research gave a presentation on “**Psychological Risk Analysis for Terrorism**”. The presentation included crucial issues of metaphysics and epistemology of terrorism, types of terrorism risks, psychological risk analysis model, risk assessment methods and risk management models. During the deliberations on risk analysis model she discussed the cognitive, affective and co native aspects, and explained the known, unknown, dead and non dead risk while analyzing the risk matrix. She suggested that management effectiveness becomes stronger if the risk attitude is understood and managed appropriately as compared to the risk attitude is ignored and unmanaged. Risk attitude stems from the conscious, subconscious and affective dimension of the personalities of people at risk as well as people who has the responsibility. The fact that risk communication of the public reduces the uncertainty and increases the participation in better management of threat. She also accentuated on role of media and public plays an important role in risk assessment, risk communication and risk management.

Mr. Subhasis Bhadra, Central University, Silchar gave a presentation on “**Coping and Social Support among the Survivors of Disasters**”. It was an empirical study comparing the coping, perceived and received social support of randomly selected 300 survivors of earthquake and riots in Gujarat. It was mentioned that social support cause higher mental health and adjustment problems and plays an important role in determining morbidity and accepting challenge, hence crucial for recovery. Various tools such as, Family Schedule, Social Support Appraisal Scale, Coping Scale, and schedule for Assessment of Inter-Sectoral Support were administered to seek information on various dimensions of coping and social support. The findings of this study mentioned that interpersonal coping strategy was found to be the most frequently adopted coping strategy and fatalism was found to be significantly higher among the survivors of human made disasters as compared to natural disasters. Action strategy as a coping was significantly higher among the earthquake survivors and that negative coping patterns were higher among the riot survivors as compared to the earthquake survivors. Higher perceived social support (reduces stress in daily life) was found among the earthquake survivors as higher perceived threat in the inter-personal community resulted in lesser perceived social support in riot affected survivors. Earthquake survivors had higher level of satisfaction with perceived support as riot rehabilitation had various socio-political implications; therefore participation of general public and agencies was less. Enhancing opportunities for the survivors to adapt positive coping styles through various psychosocial interventions and strengthening community ownership through community ownership process are essential for long-term recovery planning.

Pandemics

Concept Note

New Influenza A (H1N1) is a re-assorted virus which originated in Mexico and has spread across the world causing a pandemic. Previous experiences with SARS and Avian flu in this decade have helped in evolving preparedness plans across the globe including India. These plans are proving their value today when the H1 N1 pandemic has started knocking at our doors and we have been able to contain the problem reasonably well so far.

This influenza pandemic, as per WHO estimates, may affect up to one-third of the world population in view of lack of immunity human beings carry against this virus. In April 2009, outbreak of Influenza A (H1 N1) was declared in Mexico, leading to Phase 5 Global Alert of pandemic by WHO. Being geared up for the action already, NDMA and MoH&FW released documents and guidelines suggesting various preventive and preparedness measures to contain the spread of pandemic. On the basis of these documents, Crisis Management Plans were prepared for health and non-health sectors which were triggered into action on declaration of Phase 6 of ongoing flu pandemic by WHO on 11th June 2009.

The government through the nodal ministry of Health and Family Welfare quick to respond and initiated many preventive measures in coordination with various ministries and departments to contain the spread of the Influenza. Despite all these measures a possibility of outbreak in certain population clusters cannot be undermined, causing serious ramifications for health and non-health sectors. All government agencies with the help of the NDMA have acted promptly, so far, to contain the magnitude of this problem. This effort has to continue at the same tempo, keeping in view the possibility of mutation of this virus and the associated dynamics. The situation as on date (24 October 2009) is that 7,23,962 cases reported positive for H1 N1 virus with 6,177 fatalities globally, while the situation in our country is 13,158 positive cases with 430 deaths, posing a formidable challenge to our overstretched medical system.

The thematic session on Pandemics would bring professionals who are dealing it on day to day basis to discuss various strategies and plans for response, mitigation and preparedness to contain this disaster.

Proceedings

The session on pandemics was chaired by Lt Gen (Dr) Bhardwaj, Member NDMA and 14 eminent Speakers presented on different themes on H1N1 pandemic influenza. Approximately 94 participants attended the session and actively participated in the deliberations. The sessions were of high quality combining first-hand experience of dealing with the H1N1 pandemic with scientific and empirical data, various prevention and mitigation strat-

egies and follow up measures were discussed.

“An introduction to pandemics and global scenario of H1N1 Influenza” was presented by Dr. R. K. Sharma, wherein he highlighted the present status of the pandemic flu. He spoke on the global scenario on pandemics in 20th century and specified the journey of pandemic sequentially. He also focused on pandemic preparedness strategy and challenges for biomedical fraternity.

While summing up he highlighted the importance of effective cooperation and collaboration of multi stakeholders

Dr. Rajesh Vaidya, DRDO spoke on **“The Epidemiology of H1N1 influenza and its progression”**, and pointed out the nature of spread of the Pandemic around the world. He presented a historical background of swine flu in different countries, its virology and host characteristics and transmission. His focus was on the history of human transmission and current global and Indian situation. He supported his presentation with data on the demographic profile of the human transmission.

“Mitigation strategy for prevention of H1N1 Influenza” was presented by Dr. P Ravindran, Director, Emergency Medical Response, MOH&FW. He elaborated various measures taken by the ministry and the future course of action. He enumerated the steps in mitigation strategies and also elaborated upon policy, pharmaceutical, non-pharmaceuticals, societal and psychosocial interventions.

Dr. Shashi Khare, National Institute of Communicable Diseases made a presentation on **“The Role of laboratory investigations during pandemic outbreak”** with supported data's collected from different parts of the country and the steps taken on laboratory investigations which play a crucial role in the detection. She started with the role of NICD in containment, prevention and control of bird flu and moved on to the vaccine policy, pandemic preparedness, rapid diagnostic development, characterizing the host response, evaluating transmission and finally epidemiology and surveillance. Her focus was on the domestic influenza surveillance data, its use and role of laboratories after this. She highlighted the specimen collection and laboratory diagnosis and the details of technicalities within these procedures. The role of laboratory networks in these procedures and how multidisciplinary actions taken place during analysis of these data was emphasized. The presentation was summarized putting more emphasis on prevention and control mechanism.

Dr. Rajesh Arora, Institute of Nuclear Medicine and Allied Sciences, DRDO made a presentation on **“The role of alternative medicine in pandemic H1N1 Influenza”**. Starting with an overview about the disease, he outlined the high risk groups and talked about preventive measures and described the composition of most effective drug i.e. Tamiflu



and its origin. He explained about the Star anise which is a source of shikimic acid, that is used to produce the anti-flu drug Tamiflu. It also contains anethole, which gives them their licorice-like flavor. Chinese star anise has been used as a spice and medicine for over 3000 years. It's soothing to the stomach and is often used in cough medications. He also presented the cost-benefit ratio of vaccination of this drug and he deliberated upon the alternative herbal drug therapy solutions for H1N1 influenza, method of drug delivery, herbal drug development and the future of alternative medicines for bird flu pandemics.

Dr. Shakti Gupta, AIIMS highlighted the importance of Hospital preparedness and intensive care during pandemic H1N1 influenza. He elaborated on the role of administrators in keeping the hospital ready to deal with situation like pandemics. He elaborated on Hospital preparedness and human resource development, procurement, patient transfer, and transmission control plans



Dr. Y. K. Gupta, AIIMS deliberated upon the various issues of Pharmaceutical intervention in H1N1 Influenza in India and abroad.

He explained about anti-influenza therapy, antipyretic therapy and anti viral therapy for 2009 influenza. He described the adverse impact of NAIs and AE profile in Indians, and specifically mentioned about the reported neuron-psychiatric events particularly for pediatric age group.

Dr. R. P. Vashist, Head of Community Medicine, Govt. of NCT talked about Public health issues and role of State Government in the pandemic.

Dr Aruna C Ramesh, talked about the importance of Public private participation in pandemic H1N1 Influenza and need for coordinated effort for better preparedness for future. She explained how antigenic shift is taking place and consequent reassortment of influenza strain 1 and 2 has emerged, and what is the global position on this regard. More importantly, she mentioned that the best antidote for this is public education and capacity building of community and public health delivery systems. In addition, she also crisply touched upon the preparedness at the govt. level in terms of hospital readiness, regular surveillance and public awareness. She emphasized on the power of effective partnership and proper communication between the various stakeholders to prevent and control the Swine Flu virus.

Dr. Jayakumar, NDMA gave a presentation on **“Psycho-social impact of pandemic H1N1”** and explained as to how it will have an impact on the individual and the community. He started with the psychological impact of SARs 2003 and the media reports attached to that. He emphasized the role of multi-sectoral response for allaying the fear, better dissemination of information to community and responsibility of media. He highlighted how to cope up with anxiety, stress and panic during this period and specific steps that are required to be taken. He oriented the audience towards the impact of swine flu on school

children and who are required to be given much needed psychosocial care. He concluded by mentioning about the important role of care givers and how psychosocial and mental health care of these workers plays an important role in ensuring effectiveness in response.

Maj. Gen. J. K. Bansal, NDMA presented a work continuity Plan for pandemic H1N1 Influenza. The importance of non health sector in the prevention and mitigation was succinctly discussed. He mentioned about the impact of bird influenza on business continuity, impact on health as well as non health sectors, the initiatives taken up by NDMA, and mentioned about basic features of business continuity planning and operation



“Role of international agencies in pandemic H1N1 Influenza” was presented by Dr. Sampath Krishnan, WHO India. It was explained how WHO is looking at the coordination of Gos and NGOs. He mentioned about the role of Consolidated UN Action Plan for Avian and Human Pandemic Influenza (UNCAPAHI) in achieving seven objectives of this plan. He specifically mentioned on the activities of WHO in surveillance, rapid response teams, training and capacity building, collection of samples and BSL-3 labs. Training of microbiologists and other health personnel was a significant activity that was undertaken by WHO.

Climate Change

Concept Note

India exhibits great diversity in climate, topography, flora, fauna and land use and as the seventh largest country in the world, it is distinct in its snow capped mountains of the Himalayas in the north, long sea coast in the south, east and west (surrounded by three Seas), plateaus, forests, desert regions and numerous river systems spread all over the country. However with such topographical miscellany come certain climate induced natural hazards such as floods, droughts, landslides and cyclones that expose India's vulnerability time and again. Not only do these have an environmental fall out but also adverse socio-economic and physical infrastructure impacts.

Various studies conclude that surface temperatures in India show warming with considerable regional variations i.e. 0.5 to 0.6°C during 1901-2005 with 1971-2003 having seen a relatively accelerated warming of 0.22°C/decade. Warming is projected to increase by 2-5°C by 2100s. While no clear trend has emerged for rainfall increase or decrease however it is projected that rainfall intensity will increase and rainy days will decrease by 2100. Having said this however it has been noted that rainfall variability from one extreme to the other i.e. droughts and floods seems to have become a regular occurrence thus adversely affecting agricultural output and in turn the economy. According to Intergovernmental Panel on Climate Change (IPCC), India's Initial National Communication on climate change 2004 (NATCOM) to the United Nations Framework Convention on Climate Change (UNFCCC), and recent projections by different studies in India, anticipated climate change will alter rainfall and temperature patterns, thus posing a range of threats to development in India such as change in agricultural production (implications on food security), reduction in fresh water availability, boundary shifts in forests (affecting dependent communities), adverse impacts on natural ecosystems (e.g. Himalayan mountain ecosystem), sea level rise along coastal zones, changes in disease patterns, increased energy demands and impact on climate sensitive infrastructure.

A major part of India's population of over one billion with decadal growth of 21.34% from 1991-2001 is rural and agriculturally oriented for whom the rivers and groundwater are the source of their prosperity. It is investigated that if the National Population Policy (NPP) if fully implemented, the population of India should be 1,107 million by 2010. However, country's population is expected to reach a level of around 1,390 million by 2025 and 1,700 million by 2050. According to World Bank's development data 2008 put India's population at 1,123.3 million for the year 2007 with an estimated growth rate of 1.4% during 2001-07. In its poverty estimations for the same period it positioned infant mortality rate at

57 per 1000 live births, child malnutrition (children under 5) at 44%, literacy age 15+) at 61% and access to an improved water source at 89% of the total population. Furthermore, in another report by Department for International Development (DFID) highlighted that in India 300 million people live in extreme poverty and earn less than US\$1 per day, while 500 million earn less than US\$2 a day. It is these groups according to them who are most adversely affected by the above mentioned climate variability as they rely heavily on climate sensitive sectors (rainfed agriculture, fisheries) for livelihood and sustenance, tend to be geographically located in exposed or marginal areas such as flood plains and are less able to respond due to limited human, institutional and financial capacity.

Context

It is keeping this countrywide context in mind that there has been growing awareness and mobilization over recent years regarding the problem of extreme weather events/ natural disasters that cause widespread damage and disruption in India are droughts, floods, cyclones, storms/storm surges/ coastal flooding, extreme temperature, landslides, and avalanches etc., on the part of many of the actors concerned: scientists, policy makers, NGOs, and states. These hydro meteorological disasters are on the rise and threaten the development gains and poverty alleviations efforts of many developing countries. At the same time, climate change is modifying the hazards triggering these disasters, leading to more severe impacts. These changes should be factored into development practices and especially disaster risk management in order to reduce the rising human, economic and financial losses from extreme weather events and climate variability. Since disasters are human phenomena, we can change our ways to reduce our risks. There is need to bring a paradigm shift in disaster management approach especially under the changing climate.

Proceedings

Ms. Margareta Wahlstorm, UN Assistant Secretary General- Disaster Risk Reduction, Geneva in her keynote address apprised the audience about WMO's role, climate and water related disasters and how climate change is likely to change the range, severity and frequency of these disasters. She emphasized that the human being has a great capacity to adapt to varied climates and environments but remain vulnerable to marked changes in weather and climate conditions. Global statistics highlight the increasing number of the people affected by hydro meteorological disasters that account for 90 % of those killed. In assessing the sensitivity and vulnerability of communities to weather and climate hazards, long- term climate records and related sectoral information are



of vital importance. Such records are also essential for preparedness, planning and response strategies that build resilience for coping with extreme events. Otherwise each extreme event will cause distractions and set back development, in some cases, for many years.

Prof. J. Shukla, University Professor, George Mason University (GMU) & President, Institute of Global Environment and Society (IGES), USA made a key note presentation on myth and reality of the climate change. He stated that the planet is getting warmer, the sea level is rising, concentration of greenhouse gases in the atmosphere is increasing at an unprecedented rate and glacial is retreating. Yet, there continues to be skepticism, and in some sections of society outright hostility, towards the concept of global warming and its human origins. Prof. Shukla showed comprehensive evidence from observations and models that global warming is real and will explain the scientific basis for the validity of the proposition that global warming is a clear and present danger. The projected trends implicate human activity and that no natural causes can possibly be responsible for the unprecedented changes. He concluded with suggestions for adaptation and mitigation strategies, and possible roles of individuals, institutions and governments in responding to the consequences of projected climate change.

Dr K. Krishna Kumar, Indian Institute of Tropical Meteorology (IITM), Pune made a technical presentation on **“The recent projections of climate change over India”** and how India is vulnerable to extreme weather events (drought, flood, Cyclone, Heat & Cold wave etc.). There is now world-wide concern about anthropogenic climate change and recent occurrences of extreme weather events in India and their unusual intensities and duration are a matter of concern for scientists and society. Dr Kumar informed that an attempt has been made by them to analyze extreme rainfall and temperature events in India, to examine the spatio-temporal changes in their intensity, durations using daily gridded rainfall data set (resolution: 10 X10) for the period 1951-2007 and daily gridded temperature data set (resolution: 10 X10) for the period 1969-2005. While future scenarios of these extreme events are assessed using daily rainfall and temperature simulations for the period 2071-2100 from a regional climate model: PRECIS (resolution: 0.440 X 0.440).



While discussing about general increase in the extreme rainfall amounts and temperatures and their frequencies are observed at many places in India, he stated that one of the anticipated effects of climate change is the possible increase in both frequency and intensity of extreme weather events leads to hydro-meteorological disasters. Dr Kumar also informed to the audience about the establishment of a Centre for Climate Change Research (CCCR) at IITM, Pune and their future plans about climate change projection and impact studies.

Dr. Pramod Kumar Aggarwal, Indian Agricultural Research Institute, New Delhi informed about the ongoing research on **“Adapting Indian agriculture to global climate change”**. He stated that the global climatic changes and increasing climatic variability are likely to exert pressure on agricultural systems and may constrain attainment of future food production targets. He has explained the ongoing research activities in the Institute i.e. crop response to carbon dioxide, use of crop simulation models, validation of crop models, projected impact of climate change on agricultural production, uncertainties in climate change impact assessment and how to adapt agriculture to climate change.



He projected that increase in CO₂ to 550 ppm increases yields of rice, wheat, legumes and oilseeds by 10-20%, a 1°C increase in temperature may reduce yields of wheat, soybean, mustard, groundnut, and potato by 3-7%, productivity of most crops to decrease marginally by 2020 but by 10- 40% by 2100 and length of growing period in rainfed areas is likely to reduce, especially in peninsular regions and southern India. Prof. Aggarwal also mentioned that increased droughts, floods and heat waves will increase production variability and available adaptation strategies can help reduce negative impacts in short-term but to a limited extent. We, therefore, need to urgently take steps to increase our adaptive capacity. This would require increased adaptation research, capacity building, development activities, and changes in policies. Most of these are actions that are required even today for sustainable development and are related to judicious applications of current scientific knowledge, pricing policies, institutions, and good environmental behaviour at all scales.

While discussing about greater need for agricultural risk management he discussed about the proposed National Mission for Sustainable Agriculture under the National Action Plan on Climate Change (Government of India, 2008) does mention some of these. He concluded with suggestions that although the costs of adaptation and mitigation are not clearly known but these are expected to be high.

Dr. R. D. Singh, National Institute of Hydrology (NIH), Roorkee talked about the **“Climate change and its impacts on the water resources with a special emphasis on floods and droughts disasters”**. He stressed that climate change is likely to affect the temporal and spatial variability of the available water. IPCC projections and evidence from recent observations in India were also mentioned. Dr Singh explained that NIH has initiated a few studies to investigate the impact of climate change on water resources and in this regard, some of the Himalayan and Peninsular rivers sub-basins are selected for carrying out these studies. While discussing briefly about the outcome of these studies, he stated that conceptual models are calibrated and validated for the selected sub-basins and used to

simulate the hydrological response of the basin considering the changed climatic scenarios. He proposed that the various studies need to be carried out for addressing the important issues involved in flood and drought management under changed climatic conditions and findings of such studies would be very much useful for evolving the adaptation strategies in order to combat the future challenges in water sector due to climate change particularly in dealing with the disaster management related to water in most effective manner.



Dr. D. R. Sikka, Ex. Director, Indian Institute of Tropical Meteorology discussed about **“Early warning and disaster communication under changing climate scenarios over India”**. He stated that establishment of India Meteorological Department (IMD) came as a result of a severe cyclone striking Kolkata in 1865 which resulted in heavy losses to trade, commerce and shipping and the developments in IMD during 1875-1950 resulted in upgrading of storm warning services, flood warnings and heavy rainfall warnings as well as warnings against slowly evolving drought situation, landslides and severe local thunderstorms. He also stressed about the need for a reliable weather forecasting and warning systems for hydromet disaster prediction. He informed that the progress of early warning system depended on monitoring of atmospheric-ocean environment and research on such events. He pointed out the uncertainties in prediction of extreme weather events which leads to hydromet disasters; however, there is a hope that due to recent development in simulation modeling, data management and fast computers uncertainties will decrease. He also stressed upon active participation of print and electronic media and considers it essential for communicating the early warnings. He suggested that research is needed to reduce the knowledge gap and societies have to be kept informed about the progress. His talk ends with the note that the way to continued progress in risk reduction of hydro-meteorological disaster rests with better monitoring, better modeling efforts and better communication of threat perception in a probabilistic manner for which public awareness is to be progressively promoted.

Dr. Sudip Mitra, JNU, New Delhi made a presentation on **“Global warming and the**



characteristics of water under changing climatic conditions”.

Dr. Mitra stated that in the case of developing economies, the global warming crisis due to changing climate and its economic consequences presume vital importance in the process of realizing sustainable development. He informed, that in the Natural Resources Defense Council report it has been concluded that, the global warming may increase the risk of floods, so an efficient and conservative water use will be of paramount importance for future water supply.



He focused on the broad area of water management issues such as the major river system of India, condition of ground water resources, the current water utilization, water losses, water under stress, water pollution and increased population & its impact on the problem of scarcity of water. An attempt has been made to illustrate the environmental interface between water and climate. He proposed an interdisciplinary approach combining knowledge from environmental sciences with social sciences.

Dr. Partha J. Das, AARANYAK, Assam made a presentation on **“CC adaptation to water induced hazards: a study in the flood plains of the Brahmaputra river basin in eastern Assam”** and discussed about climate indicators and water induced hazards prevalent in NE India. He presented the results of a study on coping and adaptation strategies-both traditional and contemporary that are in practice among the indigenous communities in two remote and socio-economically, under-developed but highly flood prone areas of the Lakhimpur and Dhemaji districts of eastern Assam.

He informed that the study, carried out in five villages in the two chosen sites attempts to understand how ethnic communities living in remote and isolated pockets of very high flood risk zones have lived with and adapted (housing & livelihood) to floods and associated water-induced hazards. He concludes with the suggestions to crease awareness, sensitivity, and capacity of communities to adapt to their changing environment and to develop alternative livelihood, train farmers in innovative agricultural techniques suitable for degraded lands, and promulgate suitable policies pertaining to embankments, flood insurance, resettlement and rehabilitation, and implement these programmes effectively.

Dr. Rajesh Kumar, BIT- Jaipur spoke on **“Glacier lake monitoring using remote sensing and GIS in the baralalacha la region, Himachal Himalaya”**. He presented an overview about the frequency of the occurrence of Glacial Lake Outburst Flood (GLOF) events in the Himalayan region in the second half of the twentieth century and their devastating effect towards the life, properties and infrastructures. He informed that a study of glacier lake monitoring is being carried out based on the Satellite imagery and GIS as well as field observation in the Baralacha La region at about 16,500 ft high. He informed that

the glacial area has increased about 54% during last 8 years. He concluded by suggesting to make downstream people aware about GLOF and other flash floods like, cloud bursts which is very common in the mountains; to update about Glacial Lakes under changing Climate; develop GLOF hazard zonation map; warning system in the downstream well before GLOF can happen; Strategies to cope with GLOF hazard; learning lessons from previous disaster; and Knowledge and support for adaptation.

Dr. Arun B. Shrestha, ICIMOD-Kathmandu, talked about **“A comprehensive glacial lake outburst flood risk assessment in the hindu kush–Himalayas”**. He mentioned that

climate change has resulted in the retreat of glaciers in the Hindu Kush – Himalayas (HKH) region. One of the most visible and tangible impacts is the formation of glacial lakes. Some of these lakes can burst out causing large flash flood with potentials to cause significant damages to property, lives and livelihoods. He informed that the awareness among scientists, decision makers and media on the glacial lake formation and outburst process has increased

in recent years and this prompted several initiatives related to glacial lakes, and there is need for a concerted and coordinated assessment of the risk for glacial lake outburst floods (GLOF) in the HKH, and their socio-economic implications.

He stresses that at the moment, knowledge of the current GLOF risk in the HKH is incomplete, and a proper risk assessment is often circumvented. He added that there is urgent need for a comprehensive GLOF risk assessment in order to support proper planning of mitigation and adaptation strategies in this context. He also informed that ICIMOD has developed a methodological approach for the GLOF risk assessment.

Dr. Praveen Singh, WINROCK International India, made a presentation on **“Performance of DRR strategies in changing climate: a case study of Eastern U.P.”**. He informed that historically we have been dealing with the phenomenon of floods through various structural and non-structural strategies. These strategies adopted by the state as well as communities have given both benefits and dis-benefits in the past. He discussed the results of a cost-benefit analysis exercise carried out of all possible Disaster



Risk Reduction (DRR) strategies under the changing climate. He informed that due to projected increase in rainfall (intensity and amount) during middle of 21st century flood event will increase; projected climate change may negatively impact on embankment performance; therefore a proper planning is needed. He opined talk with opinion that while hard structural solutions (e.g., embankments) to deal with floods will not give very good economic results therefore, more decentralized, community based soft options will be beneficial.

Dr. Colin Fernandes, Austcare, Banda Aceh, Indonesia, talked about **“Empowering communities to understand climate change”**. He discussed the Climate Change issue in the Indonesian Context which is extremely prone to various forms of hazards. In the Indonesian context temperature is increasing and rainfall is decreasing since 1940, resulting in drop in catch of fish near the coast areas. He informed that according to the Centre for Research on the Epidemiology of Disasters (CRED), in the last century, there have been over 100 major floods, 85 earthquakes and 46 volcanic eruptions and sea level rise is likely to lead to the submergence of about 40000sq. Km of land mass by 2080. His talk seeks to approach how development practitioners and local communities can work in risk prone areas where disaster vulnerable populations are subject to climate change. He focused on how civil society and government can go beyond the policy and demonstrate practical and sustainable models to engage communities to prepare and mitigate climate change, especially in areas where these are linked to future disaster scenarios.

He mentioned that some of the world’s poorest people live in regions which are disaster prone and highly subject to the changing course of climate. While policy frameworks have been developed, the community engagement on the ground is yet to find a voice in these legislations. In this situation, civil society organizations working with disaster vulnerable populations are looking beyond conventional means of disaster preparedness and risk reduction. He concluded by proposing a model for community based climate change empowerment and management, combining a theoretical base along with a case study from Indonesia.

Dr. Harjeet Singh, Action Aid International, talked about the **“Climate change adaptation: is it all about ‘good’ development?”**. He discussed the approaches of the concept of adaptation by unraveling the development approach that addresses the underlying factors that cause vulnerability. Adaptation ‘solutions’ cannot be exported to a vulnerable area or community but need to be premised on sustainable development approach that empowers vulnerable communities with adequate capacity and resources to build their resilience to adapt to the changing climate. He observed that though the issue is global but impact will be local and therefore community need to be aware and their capacity need to be improved.

He suggested that from a policy



perspective, adaptation should be seen as an integral and urgent part of overall poverty and risk reduction strategies that will reduce the levels of relative or total risk vulnerability as a determinant of risk. He concluded that adaptation cannot be seen as an outcome but as the process to build resilience of communities to climate variability and change.

Mr. Vinson Kurian, Hindu Business Line, The Hindu, talked about “**Climate change: to learn to adapt is the best policy**”. In South and Southeast Asia, the most affected countries include India, Pakistan, Bangladesh, southern and eastern China, Myanmar, Vietnam, Philippines and Indonesia and the only way to reduce the present human impact is through adaptation. In last decade the climate scientists and disaster managers were working in different direction. He stresses that the need of the hour is that scientist, policy makers and disaster managers should come together under one umbrella.



He stated that as mitigation is long term solution, despite the lack of funding, some cases of successful adaptation do provide a glimmer of hope and integrating strategies between adaptation, mitigation, development and disaster risk reduction is the need of the hour. Mechanisms and sanctions, including a globally accepted solution on taxing CO², should also be pursued in right earnest. But such a pricing system must not add to burden of the poor. He emphasized that it is urgent need of the day to address sustainable alternate livelihoods to enhance resilience in changing climate.

Panel discussion on “**Disaster Risk Reduction in Changing Climate Scenario: Scope, Strategies and Challenges**” was held under the chairmanship of Prof. J. Shukla, USA and was co-chaired by Dr. D. R. Sikka.

Recommendations

- ◆ Setting up of high density observational networks suitable for detection and monitoring of hydro-meteorological disasters on priority
- ◆ Deployment of high resolution global and regional climate models which to be run on petaflop computing systems
- ◆ Improving the accuracy of weather forecasting and short-term climate prediction for high impact weather events.
- ◆ Development and implementation of Early Warning Systems for all hydro-meteorological disasters
- ◆ Up-gradation of communication systems for improving dissemination of warnings
- ◆ Establishment of a State-of-the-art Regional Centre for Climate Change Research through multi-lateral cooperation

- ◆ Urgent need to train young scientists in the best available Institutes or acquire trained manpower available across the world in the field of climate science
- ◆ A national policy for sharing and access of meteorological, hydrological, geological and environmental data and products within the government and among the communities.
- ◆ Launch of massive Public awareness programmes to address people at grass-root levels (Farmers, Workers, NGOs, community level organizations, local administrators/ disaster managers, etc) using mass media and other media. Efforts should also be made to launch TV /Radio Channels on weather and climate information.
- ◆ Launch of programmes to enhance coping capacity of community (including alternative livelihoods) to reduce risk from disasters under climate change scenarios.
- ◆ Launch of programmes for assessing sectoral vulnerability of climate change impacts based on future scenarios
- ◆ Involvement of state/district level communities in the areas of water resources.
- ◆ Involvement of civil societies, educational institutions, and religious organizations in the climate change related adaptation and mitigation actions.

Urban Risk Mitigation

Concept Note

Over millennia cities have been seen as benchmarks of the greatness of civilizations. The precise planning and governance of Mohenjo-daro, Babylon, Alexandria, Rome, Pompeii and Neapolis, to name a few, have awed mankind as marvels of innovation and engineering. Many of these great cities have gone into oblivion due natural and man made disasters, while many others have survived many catastrophes. The resilience of cities in the modern ages has been demonstrated time and again, as cities as engines of economic growth have bounced back to life, but often at huge costs and miseries, which could be avoided if the cities are better planned to mitigate the hazards of nature and the vulnerabilities of socio-economic and environmental conditions that confront them.

Today the world is witnessing exponential urban growth, especially in the developing countries. For the first time in history the global urban population has equaled urban population at 3.25 billion in 2007 and it is projected that by 2030 another 1.8 billion people would be added to the cities mostly propelled by migration of poor people from the rural areas to large urban centers in the developing countries in search of employment and livelihood. Most of this growth is likely to take place in Asia and Africa.

India would be one of the main theatres of urban explosion in the coming years, the parallel of which was not seen before in the history of civilization. At 285 India stood relatively less urbanized (28.5%) in 2001, but by 2021 India would have 550 million people living in its cities. The number of cities with million plus population would swell from 35 at present to 75 in 2021.

Many countries of South and South East Asia and Western Africa would be experiencing similar urban growth. Before 1975 only 4 cities in the world had more than 10 million population each (Tokyo, New York, Shanghai and Mexico), by 2015 the number of 10 million plus cities would go up to 26, most of them from the developing world (Cairo, Lagos, Dhaka, Beijing, Tianjin, Mumbai, Kolkata, Delhi, Jakarta, Osaka, Karachi, Seoul, Manila, Buenos Aires, Rio de Janeiro, Sao Paulo, Mexico, Los Angeles, Hyderabad, Teheran, Lahore, Bangkok and Istanbul),

Context

Increasing concentration of people, infrastructure and human activities in cities would create risks of unparallel dimensions. While some of these risks are embedded in the historical location of many cities along river side or sea coasts, the spatial expansion of cities to new low-lying, flood prone and other vulnerable areas and unplanned slum settlements without

safe buildings and adequate infrastructure would expose increasingly large number of people to different kinds risks of nature such as flood, storm surge, earthquake, landslides etc.

While devastating earthquakes have struck large urban centers like Tokyo (1923), Kobe (1995), San Francisco (1906), Mexico City (1985), Morocco (1960) and Chengdu (2008), typhoons and cyclones have regularly affected great cities across the world like Manila, New Orleans, while floods have remained recurring phenomena in most of the riverine and coastal cities.

In India as many as 38 cities with a population of over half a million each are located in seismically active zones III, IV and V. This includes the four mega cities of Delhi, Kolkata, Mumbai and Chennai. Considering the large mass of unsafe buildings and high density of population in these cities any earthquake of even moderate intensity would cause catastrophic damages to people, property and infrastructure in these cities.

The Mumbai flood of 2005 and the regular floods in metropolitan cities are grim reminders of the risks hydro-meteorological disasters, which would worsen further due to global warming and climate change. Many coastal cities would have to grapple with the problems of sea level rise.

The risks of natural hazards have been compounded manifold by human-made threats like fire, environmental pollution, accidents, epidemics, industrial disasters, terrorism, civil disturbances etc which take toll of thousand of lives every year. The Bhopal Gas tragedy of 1984, the Surat plague of 1994, the terror attacks in New York, Mumbai and many places and the current threats of swine flu in many cities are examples of some of human induced disasters faced by the cities.

The Thematic Session on Urban Risk Management would discuss these emerging risks and find solution for mitigation and management of these risks.

Proceedings

The session covered various dimensions of urban risks mitigation, urban governance, disaster sensitive planning for urban areas, disaster-resistant building practices, mainstreaming of disaster risk reduction for sustainable urban development and building of climate resilient cities. In the beginning the Chairperson Mr. D. S. Meshram, former Chief Planner, TCPO highlighted the emerging issues of urban risk management. He mentioned that increasing concentration of people, infrastructure and human activities in cities would create risks of unparalleled dimensions. While some of these risks are embedded in the historical location of many cities along river side or sea coasts, the spatial expansion of cities to new low-lying, flood prone and other vulnerable areas and unplanned slum



settlements without safe buildings and adequate infrastructure would expose increasingly large number of people to different kinds of risks of nature such as flood, storm surge, earthquake, landslides, etc.

The broad objectives of the session were to:

- ◆ Discuss the various dimensions of urban risks in different contexts and vulnerabilities.
- ◆ Discuss challenges, shortcomings and opportunities in safe and sustainable urban development
- ◆ Share technological and social innovations for risk reduction of urban communities as learning opportunities
- ◆ Integrate knowledge from various urban development sectors to formulate actions for urban risk reduction.

Mr. B. K. Sengupta, IIT-Kharagpur, while presenting his talk on “**Development of Risk and Vulnerability analysis model in a Regional context**” explained urban risk

factors from the view point that unplanned/ill planned development pattern and uncontrolled urban expansion has been making it difficult to manage megacity even during normal times. In addition, he has attributed further on hazardous industrial plants existing with congested informal settlements, informal construction made up of substandard materials and a built environment susceptible to natural hazards resulting from unregulated building practices are main reason for increasing vulnerability. Intensified urban vulnerability are due to physical densification of settlements, high concentration of business investments and economic assets, convergence of vital networks, along with critical facilities and transportation. The vulnerability analysis model developed by the presenter incorporated parameters such as (i) loss of life, (ii) loss of property or fixed assets at both individual and public level, (iii) loss of livelihood and (iv) loss of infrastructure and (v) time required to restore normal daily life of the inhabitants. The application of this model in context to Indian megacity has been outlined yet further improvements are required suiting Indian conditions.



Mr. T. N. Gupta, BMTPC, Delhi while presenting his paper on “**Capacity Development for Strengthening Disaster Preparedness, Mitigation and Management at the level of Urban Local Bodies**”, emphasized four-pronged action plan. These include (a) Periodic awareness meets at regional level for Mayors/ Corporators focusing on reporting of quantifiable progress achieved by each ULB, lying in seismic regions. (b) Regular training programmes for town planners, architects, engineers and plan approving officials for regulating seismic safety in the new projects and in methods of carrying structural safety audit of

existing built stock. (c) ULBs must collaborate with academic institutions of excellence and eminent professionals having practical experience from large construction entities to provide training to their staff and practicing local engineers and architects in structural safety auditing methods and practice of forensic engineering. (d) Efforts so far made through development of guidelines, advocacy for adherence to standards

& codes and creating awareness about consequences, the ULBs have miserably failed in changing the mind-set deep ingrained in the whole machinery. He mentioned about the high vulnerability profile and geographical spread of seismic risk demand, development of capacities amongst all stakeholders and at different levels where technical and administrative decision making takes place for creating and maintaining built assets – buildings and other structures. Efforts should be made at national, state and local levels, to improve preparedness, mitigation efforts and management strategies.

Mr. R. B. Singh, Delhi University, presented his paper on **“Predicting Urban Heat Island (UHI) Risk and Micro-Climate Change In Delhi Metropolitan Region Using Geoinformatics”**. Urban heat islands (UHI) and micro-climate changes are closely linked. Land use is the dominant factor for intensifying Urban heat island (UHI) effect together with industrial concentration, transport nodes and thermal power plants. Dense built-up area in Delhi has increased from 1.31 per cent in 1977 to 28 per cent in 2006. Since 1981, Urban population has increased more than 2 times and Urban area which was 40% in 1981 has increased up to 62%. Need of housing have increased due to tremendous population growth rate resulting into conversion of land into built-up area. Several UHIs pockets in Delhi have been identified using IRS-1C LISS-III and LANDSAT-MSS data. The speaker suggested land use planning and promotion of Green buildings and Green neighborhood concept for mitigating the UHI effects and related disasters.

Mr. Pawan Kumar, TCPO, Delhi, while presenting his paper on **“Transportation issues in disaster management”** gave examples on severe transport problem faced during hurricane Katrina and Rita in USA. He has stressed for improved transportation network and evacuation planning in the country before, during or after an event, and ade-



quate accommodation of evacuees at refuge destinations. It was also mentioned that a multi modal transport system that provides a variety of mobility options and networks for multiple links including metro, LRT, rails, roads, paths, bridges, underpass, etc. in coherence with, advanced information and communications systems are required for proper dissemination of warning, evacuation, emergency services, etc among residents, travelers and transport authorities. Contingency plans to allocate fuel, emergency repair, mechanical operations, priority to public transport, high occupancy vehicles, repair of transport infrastructure, etc in emergencies have to be developed. He has mentioned about the 72 permanent re-settlement plan prepared by TCPO and handing over of 300 permanent houses to Tsunami victims in A& N Islands.

Mr. R. C. Sharma, Delhi Fire Services Institute, in his presentation on **“Fire Following Earthquake and Role of GIS”** highlighted various problems likely to be faced in case of post-earthquake secondary events in Delhi. Taking cue from large number of fire incidents after Indira Gandhi’s assassination in 1984, Mr Sharma stressed for creation of data base of the past fire incidents in Delhi and representing them in GIS platform for aiding policy decisions. As



preparedness measures it was suggested that static water storage tanks / over head tanks provided in new buildings as per law, can be a positive factor for fire following earthquake as the dependency is not on town mains. It was mentioned that 50% of area of Delhi is dependent on mobile water carriers. Alternative arrangements for augmentation of water are required e.g. tankers of water supply department, can be fitted with a fire service connection for easy transfer of water to the suction inlet of water tender for additional requirement.

Mr. P. K. S. Chauhan, CBRI, Roorkee, based on his presentation on **“Micro-tremor studies of Heritage buildings”** envisaged quality data collection in Delhi using Digital Triaxial Strong Motion Accelerograph (SMA) with particular reference to the Kutub Minar area. He has mentioned the damaging effect of Chamoli (1999) earthquake to the Tarang Apartments in Delhi. Ground frequency measured near Tarang Apartment and the same in the apartment buildings showed matching frequency of 1.8 Hz. The



micro-tremor data analysis from Kutub Minar, Delhi and Sun temple, Almora has shown that the natural frequency of these monuments is same for each part of the monument and is different from the ground frequency of the surrounded area. For Kutub Minar the natural frequency comes out to be 0.8 Hz. The same frequency for whole monument is a good sign for the structural integrity, but detailed investigations for other parameters are needed to comment on the health of the monument definitively.

Mr. Ashwani Luthra, School of Planning, Amritsar in his presentation on **“Disaster Risk Reduction through Urban Planning”** expressed concern about the accelerated vulnerability spread of urban agglomerations in India, which in a way have been affecting developmental perspectives. The main reason cited by the presenter are due to over-utilization as well as provocative exhaustion of the available natural resources, unprecedented migration from rural areas, unpalatable distribution of densely populated communities, greater unplanned/ haphazard development and sub-standard social and physical infrastructure in urban areas. Citing UNDP’s role in the Disaster Risk Reduction (DRR) policies, strategies and practices to minimize vulnerabilities, hazards and the unfolding of disaster impacts throughout a society, the speaker emphasized for the applications of principles & techniques of modern urban planning, good governance and legislative controls.

Ms. Mahua Mukherjee, IIT-Roorkee, in her talk on “Climatic Resiliency for Indian cities” explained various climatic control issues such as macro-micro-new urbane controls and their impact on climatic elements individually and as a whole. Climatic resiliency of Indian cities are gradually becoming distant-goal to reach. Reason being, some of the climatic controls have been heavily affected by unplanned urbanization. She has discussed the influence behaviour of the climatic elements like temperature, humidity, wind, rain, snow and radiation and mentioned about the increasing impact of Urban Heat Island (UHI), urban flood, etc. occurring in urban environment. Urban hydrological cycle in Indian cities has become significantly erratic to face both the problems of drought and flood. Water level is going down due to i) faster rate for tapping the ground water than refilling the aquifer, and ii) reduced scope to recharge has also been minimized. She explained reason for urban flood due to, high intensity rainfall; erratic spatial distribution of rainfall; inflows from rivers in the urban drainage system during high stages and inadequate and/or nonexistent storm water drain system catering intensive rain fall runoff. To elaborate the issue an example of UHI in Central Business Districts (CBDs) have been cited. Temperatures in CBDs are always 5 to 6 deg C higher and the situation is getting aggravated due to increase in hard-covered surfaces. To recreate urban resiliency, she emphasized to set a benchmark standard which supposedly be individual for every city and should indicate the condition which was existing at the earlier stage of urbanization.

Mr. Sudhakar K., SPA, JNTU, Hyderabad, while talking on **“Integrated Urban Development with Real Time Urban Hazard Information Systems - An Approach to Building Climate Resilient Intelligent Cities”** quoted the UN-HABITAT -1996 mandate that promotes concepts of inclusion, participation, collective action and sustain-

ability in the context of human settlements. The agenda spells how to bridge the gaps that repeatedly emerge between sustainable development efforts and emergency disaster relief and to provide local government, civil society, local social structures and business organizations with practical strategies and tools for mitigating and providing people centered solutions in disaster management. The Habitat Agenda recognizes the particularly deleterious impact of disasters on women and children. The speaker highlighted on the development of strategic tools for Indian subcontinent in planning and designing and development of cities that are disaster resilient against all vulnerable environmental impact. He presented a methodology for development of intelligent settlements that can handle all the extremities posed by nature and contribute to the disaster mitigation process in cities.

Mr. Ved Mittal, former Chief Architect and Town Planner, Uttar Pradesh presented on the topic “Amendments in Town & Country Planning Legislations for safety in Natural Hazard Zones of India”. He outlined about the Town and Country Planning Legislations-2004 of the States/UTs under which Regional/Sub-Regional Plan and Settlement Plans were being prepared. He observed that these documents do not define the natural hazards, nor there is any provision to identify vulnerable areas relating to floods and land slides etc. with the result that land uses proposed in such vulnerable areas results into disasters. Therefore, Techno-Legal Regime needs to be put in place to be followed while preparing existing land use maps, proposed settlement development plans with land use zoning so that Settlements including Rural and Urban are safe against natural hazards. With regards to Land Use Zoning, the speaker stated that different types of buildings and utility services are grouped under three priorities as indicated below:

Priority1. Defence installation, industries, public utilities, life line structures like hospitals, electricity installations, water supply, telephone exchange, aerodromes and railway stations; commercial centres, libraries, other buildings or installations with contents of high economic value._

Priority2. Public and Semi Public institutions, Government offices, and residential areas._

Priority3. Parks, play grounds, wood lands, gardens, green belts, and recreational areas.

In ensuring environmentally sound development of hill towns, the speaker outlined the following restrictions and conditions:

Where cutting of hill slope in an area causes ecological damage and slope instability in adjacent areas, such cuttings shall not be undertaken unless appropriate measures are taken to avoid or prevent such damages.

No construction should be ordinarily undertaken in areas having slope above 30° or areas which fall in landslide hazard zones or areas falling on the spring lines and first order streams identified by the State Government on the basis of available scientific evidence.

Construction may be permitted in areas with slope between 10° to 30° or spring recharge areas or old landslide zones with such restrictions as the competent authority may decide.

Recommendations

- ◆ There is need to develop “Real Time Urban Hazard Information System” which requires various tools for intelligent urban planning and administrative decisions based on both conventional planning techniques and real time urban information systems and people participation.
- ◆ Transport is an integral part of any development plan. In context of Disaster, it is important to develop multi modal transport system that provides variety of mobility options and networks for multiple links including metro, LRT, rails, roads, paths, bridges, underpass, etc. to each destination.
- ◆ It is important to develop capacity building of Urban Local Bodies (ULBs) in both rural and urban areas in terms of preparedness against disaster risks. Techno-legal regime needs to be put in place to be followed while preparing existing land use maps, development plans, zoning regulations against natural hazards.
- ◆ It is important to develop “Risk and Vulnerability Analysis” model in regional context. It will assess hazard components and predict the same to a certain extent. It can help in reducing the vulnerability of settlements to risks.
- ◆ To recreate urban resiliency, it is to be emphasized to set a benchmark standard which supposedly be individual for every city and should indicate the condition which was existing at the earlier stage of urbanization.
- ◆ Fire followed by earthquake has potential to go well beyond the statistics of death and injuries. Delhi Fire Service has developed data base, which locate all areas where the hazards have occurred and it is a useful measure for evolving certain policy decisions.
- ◆ Urban Planning is a major tool, which reduce disaster risks. Techniques of modern urban planning, good governance and legislative controls can prove to be valuable framework to reduce the risk of disasters in urban areas.
- ◆ Disaster Risk Reduction (DRR) policies, strategies and practices to minimize vulnerabilities, hazards and the unfolding of disaster impacts throughout a society, it is to be emphasized for the applications of principles & techniques of modern urban planning, good governance and legislative controls.
- ◆ Techno-Legal Regime needs to be put in place to be followed while preparing existing land use maps, proposed settlement development plans with land use zoning so that Settlements including Rural and Urban are safe against natural hazards.

Corporate Sector in Disaster Management

Concept Note

“Without question, business must respond for their own good, and what is good for them is invariably good for the community”

- Nelson Mandela

Globally disaster risk mitigation and management is now taken up as everybody's business. It is increasingly realized that private, or more appropriately, corporate sector cannot remain insulated from either the effects of increasing natural disasters or the responsibilities of reducing the risks of disasters. Corporate sector depends on community at large for sustenance, not only as a source of labour, capital and material but also as a market for products and services. If the community life itself is destroyed by disaster the lifeline of the corporate gets threatened. Further in a globalized economy market in the remotest part is integrated by a long supply chain, which is disrupted by disasters.

The Pan American Health Organisation in 1991 urged the private sector to transcend concerns about its own security but “to cross over the fence” into neighbouring community to assist in preparing disaster resilient plans. The Yokohama strategy (1994) called for “integration of the private sector in disaster reduction efforts through promotion of business opportunities”. The Hyogo Framework for action 2005-2015, strongly advocates corporate roles in reducing disaster risks of communities. High Power Committee (1999) formed in

India stressed the need for a multi-sectoral approach by way of integrating the participation of all stakeholders into a comprehensive whole. It has also advocated setting up of system where private sector efforts could be integrated with national efforts.

There are three main ways in which corporate sector contributes to the process of disaster risk reduction:

- ◆ Corporate Social Responsibility (CSR) in supporting relief, rehabilitation and risk reduction activities;
- ◆ Redefining the business continuity plan to factor in hazards, risks and vulnerabilities;
- ◆ New business opportunities created in disaster reduction due to the increase in emphasis on risk reduction.
- ◆ Corporate Social Responsibility

Historically business houses have been spending money on disaster relief and rehabilitation on following grounds:

- ◆ It helps community in distress;
- ◆ It helps community to bounce back as ultimate consumers as also producers and therefore helps to sustain business;
- ◆ It improves the image and public relations of the company;
- ◆ It attracts tax concessions.

In many countries big business houses have their own non-profit organizations which run a range of social projects on education, health, community development and entrepreneurship development etc which reduce disasters in the long run.

Smaller business houses mainly contribute to projects run by NGOs. Government can create an enabling environment for greater corporate sector investment in disaster risk reduction activities through innovative partnership. A few examples of such partnerships are: APELL (Awareness and Preparation for Emergencies at the Local Level): It involves private sector, government and people to raise awareness of communities to prevent technological accidents. This network has been supported in a number of countries by United Nations Environment Programme; DRN: (Disaster Resource Network). This network is run by Construction Federation of India to encourage safe construction practices; IDRN (India Disaster resource Network): This is a web based inventory of human and material resources on disaster response.

Most of the Asian countries are highly vulnerable to natural hazards. Many Asian countries are also on a high trajectory of economic growth and most of this growth is driven by private investments. A large part of such investments are taking place in geographical areas that are highly prone to hazards. Big businesses have generally withstood such risks due to scale of their operations. Multi-national companies and large corporate houses have developed mechanisms for integrating risk reduction into investments. However many small businesses have suffered and gone out of business due to disasters. Documentation and concern for such losses have generated demand and need for enhanced capacity building for preparation of good business continuity plans. Many business schools are showing their interest in developing tools and methodologies for retrofitting investments especially in hazard prone areas. Government regulations in many countries have made it mandatory for preparation of off site and on site risk reduction plans, which has created the demands for such services.

Increasing emphasis on disaster risk reduction at the global, regional and national levels have created new opportunities for business. For example, there is a new wave of investments on the following areas: GIS based risk assessment and mapping by spatial data integration; Early warning and disaster communication; Retrofitting structures in high seismic zones; Recharging deep underground aquifers with surplus flood water for use in peak demand. Enabling policy framework is needed at the national level to promote further investments and research for such projects.

The Kyoto Protocol on Climate Change has committed industrialized countries to invest in emission reducing Clean Development Mechanisms in developing countries. The potential size of CDM market is estimated 144-723 MtC in terms of emissions and US\$ 5-21 billion in terms of annual value. The CDM would open windows of opportunities for

disaster risk reduction and sustainable development through transfer of resources and technologies. Again an enabling policy and regulatory framework is needed in many countries to take benefit of such projects.

Various innovative models of Private-Public-Partnerships are emerging in many countries for promoting multi-sectoral partnerships on disaster risk reduction under the leadership of the private sector. Some of the examples of such innovative models are: Private-Public-People Partnership - private sector joining hands with government and community based organizations for risk reduction programs at local level. Example: Bhagidari of Delhi; Pro-Poor Public-Private Partnerships designed to government, civil society and NGOs coming up. Proactive attract investment and technology in dry land areas policy interventions of national governments shall for production of high value food commodities and encourage such innovations on disaster risk reduction for creating supply chain in a globalize economy with minimal direct investments of government.

Proceedings

In his inaugural address, Mr. Shyamal Ghosh, DSCI, Chairperson of the session stated that corporate sector depends on community at large for sustenance, not only as a source of labour, capital and material but also as a market for products and services. If the community life itself is destroyed by disaster the lifeline of the corporate gets threatened. Further in a globalized economy market in the remotest part is integrated by a long supply chain, which is disrupted by disasters. High Power Committee (1999) formed in India stressed the need for a multi-sectoral approach by way of integrating the participation of all stakeholders into a comprehensive whole. He has also advocated setting up of system where private sector efforts could be integrated with national efforts.



Three main ways in which corporate sector contributes to the process of disaster risk reduction are Corporate Social Responsibility (CSR) in supporting relief, rehabilitation and risk reduction activities; Redefining the business continuity plan to factor in hazards, risks and vulnerabilities; New business opportunities created in disaster reduction due to the increase in emphasis on risk reduction.

Mr. N. Murali, Standard Chartered Bank, while giving his presentation on “**Lessons Learnt and Public Private Partnership in Business Continuity**” mentioned about the pros and cons of effective disaster response. The speaker said “the best plans are the ones where the government, Corporates and NGOs are prepared and know how to interact during an emergency effectively and this requires an effective Public Private Partnership frame-

work. A legal framework for PPP is not in place yet, if done carefully, it can help remove impacts of individual priorities for the collective good. He mentioned about the good efforts made by Government soon after Kumbakonam fire accident, but no sustenance persisted. He has stressed on the importance of making proper framework on effective response to disasters and business continuity. Some of important issues mentioned by the speaker were: Corporate partnership (consortium) during any exigencies, sharing knowledge on emergency response (Golden Hour) with larger society, upfront planning through interaction between public & private sector during disasters, leverage strengths of each sector through the partnership forum and regular interaction with governmental agencies for knowledge dissemination to staffs.



Mr. K. J. Devasia, Bangalore International Airport Ltd. made presentation on **“Disaster Management in Indian Aviation Sector: A Bangalore Greenfield Airport Model”**. The speaker thanked the government for opening of Indian sky to private players and the Indian Airports to Corporate Promoters that have initiated a revolutionary change in approach to aviation safety and disaster management. The most advanced technologies and approaches in aviation emergency management, which was a product of the western world, has been brought to India by the first Greenfield Private Airport of the country, Bangalore International Airport.

The presentation highlighted the pioneering effort and the role model that Bangalore international airport has instituted for managing civil aviation disasters and to ensure business continuity management. Sticking to the national and international air safety guidelines and imbibing the real spirit of National Disaster Management Act -2005, Bangalore International Airport has developed a state-of-the-art, and a foolproof airport disaster management system, the only one of its kind in the civil aviation sector, which has also been projected as role model to many airports in India and abroad.

The speaker in his concluding remarks stated that the emergency management system across Indian Civil Aviation airports may be integrated and a common standard based on the ICAO guidelines and prevailing Indian regulations may be adopted for World class management of aviation emergencies. Various Indian civil aviation Acts and the National Disaster Management Act needs to be synchronized, so that conflicts in managing civil aviation emergencies could be avoided. So far emergency response and management was the only focus area in Indian airports. Appropriate regulations should be made to ensure Business Continuity Management in civil aviation sector, a mandatory requirement.

Mr. Karthik Vaidyanathan, Microsoft India R&D Pvt. Ltd, Bangalore spoke on **“Government policy and guidelines on Corporate Business Continuity Planning”**. The speaker

explained the role of corporate social responsibility that several business houses have been spending money on disaster relief and rehabilitation because It helps community in distress; It helps community to bounce back as ultimate consumers as also producers and therefore helps to sustains business; It improves the image and public relations of the company;

The speaker stated that in many countries big business houses have their own non-profit organizations, which run a range of social projects on education, health, community development and entrepreneurship development etc. which helps in reducing disasters in the long run. Smaller business houses mainly contribute to projects run by NGOs. Government can create an enabling environment for greater corporate sector investment in disaster risk reduction activities through innovative partnership. The speaker also mentioned that, there is a growing awareness among business houses in India on the need for business continuity as well as an increase in the number of threats which could possibly disrupt their business operations. A well defined government policy or guidelines specific to business continuity would immensely benefit the corporate sector to setup and execute realistic business continuity plans.

Mr. Patrick Kishore, State Bank of India, Mumbai spoke on **“BCM in a disaster affected area”**. Mentioning about the heavy loss of life and property in Bihar flood-2008, the speaker heighted the problems faced in the affected area such as Madhepura, Supaul, Sajarsa along with 28 branches of SBI which have been affected. People were unable to withdraw cash due to unavailability of banking services in affected areas where 12 branches got fully flooded. SBI initiated measures to provide minimum banking services in the relief camps, and also provided services using mobile units for 35 days as one of the business continuity operations. The speaker defined BCM as “a holistic management process that identifies potential impacts that threaten an organization, and provide a framework for building resilience and the capability for an effective response that safeguards the interest of its key stakeholders, reputation, brand and value creating activities”.

A special presentation was made by Mr. Venkataram Arabolu, BSI India, on **“Corporate sector in Disaster Management”**. Some of his suggestions were minimise the potential risks by developing disaster early warning strategies; prepare and implement developmental plans to provide resilience to such disasters; mobilise resources including communication and tele-medicinal services; and help in rehabilitation and post-disaster reduction

The speaker identified some gaps and challenges in the following five main areas i.e. governance: organizational, legal and policy frameworks; risk identification, assessment, monitoring and early warning; knowledge management and education; reducing underlying risk factors; and preparedness for effective response and recovery.



Mr Dhiraj Lal, Country Manager, BCM Institute India, summed up the discussion and presented the recommendation of the session.

Recommendations

◆ **Business Continuity Plans:**

Multi-national companies and large corporate houses have developed mechanisms for integrating risk reduction into investments. However many small businesses have suffered and gone out of business

due to disasters. Documentation and concern for such losses have generated demand and need for enhanced capacity building for preparation of good business continuity plans. Many business schools are showing their interest in developing tools and methodologies for retrofitting investments especially in hazard prone areas. Government regulations in many countries have made it mandatory for preparation of off site and on site risk reduction plans, which has created the demands for such services.

◆ **New Opportunities for Business:** Increasing emphasis on disaster risk reduction at the global, regional and national levels have created new opportunities for business. For example, there is a new wave of investments on the following areas i.e. GIS based risk assessment and mapping by spatial data integration; early warning and disaster communication; retrofitting structures in high seismic zones; and recharging deep underground aquifers with surplus flood water for use in peak demand. Enabling policy framework is needed at the national level to promote further investments and research for such projects.

◆ **Innovative Public Private Partnership:** Various innovative models of Private-Public-Partnerships are emerging in the country for promoting multi-sectoral partnerships on disaster risk reduction under the leadership of the private sector. Some of the examples of such innovative models are:

- Private sector joining hands with government and community based organizations for risk reduction programs at local level. Example: Bhagidari of Delhi;
- Pro-Poor Public-Private Partnerships needs to be designed to attract investment and technology in dry land areas for production of high value food commodities and for creating supply chain in a globalized economy.



Role of Media and Disaster Management

Concept Note

Reducing the losses of life and property caused by natural hazards is a compelling objective now receiving worldwide attention. It is now being increasingly believed that the knowledge and technology base potentially applicable to the mitigation of natural hazards has grown so dramatically that it would be possible, through a concerted cooperative international effort, to save many lives and reduce human suffering, dislocation, and economic losses simply by better information, communication and awareness. Timely mass media communication about impending disasters can lead to appropriate individual and community action, which is the key to implementing effective prevention strategies including evacuation and survival of people. Such communications can educate, warn, inform, and empower people to take practical steps to protect themselves from natural hazards.

The role of media, both print and electronic, in informing the people and the authorities during emergencies thus, becomes critical, especially the ways in which media can play a vital role in public awareness and preparedness through educating the public about disasters; warning of hazards; gathering and transmitting information about affected areas; alerting government officials, helping relief organizations and the public towards specific needs; and even in facilitating discussions about disaster preparedness and response. During any emergency, people seek up-to-date, reliable and detailed information.

The main principle of information provision, therefore, should be an ethical one: and so, during an emergency, the media should be sensitive to the needs of the public in affected areas and should avoid misinforming and broadcasting unconfirmed reports that may lead to despair and panic. Therefore, correct and reliable information disseminated through the media is an important instrument for balancing the possible effects of incorrect, misleading or even willfully distorted information. Reliable and timely information provided through the media can help people overcome any kind of fear and fatalism during and after an emergency. Indeed, the availability of reliable and timely information and knowledge about an event and the resulting needs help to improve solidarity and also creates an atmosphere conducive to collective response for sharing the humanitarian challenges created by disasters. Media today has arguably penetrated every household in the world, in one form or another. Journalists pride themselves in reporting objectively on global events and regard an independent media as one of the pillars of democratic society.

Proceedings

The session on “Role of Media in Disaster Management” was organized in the form of a panel discussion with Mr. W.Q. Naqvi, Aaj Tak, Mr. Ravish Sharma, NDTV and Dr. Santosh Kumar, NIDM as panelists. The objective was to initiate a dialogue among various stakeholders on issues related to the role of media during disaster events and also, to generate ideas on a standard code of conduct for print and electronic media covering such events. The panel discussion focused on the role of government agencies, civil society and other organizations in informing the media and clarifying various issues that come to the centre stage during, before and after disasters. The responsibility of media in covering disaster events, recovery and mitigation initiatives was discussed.



Mr. Naqvi voiced his concern that authentic information on disasters is generally not forthcoming and in the absence of the same, the news channels are generally unaware about the reasons for a disaster event. It was stated that it becomes difficult for the journalists to get hold of experts who can provide complete information during any emergency situations and even if media tries to gather details, their attempts at times remain unsuccessful in bringing out the factual information of the disaster event.

Mr. Naqvi reiterated that the role of media, both print and electronic, in informing the people and the authorities during emergencies is critical and that timely communication about impending disasters can help the community for appropriate for effective evacuation and follow up action. There was a consensus that such vital information can educate, warn and empower people to take practical steps to protect themselves from natural hazards, timely.

The participants asked questions on the issue, such as, access to updated, reliable and detailed information during emergencies which becomes a challenge. It was agreed by all that such information must be ethical and also that the media should be sensitive to the needs of the public in affected areas and should avoid misinforming and broadcasting unconfirmed reports that may lead to despair and panic.



Since, the media is a powerful instrument for disaster communication; it is the earnest responsibility of the media to ensure that conflicting and factually incorrect information is avoided. The panelists' were of the view that media ethics is an important aspect of media reporting during any disaster event.

Mr. Ravish mentioned his concern about the dilemma of journalists/ reporters for not being able to determine what is right and choosing the best from several alternatives. He spoke about the need to have ethics, set guidelines or codes so as to help journalists and other media workers for appropriate and correct reporting. It was agreed that the media can play important role in creating awareness about the risks of different natural hazards and disasters. Similarly, media can take into account and report post disaster recovery and reconstruction activities.



Mr. Ravish while sharing his personal experience of covering disaster events especially on the aspects of provision of relief work mentioned that most of the time, relief is provided in bulk, neglecting the need of the people in specific and a lot of such relief materials remain unutilized, which only adds to the chaos of the relief activities and therefore, it is important that before any relief work begins, proper identification of relief requirements should to be worked out.

During the discussions, concerns were expressed on the impact of VIP movements, which hampers the relief work. In this regard, various suggestions were given by the participating delegates.

Co-ordination issues were also discussed at length. It was mentioned that, each state should have a dedicated department catering to the needs of disaster management and may also provide the exact information to all concerned.

The entire discussion culminated to suggest the need, to re-examine the role media plays in disaster management and the interdependencies among the various stakeholders. It also calls for a review of spoken and unspoken rules in dealing with the media, what works and doesn't work, and how best we can manage the fragile balance between sharing information and protecting the public and corporate interests.



Recommendations

- ◆ Timely mass media communication about impending disasters can lead to appropriate individual and community action, which is the key to implementing effective prevention strategies including evacuation and survival of people.
- ◆ The role of media, both print and electronic, in informing the people and the authorities during emergencies is critical. Media can be effectively used for creating awareness and preparedness and information sharing for the larger benefit of the community.
- ◆ The media reporting should be based on ethical norms and that media must avoid misinforming and giving unconfirmed facts/inputs that may lead to despair and panic. Thus, ethical code should set guidelines and principles for media reporting.
- ◆ Media can play a role in preventing unfounded rumors and avoid exaggerated and negative reporting.
- ◆ Media can be an impressive mode in assisting authorities, voluntary organizations and volunteers in reaching, informing and assuring the affected ones of the assistance and measures taken for their relief.
- ◆ In order to discharge its duties efficiently during exigencies, it is necessary to have a complete coordination between media and Government agencies and this, calls for a two-way cooperation and sharing of relevant information from the Government side as well.

Post-Disaster Recovery and Reconstruction: International Experience and Best Practices

Concept Note

Despite all the efforts made at the global, national and local levels for the past two decades, natural disasters are on the rise and there is every indication that disasters would continue to rise due to the increasing exposure of vulnerable population and assets to the risks of disasters. The impacts of climate change and rapid urbanization, particularly in the developing countries, would be compounding the frequency and intensity of disasters.

Although average loss of life and injuries in disasters has reduced over the years, the mega disasters have been recurring at regular intervals with large scale damage of life and property.

Recovering from the disasters and reconstructing the lives of households, communities, cities and villages that involve multiple sectors - housing, infrastructure, livelihood, health, education, environment etc - have been one of the daunting tasks of sustainable development.

Wealth of experiences - good and bad - are available from the reconstruction efforts after many disasters around the world. There is a need to document and learn from these experiences, develop tools and methodologies for pre-disaster recovery planning and upgrade the knowledge and skill of all those stakeholders who would be involved in the assessment of damage and loss after disasters, planning of recovery and reconstruction and implementation of the plans in their different phases.

The Thematic Session on Post-Disaster Recovery and Reconstruction: International Experiences and Best Practices would bring together resource persons from around the world to present their experiences and discuss various issues of recovery and reconstruction.

Proceedings

Mr. Christoph Pusch of World Bank initiated the session by inviting Mr. V. Suresh, Ex-Chairman, HUDCO to preside over.

Mr. V. Suresh, Chairperson welcomed the participants and informed that there will be 7 presentations, sharing their international experiences and best practices in post disaster recovery and reconstruction. He gave



a brief background of the presenters and the thrust of their presentations. The presentations were focused on 2004 Tsunami, Gujarat and Pakistan Earthquake, Istanbul Reconstruction Projects and SAARC initiatives etc. In this regard, it was stated that the post disaster recovery and reconstruction practices, particularly experiences of Lator Earthquake, Uttarkashi Earthquake, Orissa Cyclone and Gujarat earthquake are very important as there are a large



number of lessons to be learnt from each case to rectify the past mistakes and to ensure that the same are not repeated. It was mentioned that post disaster recovery and reconstruction is a very important phase which concerns the affected people and lives of the survivors.

The Chairperson, thereafter, invited Mr. Salih Erdurmus, a Senior Civil Engineer, Istanbul Governorship, Istanbul Project Coordination Unit who gave a presentation on **“Istanbul Seismic Risk Mitigation and Emergency Preparedness Project”**. He started by presenting the demographic information and data regarding various natural disasters in Turkey. He gave an overview of Marmara Earthquake that happened in 2003. It was mentioned that in the last earthquake, around 7480 lives were lost and 55000 people got injured. Around 1 million people were rendered homeless resulting into a financial loss of about US\$15 million. In addition, the economic loss was to the tune of US\$10-15 million. He elaborated on the collapse of communication systems, lack of organization and coordination in search and rescue activities, bureaucratic inefficiency and inefficient logistics support. As a result of these inadequacies, Turkey lost a great deal of infrastructure, public buildings, mainly because the development was done with ignorance on various hazards. After the Marmara Earthquake, Government of Turkey initiated various correctional measures, such as, establishing Disaster Emergency Management Agency, to reconstruct and streamline institutions, and define responsibilities for Disaster Management. Secondly, a National Emergency Programme was set up wherein the compulsory insurance was started for residential buildings. This was aimed to minimize and to transfer risk from state budget. It was also highlighted that consequent to the Marmara Earthquake there was a paradigm



shift in the strategy from rehabilitation and recovery to mitigation and preparedness.

Mr. Salih Erdurmus, thereafter, briefly shared information on the seismic risk in Istanbul. It was mentioned that the probability of another disaster is very high in next 30 years. In view of this, it was mentioned that they are implementing a new project (Istanbul Seismic Risk Mitigation and Emergency Preparedness) to meet the challenges of a future seismic risk. This project has 3 main components: a) strengthening emergency management capacity; b) seismic risk mitigation for buildings; c) enforcement of building codes. The details of these components were elaborated. A special mention was made about the government initiative in securing the public buildings such as schools, hospitals and other important buildings where retrofitting work has been completed and multi-hazard and earthquake retrofit evaluation of cultural heritage buildings in Istanbul has also been undertaken. He concluded his presentation by highlighting various government initiatives undertaken to make buildings safe. Such initiatives also included training of civil engineers, vulnerability assessment, damage assessment etc. The presenter stated that their motto of disaster management is to ‘strengthen their future’.

Mr. R. Bannerji, Gujarat State Disaster Management Authority gave a presentation on **“Build Back Better – The Gujarat Experience”** in which he shared the experience of Gujarat Earthquake. He gave details of loss of lives, damage to buildings, livelihoods etc and mentioned that the devastating earthquake has severely affected the livelihood of the people in a big way. He went on to explain the government initiatives on each sector and elaborated as to how Government of Gujarat has taken action to reconstruct damaged buildings and various other measures for social rehabilitation of the affected people.

The Gujarat experiment, especially on housing was explained in detail along with the problems faced by the Government agencies on relief and rehabilitation and reconstruction. It was mentioned that while working on various choices, the policy options depended a) on the mindset of people; b) on governance conditions; c) institutions that have been embedded well before a reconstruction takes place; and d) pre-disaster governance conditions to a very large extent which determine the success or efficacies of the policies.

The importance of a sound government structure for any meaningful and sustainable reconstruction and rehabilitation programme was highlighted. All rehabilitation and mitigation projects are to be planned based on the strength of the Government structures and institutions at grass root level. In this regard, the approach of the Government of Gujarat was explained in the reconstruction of damaged houses. The various options that were available to the Government, and the model adopted by them regarding ‘owner driven reconstruction’ plan was elaborated. Various processes such



as creating material banks, opening bank accounts, joint ownership of houses and importance of third party audit was explained. The Government's output was driven by the dissemination of information and educating the public which is the essence of getting things done right way. The government endeavoured on capacity building and training, and that about 29000 masons and 6000 engineers were trained in hazard resistant construction techniques.

The presentation on Gujarat experience highlighted the following lessons that have been learnt in the recovery and reconstruction phase:

- ◆ There was an owner driven reconstruction demand than the government driven, contractors driven or donor driven reconstruction.
- ◆ The control of the cost of construction material is critical in making sure that costs do not balloon away. In this regard, government of Gujarat took initiatives to provide construction material at controlled prices.
- ◆ Government structure at the grass root level and district level is vital for success of reconstruction initiatives which resulted in better town planning decisions.

While concluding his presentation, Mr. R. Bannerji also highlighted the shortcomings for further improvement. These are:

- ◆ The PPP structure between NGOs and government did not yield satisfactory results.
- ◆ It was pointed out that for any reconstruction planning, the people's satisfaction should be the core of planning activity. In this regard, it was explained that the people's satisfaction is driven by a distinct preference of relocation, a preference for having a house of at least of same size, as have been before and a preference of a house design which will have a scope of future expansion etc.
- ◆ A comprehensive insurance scheme was introduced whereby a householder was ensured against 14 different calamities for a period of 10 years at a nominal amount of Rs. 367/-.
- ◆ On multi-lateral funding, it was stated that there is a need for a careful approach while seeking such funds. The Gujarat initiatives were without the international monetary support.

The Gujarat experiment brings home two major thrusts in paradigm shift; (a) built back better and (b) that the public expenditure compensates for the public losses to the infrastructure. The private losses have to be borne by markets to the extent possible through insurance.

Mr. Keshav Verma, from World Bank Institute gave a presentation on “**World Bank Aceh Infrastructure & Housing Program**” in Indonesia after the Tsunami disaster. The presentation started with an overview of the Tsunami disaster in Indonesia and the response of Indonesian Government. Mr. Verma



appreciated the quick response of the Government and the people to start the process of reconstruction for which a multi-donor trust fund was established. He gave details of two projects which he handled. One project was directed towards building capacities for the DRR for which special agency was created to handle investments that were pouring in. The idea was, to first build the capacities at regional and local level and then develop the project of infrastructure development. He briefly gave details of the project implementation and the progress thereof. He elaborated on the procurement, material management and importance of high intensity field inspection and supervision. He shared his experience of handling the pressures during project implementation and to show results in a time bound manner, and the pressure to ‘build back better’. He mentioned, that in the process, the need for community involvement at the time of planning, lay out of the houses was very important. He appreciated the unbelievable dedication of the people, and concluded by saying that the community involvement in the process of rebuilding eases the trauma.

Mr. C. V. Shankar, from National Disaster Management Authority gave a presentation on **“Reconstruction Experience in Tamilnadu after Indian Ocean Tsunami in 2004”**. While giving an overview of the damage, it was mentioned that 90% of the people who were affected were fishermen. Therefore, the entire reconstruction planning regarding housing was done to the extent possible depending on factors as to how far the fishermen are close to the sea and at the same time, the new locations should be safe. It was decided that in terms of disaster preparedness, the communities are required to be trained adequately to



meet the future challenges. It was informed that lot of work was done for replacement of assets and infrastructure. Tamilnadu Government is working with the World Bank to have a long term fisheries policy to ensure that fisheries sector remains sustainable. On housing sector, it was mentioned that the housing reconstruction planning was guided by the Gujarat model incorporating disaster resistant features. The houses were in the joint name of wife and husband and government took the responsibility of providing land and specifications for the entire reconstruction to avoid over-costing etc. The reconstruction programme was also extended to those houses which were not damaged by Tsunami but are highly vulnerable. It was decided to extend the programme to build houses for these people as well. The other features like evacuation shelter, evacuation rooms were added to reduce vulnerability. To support livelihood and economic activities, some revolving funds were given along with skill training. Bank subsidy and loans were added. In the process of reconstruction, efforts were made to involve community in a big way. Vil-

lage level committees and district level committees were formed which had the list of beneficiaries for each village. It was mentioned that because of the government's untiring efforts, there is not a single case where a person is not rehabilitated. Government of Tamilnadu made a policy to get a proper feedback from people, NGOs and others. The initiatives were also taken to focus on children education and gender issues.

Prof. Rajiva Wijesinha, Ministry of Disaster Management and Human Rights, Sri Lanka made a presentation on

“Tsunami Recovery in Sri Lanka”. It was mentioned that 14 districts in the coastal belt in Sri Lanka were severely affected by the Tsunami. Around 25000 persons were dead and more than one million persons were affected. It was mentioned that the Tsunami devastation left many disabled, widows & orphans. Housing and education sectors were severely affected. The estimated cost of damage to health



sector is US\$ 100 million. Loss to employment was 275,000. He elaborated on damage to other infrastructure such as railways, telecommunication, power etc.

The overview on extensive damage was followed by detailing the strategies adopted by the state. It was mentioned that a high level political committee involving all parties were formulated and three task forces were appointed by the Government which looked after rescue and relief, reconstruction, logistics and law & order. The estimated value of the various relief packages was Rs. 13530/- million. It was mentioned that after the Tsunami disaster, RADA was established which is a single Government Agency to focus on short-term and long-term reconstruction and development issues. In the process of redevelopment the most important need was for community based knowledge and empowerment of communities. The Government of Sri Lanka has done it through two processes i.e. the recovery process, and the mitigation and training.

The achievements on rescue and relief phase and reconstruction was elaborated. It was mentioned that there is complete rehabilitation of infrastructure facilities and 95% of the livelihood has been restored. The presentation concluded by highlighting the lessons learnt. These are:

- ◆ Need to have a properly developed disaster management system network for the country.
- ◆ A coordinating mechanism for the donor community, NGO's. In particular, mechanisms are required to prevent duplication of work and to ensure that all programmes are in accordance with Government policies and priorities.
- ◆ Strengthening the administrative capacity at the provincial-district levels, and reporting mechanisms.
- ◆ Participatory approach for the community level projects.

- ◆ Maintaining a desirable balance between macro level economic development and reconstruction.

Lt. Gen (Retd) Farooq Ahmed, Chairman National Disaster Management Authority of Pakistan gave a presentation on **“Earthquake Reconstruction & Rehabilitation Programme in Pakistan”**. At the outset, he briefly stated about the scale of devastation and the damage cost by the earthquake followed by the steps initiated by the Government of Pakistan in the relief, reconstruction and rehabilitation phase. It was mentioned that Earthquake Reconstruction and Rehabilitation Authority was created with basic mandate of coordination among various agencies and monitor the implementation of rehabilitation and reconstruction schemes.



He further elaborated on Pakistan’s broad reconstruction framework which included capacity buildings initiatives, implementation mechanism, multi-stakeholders consultations and policy formulations. Internal audit and third party validations, fund raising and its management were the other initiatives which were briefly brought out. It was stressed that in order to speed up the reconstruction activities, certain time lines are to be met for which it is very essential to build and enhance the capacities of the manpower. In this regard, it was mentioned that 2,50,000 people in various disciplines have been trained and this target could not have been possible without huge social mobilization initiatives.

On media policy and knowledge management, it was mentioned that flow of information from top to bottom is key to success. Regular dissemination of information nationally and internationally kept people informed about the progress on Government’s action. He elaborated on the progress achieved in reconstruction particularly on rural housing which is substantial, wherein 95% houses have been completed and remaining 5% are under construction. He also informed about the progress achieved in health, education, roads, bridges and other infrastructure sectors.

On social protection and livelihood, the various measures taken by government were presented which included cash grants, land to landless people, relocation of people, skill development training, legal aid, medical rehabilitation etc.

He concluded his presentation by highlighting the lessons learnt. These are:

- ◆ A dynamic organizational structure with central policy planning and decentralized implementation mechanism will ensure equitable and flexible policies.
- ◆ Involvement of all stakeholders in policy planning and critical decision making to ensure ownership by all, makes implementation easy.

- ◆ Develop customized procurement system, financial management systems, Planning to enhance efficacy.
- ◆ Information Sharing and Coordination is the key to success. Develop structured mechanisms to coordinate activities and share best practices.
- ◆ Open, transparent and accountable systems enhance donor confidence.
- ◆ Prioritize sectors in accordance with the need so as to retain focus on critical programs.
- ◆ Multi sourced reconstruction efforts by donors, sponsors and the government, with centralized design approvals and monitoring but decentralized implementation to help meet time lines.
- ◆ Equal emphasis on software interventions to build human resource capabilities to ensure better management and improved service delivery.
- ◆ Risk reduction, gender balance, environmental safeguards and social protection of vulnerable be mainstreamed into all sectoral developments to ensure long term sustainable gains.
- ◆ Donor be encouraged to provide budgetary support instead of project specific support.
- ◆ Alternative fast construction technologies be encouraged right from the outset, to meet the target objectives within the given time line.
- ◆ A decentralized grievance redressal system to ensure speedy dispensation of justice to the affected population.
- ◆ A well thought out pro active communication strategy for multiple stakeholders to avoid misperceptions, manage expectations and ensure effective dissemination of information.
- ◆ Owner driven and community owned development is beneficial for long term sustainability.

Mr. P. G. Dhar Chakrabarti, Executive Director, National Institute of Disaster Management gave a presentation on **“Towards Development of Comprehensive Framework of Recovery and Reconstruction in South Asia”**. He mentioned that every disaster is unique in its own way, therefore, disaster reconstruction recovery experience is also unique. Elaborating the disaster prone South Asian scenario, the vulnerabilities of the people living in South Asia, he presented an overview of mega disasters in South Asia since 1970. It was informed that there were 1132 events of disasters leaving 9,00,000 people dead. Despite so many disasters, there are only 4 main examples of reconstruction. The Government’s efforts were mostly restricted to relief and rehabilitation assistance only.

With this backdrop, it was mentioned that during last 5-7 years, the South Asian scene has improved in terms of disaster preparedness. As a result of which, the number of people dying in disasters has reduced substantially. In this regard, he elaborated on



Government's efforts in Kosi, Karnataka and Andhra Pradesh floods and highlighted the capacity building initiatives and community based preparedness to handle such disasters. In view of various successful experiences in handling disasters, he mentioned about 5 lessons learnt in recovery. These are:

- ◆ It is possible to reduce loss of life and property through preparedness.
- ◆ Preparedness is necessary at every level – national, provincial, local and community.
- ◆ Preparedness is necessary in every sector.
- ◆ Pre-Disaster Recovery Planning to ensure better coordination among various sectors in different levels.
- ◆ Such planning needs to be formalized in the shape of manuals and Standard Operating Procedures so that there is no confusion during and after disasters.



While talking about the need for preparedness, he stressed that Disaster Management Mechanism should be in place to meet the challenges of any disaster and our endeavour should not only be restricted to mainly rescue and relief.

Mr. Chakrabarti elaborated the 5 basic principles of recovery. These are:

- ◆ **Holistic** – to provide housing, infrastructure, education, livelihood, health, psycho-social care etc.
- ◆ **Long term** – to provide livelihood support including development of skill, provisioning of credit and marketing support etc
- ◆ **‘Build back better’** – to ensure that houses and infrastructure constructed after disasters withstand the hazards and risks of nature and the hazards do not become disasters again
- ◆ **Sustainable** – to integrate environmental issues, such regeneration of mangroves, conservation of water,
- ◆ **Inclusive** – to care for poor and vulnerable - women, children, aged, physically and mentally challenged people

While stressing the need for a recovery framework, it was mentioned that in South Asian scenario we have only damage assessment, whereas the requirement is of needs assessment based on scientific basis, and that, for any meaningful assessment of the needs, the involvement of community should be there along with proper training on damage assessment, loss assessment and needs assessment in a scientific way. On the recovery planning, it was mentioned that there are 3 phases;

- ◆ Short-term (0-30 days): Search and rescue, Emergency health, Temporary shelter, Food, clothes, Restoration of critica, infrastructure (power, telecom, water)

- ◆ Intermediate (1 to 6 months): Intermediate shelter, Health Care, Continuation of support, for food, clothes etc., School and day care, Resource mobilization, Institutional mechanism
- ◆ Long-term (6 months to 3 years): Permanent housing, Livelihood support, Restoration of physical, Infrastructure, Reconstruction of social infrastructure, Psycho-social recovery, Documentation

He concluded his presentation by pointing that resource mobilization is going to be the critical factor for any long term rehabilitation framework. ‘The multi-lateral funding is one such source, but this can not cover all the costs of reconstruction for all the disasters, and therefore the national governments must devolve mechanisms for funding recovery and reconstruction programmes in their budget or develop innovative initiatives like special funds for catastrophic disasters, risk pooling, risk insurance etc.’

Outcome Document

The Outcome of the Congress and its main recommendations were discussed in Plenary in the three sessions.

Geological Disasters

The first session covered the Geological Disasters (Earthquakes, Landslides and Avalanches) and was chaired by Dr. R. K. Bhandari

Under the thematic cluster Geological Disasters, a total of 132 abstract of papers were received (Earthquake, 55 and Landslides, 77), including 12 papers from abroad that bring added experience, lateral thinking and technology to our advantage. Between them, they cover the entire gamut of concerns associated with earthquake and landslide risk reduction, although spotlight was seen

on the states of Jammu and Kashmir, Gujarat, Himachal Pradesh, Uttarakhand, Sikkim, West Bengal (Darjeeling District), Meghalaya, Nagaland and Mizoram and the tsunami affected coastal states. The reported announcement of a national policy on disasters, the already promulgated National Disaster Management Act, the release of NDMA Guidelines on Earthquakes, Landslides and Snow Avalanches, and

the much talked about aim of achieving a paradigm shift in focus from the relief centric disaster management to the culture of disaster mitigation and preparedness raise our hopes that everything possible will be done to vigorously implement the related action plans, in a time bound manner.



The highlights of the Technical Session on Earthquakes

- ◆ One of the major concerns expressed at the conference was avoidable deaths due to building collapse. Besides the large highly vulnerable existing housing stock where people live under constant threat of earthquakes, non-compliance of seismic design codes and unchecked non-engineered new constructions add considerably to our woe and worry. The delegates underscored the urgency of speedy implementation of the National Guidelines on Earthquakes released by the NDMA in April 2007 and since two years have already elapsed, it is time for stock taking and midcourse correction.
- ◆ The mission of earthquake safe new construction through zero tolerance for non-compli-

ance of the Earthquake Resistant Design and Construction codes and practices is attainable provided we have a strong political will, tighter techno-legal regime, specialized training of our architects and engineers and artisans. The other major concern relates to earthquake unsafe existing housing stock that requires strengthening. In view of huge investments required, this task will need careful prioritization. Conference papers underscore the need to develop suitable (rapid) screening methods for seismic safety audit of all kinds of existing buildings especially because the methodologies developed in other countries may not suit our situation. The rapid screening methodology proposed for RC framed buildings in India was discussed as also the use of a modified rapid screening methodology to safety audit of buildings in Mussoorie and Joshimath. Several institutions in India are working on this aspect and it is time that a nationally acceptable approach is found. As regards the training of professionals and others as envisioned, we clearly see a shortage of accomplished teachers and right kind of knowledge products and teaching aids. Delegates wondered whether meaningful safety audit will be possible without investing on well designed training programmes on safety audit.

- ◆ The strengthening of seismically unsafe buildings invariably involves condition assessment of buildings and their foundations, decision making on whether retrofitting is the cost-effective answer, evaluation of anticipated seismic forces, selection of appropriate retrofitting strategy, design and construction. The variability of structure types combine with the even greater variability of geological materials underneath to make building strengthening a highly technical job. The Hand Book on Retrofitting developed by IIT Madras jointly with CPWD was well received at the conference and appears as a step forward. What we need now is the well considered feedback from the entire sweep of user agencies to make this handbook and such other publications on the subject more user-friendly and responsive to our diverse needs. We need a conscientious effort to make it happen.
- ◆ Indian examples of cost-effective retrofitting of buildings can best inspire Indians. The experience gained in retrofitting of dwellings particularly after the earthquakes of Uttarkashi (1991), Latur (1993), Gujarat (2001) and Kashmir (2005) and the major retrofitting project in Delhi implemented jointly by the Delhi Government and the GeoHazards International should be appropriately packaged and disseminated to create the much needed demonstration effect. When such dissemination programmes are designed, advantage should be taken of all the other similar projects, either completed or being pursued concurrently. It is hoped that a scientific documentation of the case histories will be peer reviewed and thereafter widely disseminated highlighting the challenges faced, assumptions made, engineering judgment exercised and the expected performance of retrofitted buildings in the event of an earthquake. Retrofitting projects must pay as much attention to the foundation of buildings as they pay to the super structure.
- ◆ Delegates are emphatic that the time tested traditional building construction technologies, like the Dhaji Dewari, the Taaq System and the Gujjar Dhokas in Jammu and Kashmir and the Assam type housing in the North East should not get overshadowed by

the glamour of new technology. Rather, both should both be integrated and go through rigorous scientific scrutiny for continuous innovation. The designers and artisans should know about what normally goes wrong in actual implementation of construction plans. It was observed that even the simple things like the ductile detailing practices (for example detailing of beam-column joint) are not being followed. One of the conference papers reminds that the tall structures in Delhi face the threat to their safety because of Rayleigh waves generated due to a distant earthquake. One other paper reminds us that a good design and a good construction do not always lead to a safe house unless it is assured that building materials used are wisely selected with appropriate choice of technology.

- ◆ Seismic microzonation has captured the imagination of the Government of India particularly after the Kachch earthquake of 2001 and reportedly today, the seismic microzonation programmes are at their various stages of progress in 63 cities of India, including important mega cities. Concerns about use of different methodologies, different mapping scales, hugely differing levels of respect for quality geotechnical investigations despite its great importance and pitfalls of deterministic seismic analyses that ignore uncertainties, need to be addressed before we go too far with the ongoing programmes. The most important recommendation that emerge out of this huge national effort is to quickly discharge the obligation of putting independently validated and certified, user friendly Seismic Zonation Maps in the hands of planners, architects, engineers, builders and disaster managers for whom they are intended. Studies of the kind reported for Guwahati city and for Chandigarh are useful but the reliability check of the information used and assumptions made is essential.
- ◆ Seismic risks in hilly areas add a new dimension to the seismic microzonation exercise. This is because buildings may be structurally safe and yet they may come down during an earthquake if it becomes part of an earthquake-induced slope failure, or a landslide. One of the conference papers cite irregular forms of construction, uneven level of foundations, wrong choice of building materials, and poor quality of construction due to non availability of skilled labour as additional matters of concern in the hilly areas. There is an urgent need to ensure that landslide mapping be made a subset of all seismic microzonation programmes in the hilly areas and we should develop Guidelines to address seismological, meteorological, geological, geotechnical civil engineering, anthropogenic and development concerns in an integrated manner.
- ◆ Records of historic earthquakes are of immense value and deserve to be catalogued from the primary sources of information to provide insights into the earthquake history of a region. Advantage should be taken of the techniques used to identify signatures of past earthquake through, for example, study of geomorphic expressions and dating techniques.
- ◆ For assessment of seismic risk, we critically depend on a reliable attenuation relationship of the region of interest. Blind use of the attenuation relationships developed abroad for their own respective regions is clearly undesirable because these attenuation relationships are based on very different seismic intensity scales under use in different parts of

the world. There is a need to develop attenuation relationships for different regions of India based on our own data and these should be tested at every field opportunity. The attenuation relationship used for the state of Tamil Nadu in one of the conference papers must be seen in the above light.

- ◆ A powerful network of seismic instrumentation and monitoring is India's strength. It is refreshing to note from the conference papers that our past earthquake areas are continuously being monitored to record and study the associated seismic activity. For example, the Kuchcha area is being monitored for which a Multi-parametric Geophysical Observatory has been established and a very sensitive dual sphere superconducting gravimeter has been installed. A dense network of more than 20 broadband seismographs has made it possible to observe foreshock clustering and precursory changes in source parameters and results so far raise the hope of earthquake prediction. Similarly, the areas affected by Uttarkashi earthquake of 20 October 1991 and Chamoli earthquake of 29 March 1999 are being monitored by VSAT linked broad band seismic network. Reporting of data by individual institutions, although useful they are, need to carefully digested and correlated not only with the past seismic histories of the areas they represent but also with relevant geo-tectonic details and other allied measurements. The co-seismic vertical ground movements in the Andaman area observed during the great Indonesian earthquake of 26 December 2004, and reported in the conference, also need in-depth studies and explaining. We need to continuously strengthen seismic instrumentation for earthquake monitoring and geotechnical instrumentation for landslide monitoring.
- ◆ Forecasting and prediction of earthquakes are the topics yet to be vigorously pursued in India although in every conference we get some papers following one or more of the known approaches such as continuous tracking of crustal movements, seismic, geo-electric, geomagnetic, geochemical, geothermal observations and geodetic and ground water measurements and reference to unusual animal behaviour . We have seen some attention being paid to geophysical and geochemical methods, statistical analysis, chaos physics, ground and satellite technologies and atmospheric precursors and real-time monitoring. References to prediction of earthquakes through monitoring of foreshock clustering and precursory changes, establishing correlation between magnitude and epicentral distance of earthquakes for the Shillong plateau and a Seismic Alert System in Shillong and Guwahati and hazard assessment using Fractal dimension of the past earthquake sequence are worthy of note. Scientists feel that thrust on earthquake prediction must continue. The engineers feel that, given the resource crunch, strengthening of buildings must get precedence. Let us find resource to give a big boost to earthquake safe construction but let it not be at the expense of research on earthquake prediction.
- ◆ 12. Success stories in post disaster reconstruction, especially after the Muzaffarabad earthquake of 2005, the Indian Ocean tsunami of 2004, the Gujarat earthquake of 2001, the Latur earthquake of 1993 and the Uttarkashi earthquake of 1991 throw many lessons of which the most important is adoption of a community-centric, multi-sector approach with efficient coordination mechanisms and empowerment. Case history of Reconstruction Programme undertaken in Baramulla district of J & K highlights promotion of tra-

ditional technologies, improved awakening of the communities to disaster preparedness for the future, strengthening of the civil society, improved understanding of seismic design codes, besides delivery of earthquake resistant housing. There is a need to critically evaluate such reconstruction projects. The challenges faced, the mistakes made and the lessons learned should be widely disseminated. These case histories should become part of the training in the management of earthquake and landslide disasters.

The highlights of the Technical Session on Landslides and Avalanches

- ◆ Landslides and Avalanches listed under Geological hazards are no longer only geological in nature but involve a very strong component of anthropogenic factor complicated by continued neglect of slopes, unabated non-engineered constructions and climate change. The challenge in front of us can be met to a significant extent by a multidisciplinary assault on the problem NDMA has come out with National Guidelines on Management of Landslides released by NDMA in June 2009. It is expected that GSI, the nodal agency, will evolve programmes and projects with a strong multi-institutional networking for pooling of expertise, leveraging of capacities and aiming at creating centres of excellence. The challenge before us is not to take management of Landslides and Avalanches as an all out war to stop them from occurring. It should mean inculcating the same culture of non-violence against Mountains as we find in the thoughts and teachings of Mahavir and Gandhiji.
- ◆ Case records presented at this conference leave one in no doubt that a number of human settlements, roads and highways, communication lines, bridges, water reservoirs and dams are becoming increasingly vulnerable to landslides and other mass movements. This is amply brought out by examples of the human settlements in the over stressed Kashmir Valley, unauthorized and non-engineered constructions in the Sikkim Himalaya, vulnerability of hydroelectric projects in Garhwal Himalaya, perennial threat to pilgrim routes to the shrines of Badrinath and Vaishnav Devi and problems encountered on the Nainital-Kathgodam portion of NH 87, widened cuts of NH 22 and constant avalanche threat to NH 1A connecting Jammu with Srinagar- a lifeline for civil and defence population. All the above concerns are distributed over a number of states, government departments, public and private sector undertakings, institutions and others. It follows therefore that new knowledge generated, experiences gained, challenges faced, and lessons learnt will continue to remain scattered unless a conscientious effort is made to breed bilateral and multi-lateral interactions among different agencies between the conferences such as this one.
- ◆ Most major slope failures of today are landslide disasters in making and call for timely preventive action. The best way to promote healthy landslide management practices suited to different geo-climatic and geotechnical situations is to create examples others can follow. Conference throws two examples of major landslides controlled through intensive effort; the Sonapur landslide in Meghalaya and the Varnavrat Landslide in Uttrakhand. The adequacy or otherwise of the steps taken, only time will show but what is to be deeply appreciated is the determined effort for a lasting solution, doing away with pal-

liative remedial action. A few handpicked cases of landslides should be taken on hand to showcase scientific geological and geotechnical engineering best practices including merit of new technology and efficacy of early warning systems. Investment in disaster resilient communities will pay rich dividends. Border Roads Organization is repository of national experience on landslide control and Snow and Avalanche Study Establishment does the same as regards to snow avalanches. Both these organizations, among others, need strengthening. Whereas proliferation of new institutions is to be resisted, we do need more such organizations or centres in areas that deserve specific focus.

- ◆ Most of the projects involving landslide control have no built in mechanism to know about the efficacy of control measures and cost-effectiveness of the designs. Adequate investments are essential for monitoring of major landslides over a length of time for early warning and cost effective remediation. NDMA, State Governments and our national project funding agencies must insist on making slope management an integral part of development projects and their control effort should involve a comprehensive slope treatment after a thorough investigation in place of the usual piece-meal (palliative) approach without adequate investigation.
- ◆ Capacity Building is primarily building of our institutions. Thanks to creation of Snow and Avalanche management that we not only have one dozen papers in this conference on the multi-faceted aspects of Snow and Avalanche management. Western Himalaya, Himachal Pradesh and Uttarakhand together regularly displays a spectrum of deadly avalanches and this matchless opportunity have been availed of by SASE to test avalanche evaluation models, forecasting techniques, early warning systems, preventive works, avalanche control measures, search and rescue, and field training in avalanche management. Our network of Automatic Weather Stations (AWS), Upper Air Stations (UAS) and Doppler radar for collection of snow meteorological and avalanche related data on daily basis has facilitated coordinated avalanche disaster management, avalanche forecasting, awareness generation and delivery of avalanche zonation and a digital Avalanche Atlas. A further impetus to Airborne hyperspectral imaging, Spectroradiometer, LiDAR, digital photogrammetry and GPR and continued innovation in tapping the full potential of Unmanned Aerial Vehicles and related robotics and sensor technology in the ongoing studies on snow and glacier will go a long way in national capacity building in the area of Snow and Avalanche management.
- ◆ Landslide management in the country can only be as efficient as the quality of investigations we make and appropriateness of technology we use. Geohazards across the globe, be they earthquakes, landslides, avalanches or volcanoes, are closely being studied and much better understood thanks to a spate of fast emerging new technologies. The Interferometric Synthetic Aperture Radar (InSAR) Monitoring study reported at the conference, is now routinely being used, for example, in monitoring landslide activities along strategic and transportation corridors in Canada, China and Latin America. The fact that Geohazard sites could be frequently revisited makes it possible to keep a constant vigil on the problematic sites for timely remediation and early warning. Germans have come out with a technology that equips cars with special radio receivers that would trigger

horns even in parked cars, in the event of an early warning. India enjoys a pre-eminent position in space technology and it is time that we multiply Satellite based warning systems (SatWaS) and Geohazard monitoring. There is an enormous potential for use of Ground Based Synthetic Aperture Radar Interferometry (GBSAR) networked with Global Positioning System (GPS). National investments should come to this area.

- ◆ Planning and Engineering of slopes and landslides critically depend on the reliability and user friendliness of Landslide Zonation maps. Geological Survey of India, the nodal agency for Landslide management, and many other organizations are engaged for decades in developing Landslide Zonation Maps at varying scales of mapping. These institutions must address four major concerns expeditiously. First of all they must converge on the criteria leading to choice of mapping scale and methodology used. Secondly, they must ensure that the maps are not open-ended but validated based on quality field evidence. Thirdly, all maps should be made user-friendly to architects, planners, engineers, builders and disaster managers for whom they are intended. And finally, all completed and certified maps should be placed in public domain with conscientious effort to promote their use. Studies on zonation of Satluj and zonation of rain-induced landslides at this conference and such other studies can help the process of validation.
- ◆ The melting of glaciers due to Climate Change has attracted our attention to Glacial Lake Outburst Floods. Investments are necessary to pro-actively identify potentially dangerous glacial lakes and early warning systems should be developed to forewarn the population under threat.
- ◆ The science of landslide investigation needs enormous improvement. Geological, geotechnical, seismological, meteorological and anthropogenic studies are all vital but the weakest link in the chain is the usual absence or poor quality of geotechnical investigation. The DST's initiative of opening a National Geotechnical Institute as discussed at the conference is laudable. Finding land, constructing a building and procuring the state of the art equipment will pose no problem, if funds are available. What needs ensuring is that geotechnical professionals of vision, experienced in institution building, are associated with this task right at the onset and a young scientists and engineers are pro-actively trained at the best centres of the world to be ready in time to man the institute.
- ◆ The launching of South Asia Disaster Knowledge Network is a laudable initiative. Launching of India Disaster Knowledge Network is also realization of the vision reflected in the recommendation of the High Powered Committee Report to the Government of India, 9 years ago. This one single initiative can make all the difference, if dedicated groups are charged with the specific responsibilities. Besides recourse to the best in information communication technology, the challenge will lie in managing flood of unfiltered information from diverse sources and platforms, and timely presenting the continuous flow of information to fulfill the needs of stakeholders.
- ◆ Educating the children on the diverse aspects by embedding the subject in school curricula is a visionary move which will ensure future success at the hands of posterity. It is time that we develop appropriate knowledge products and train a breed of teachers who will be able to do justice with the subjects they teach.

Hydro-meteorological Disasters

The second session covered the thematic clusters of Hydro-meteorological Disasters (Cyclone, Flood, Drought and Climate Change) and was chaired by Prof. D. R. Sikka

Hydro-meteorological disasters account for nearly 85 to 90 % of the total natural disasters in India and also account for 70 to 80% of the property and financial losses and also cause environmental damages. Disaster risk reduction has become part of sustainable developmental agenda. A major hydro-meteorological disaster temporarily arrests development efforts. Thus preparedness, early warning systems, disaster relief and disaster mitigation efforts of the



disaster management agencies ought to remain focused on hydro meteorological disasters which occur all the year round. The Congress has focused on the Hydrometeorological disaster in four themes viz., floods, cyclones, drought and climate change in which key note addresses and research contributions were presented by 65 speakers in different thematic sessions held on three days of the Congress. All the four themes covered under hydro meteorological disasters are multi-disciplinary in nature and the success of societal applications would critically depend upon integrating the efforts of multi-disciplinary agencies. Knowledge gaps in different themes were identified and all imbedded in thematic recommendations.

Highlights of the Technical Session on Flood

In the session 12 presentations (key note, invited & contributory papers) were made. The invited papers and key note addresses were focused on the development of researches and present status of the areas and provided glimpses of what needs to be done to address the challenging problems in respective areas. The contributed papers in the session on Floods were broadly focused on structural management of flood related problems mostly in the Ganga and Mahanadi basins. Problems associated with urban flooding due to heavy rains, use of dynamical flood forecast technology, meso-scale weather and its forecasting, flood risk management and mitigation strategies were also addressed in other papers.

Recommendations

- ♦ Flood control should be considered in overall perspective and for this purpose, the existing bilateral arrangements, mechanisms and treaties signed between India and the neighbouring countries need to give a boosted momentum to achieve the identified goals.
- ♦ The approaches of erosion control and construction of coffer dams need to be considered based on techno-economic considerations utilizing locally available manpower and materials to the extent possible with tactful strategy

- ◆ An effective regional cooperation needs to be ensured for a proper strategy for flood disaster risk reduction.
- ◆ Better understanding of physiological and hydro-meteorological features of the catchments is essential for success of a disaster risk reduction and preparedness programme.
- ◆ The flood risk reduction programmes should be holistic in approach and incorporate the local issues like family planning, health, local knowledge, micro credit, self-help groups, economic enhancement and area specific risk reduction programme.
- ◆ A proper analysis of strength and weaknesses of disaster management mechanisms associated with the failures of dams including landslide dams should be done and our future disaster risk preparedness and mitigation programmes should be re-oriented considering the results of such an analysis.
- ◆ Proper maintenance of already created assets should be given priority.
- ◆ Proper documentation of disaster management processes should be done.
- ◆ Vulnerability analysis, based on economical and flood educational status, is crucial input for flood hazard assessment.
- ◆ A proper combination of structural and non-structural measures should be considered for effective flood management. Flood forecasting plays an important role during floods; which should be based on modern technologies and catchment-specific needs.
- ◆ The available modern methods of rainfall prediction are useful in improving the forecasting ability of hydrologists but a judicious selection based on specific operating conditions is required for application of a particular model of rainfall prediction.
- ◆ There is need to take effective steps against unplanned urbanization in the form of illegal & unauthorized colonies and encroachment on natural drainage systems to avoid future flood risks.
- ◆ The urban floods have harmful effects on human lives and the environment as a whole. The natural watersheds should be duly considered in development of a strategy for urban flood management and city development planning.
- ◆ The latest scientific methods for assessment and simulation of flood inundation, hydrological models, GIS based models and L-moments approach for estimation of floods of different return periods should be used in view of need of a good analysis and a reliable database for study of climate changes.

Highlights of the Technical Session on Cyclone

In the session besides four lead talks, 18 contributory papers were presented. In the areas of Tropical Cyclone besides lead talks 10 papers were presented dealing with the genesis, forecasting and societal implications, storms surge prediction, application of space science technology to tropical cyclone monitoring and predication, land fall predication of cyclones etc. Modern predication technology is mainly based on the application of modern large scale and meso scale dynamical models for understanding and predication of cyclones in the Indian Ocean basin. Storms surge associated with land falling cyclones in the region of low bathymetry (Deltic regions) cause tremendous loss of life and property. Dynamical models for predication of storm surges and the near-costal inundation caused

by the surges, developed by the faculty by the in Delhi, were addressed in one lead talk and one contributed paper. The subject of severe local thunderstorms in the Gangetic West Bengal were covered in three papers in which empirical techniques as well as high resolution dynamical prediction system was applied. The impact of data assimilation, including data from Dopplar weather radars on the skill of high resolution mesoscale models was covered in one paper.

Recommendations

- ◆ Enhancement of observations over data sparse oceanic regions as well as establishment of mesoscale-network of observations over vulnerable regions.
- ◆ Implementation of better assimilation techniques utilizing all available data including land surface, remote sensing (satellite, DWR, UAV, aircraft) data etc. for initialization of mesoscale models.
- ◆ Extensive use of coupled mesoscale atmosphere-ocean-wave model for better track and intensity prediction of tropical cyclones.
- ◆ Preparation of probability forecasts for striking potential of cyclones using multi-models for effective and reliable warning system.
- ◆ Better prediction of storm surges and associated costal inundation along with providing information on river and estuarine water level height.
- ◆ Identification of risk / vulnerability zones of coastal regions.
- ◆ More intense and systematic interaction among scientific community, disaster managers and society.
- ◆ Awareness, community involvement & preparedness and social defense mechanism need to be strengthened.
- ◆ Introduction of disaster management courses / special subject in all graduate level technical education.
- ◆ Improved techniques for mangroves generation and maintenance to reduce casualties.

Highlights of the Technical Session on Drought

In the session on Droughts, 4 lead talks and 7 contributed papers were presented mainly, dealing with drought assessment, drought evaluation, drought management strategies including early warning system, impact of drought on food production, drought in relation to climate change and drought as a development issue in Afro-Asian region and sharing of inter-regional information on drought related issues to build inter-regional partnership. The broad spectrum of papers presented covered different aspects of scientific, agricultural and socio-economic aspects of the slowly evolving drought phenomena and its management in agrarian economies. The panel discussion in the session gave an opportunity to the participants to interact with the expert panel.

Recommendations

- ◆ Creation of Knowledge-base covering all aspects of droughts and establishment of national and international knowledge network on drought management.

- ◆ Documentation of lessons learnt on drought management.
- ◆ Documentation of knowledge on community based drought management practices.
- ◆ As drought frequency may increase under climate change, efforts to be devoted to introduce drought resistance crop varieties. Fresh water scarcity leads to societal stresses and as such modeling ought to be promoted for assessing water stress under climate change scenario.

Highlights of the Technical Session on Climate Change

In the session on Climate Change 2 key notes, 6 lead talks and 10 contributed papers were presented covering diverse aspects of currently hotly debated subject of climate change which is attracting attention of nations all over the world. Climate change on global scale has been virtually accepted by experts and policy makers. However, there is uncertainty about the magnitude of change on national scale as well as the regional impacts of the climate change. The problem of glacier melt, recession of glaciers, glacier lake out flow floods, climate change and health, climate change and water resources, food security and climate change, prediction, predictability and early warning systems for hydro-meteorological disasters in the context of climate change were emphasized in different papers. The on going revolution in the science of climate prediction and weather prediction on different scales are likely to bring about a sea change in the next two decades. But the success would depend on introduction of petaflop computing power and the quality and density of observing systems using modern atmosphere-ocean technology as well as fast communication systems. It was emphasized that India should march hand in hand with international community to reap the benefit of the emerging horizons in the emerging seamless weather and climate prediction system. The climate change scenarios project increase in the incidence of extreme weather and climate events, and this increased variability in weather and climate would make the challenge of prediction more complex. Modern society needs higher predictive capability of disaster events for disaster risk reduction. The communication of weather and climate related warnings to the end users for the disaster reeducation become very important as timely warning help disaster management agencies to take appropriate actions for risk reduction.

Recommendations

a. Scientific and Technical

- ◆ Setting up of high density observational networks suitable for detection and monitoring of hydro-meteorological disasters on priority.
- ◆ Deployment of high resolution global and regional climate models which to be run on petaflop computing systems.
- ◆ Improving the accuracy of weather forecasting and short-term climate prediction for high impact weather events.
- ◆ Development and implementation of Early Warning Systems for all hydro-meteorological disasters.
- ◆ Up-gradation of communication systems for improving dissemination of warnings.

b. Infrastructural

- ◆ Establishment of a State-of-the-art Regional Centre at international level for Climate Change Research through multi-national cooperation.

c. Capacity Building

- ◆ Urgent need to train young scientists in the best available Institutes or acquire trained manpower available across the world in the field of climate science and provide them exciting opportunities to march forward hand in hand with advanced countries to extend the frontiers of weather and climate prediction adopting state of the art dynamical prediction, system possibly on a seamless scale.

d. Policy

- ◆ A national policy for sharing and access to meteorological, hydro logical, geological and environmental data and products within the government, research organizations and among the communities. Use of data by diverse organizations adds value to the data which enhances the image of organizations who generate and provide data.

e. Outreach

- ◆ Launch of massive Public awareness Programmes to address people at grass-root levels (Farmers, Workers, NGOs, community level organizations, local administrators/ disaster managers, etc) using mass media and other media. Efforts should also be made to launch TV /Radio Channels on weather and climate information. A better coordination and interaction of disaster prediction and disaster management agencies and print & electronic media is needed. This would enhance the image of media in the eyes of the society.

f. Adaptation and mitigation actions

- ◆ Launch of programmes to enhance coping capacity of community (including alternative livelihoods) to reduce risk from disasters under climate change scenarios.
- ◆ Launch of programmes for assessing sectoral vulnerability of climate change impacts based on future climate change scenarios.
- ◆ Involvement of state/district level communities in the areas of water resources, food productivity and conservation of bio-diversity in the face of climate change.
- ◆ Involvement of civil societies, educational institutions, and religious organizations in the climate change related adaptation and mitigation actions.

Action Points

- ◆ Risk reduction of hydro-meteorological disaster rests with better monitoring, better modeling efforts and better communication of threat perception in a probabilistic manner for which public awareness is to be progressively promoted. The role of media governmental agencies and NGOs becomes all the more important for creating awareness about the hydro-climatic disasters as well as about the efforts of Disaster Management System for disaster risk reduction.

- ◆ Evolving the adaptation strategies in order to combat the future challenges in agriculture, water, health and other sectors due to climate variability and climate changes particularly in dealing with disaster management in a most effective manner.
- ◆ Focused research studies on projecting climate change and its impact on different sectors with more reliable and better data sets for prediction models for effective and realistic policy planning.
- ◆ Vulnerability assessment and assessment of increasing resilience to hydro-meteorological disasters is a powerful tool for the examination of societal well-being in the face of climatic change. For better disaster management there is an urgent need to integrate knowledge about the environment (climate, ecosystems, water, associated pollution and climate change) with knowledge about humans and their activities (agriculture/forestry/fishing, resource management, political governance, energy use, and culture). Such efforts would contribute to determination of a holistic picture of how sensitive particular places are and how resilient they are and likely to be in future to the kinds of changes that might be associated with climate change.
- ◆ Efforts to bring together stakeholders in climate change and disaster management have begun and opportunities for further integration of efforts are present and must be exploited. Challenges however lie in harmonizing diverse institutional structures, distinct sectoral planning & policies etc and also in communications between the communities about practices at global, regional and national levels.
- ◆ Sustainable alternate livelihoods in an important pathway to enhance resilience to adverse impacts of climate change.
- ◆ Efforts will have to be made towards necessary policy support for developing appropriate water management strategies, crop varieties, farming systems etc and development of disaster management linkages at local, district, state and national levels.
- ◆ For improving weather predictions on short, medium and extended-range scales and climate prediction on Inter-annual, decadal and even centennial scales, diverse models are in use but the future perhaps lies in the adoption of high resolution seamless prediction models. Such models would need very very high speed computers on petaflop basis. There is a need to adopt such models and march hand in hand with advanced countries towards enhancing research potential applications of such models. India would do well if an international, regional climate research centre is established in India with very very high computing facility providing exciting environment for young scientists who would work on the frontier research area of climate science. Reliable disaster prediction is the most sensitive part of disaster risk reduction. It requires constant monitoring of hazard parameters and precursors as well as application of tested skillful dynamical weather and climate prediction models. Marked improvements in the observational systems for atmosphere-ocean-land environment is likely to take place in India in the next two or three years in the organizations working under the Ministry of Earth Science (IMD, INCOIS). These improvements in quality and density of observations would lead to timeliness and advance lead time of hazard warnings. These would be largely driven by the scientific and technological advances as well as use of

high speed computer systems and communication technology and are likely to improve the effectiveness of disaster early warning system. The need of the hour is to integrate the efforts of national weather services, National Ocean Services, disaster management, disaster-related research institutes, research organizations and universities engaged in weather and climate research and application so that their efforts result in social benefit such as disaster risk reduction.

- ◆ Building of hydro-met disaster network over Afro-Asia-Pacific region.
- ◆ There is a need to have an annual workshop under the guidance of NIDM to discuss the effectiveness of disaster preparedness warning & management system against major hydromet disasters which occurred in the previous year in the presence of all stake holders.

Man-Made Disasters

The plenary outcome session on Man-Made Disasters covered Disaster Response, Role of Armed Forces, NDRF, Police and Civil Defence, Road, Rail Accident, Industrial and Chemical Disasters, Nuclear Emergencies, Pandemics, Incident Command System (Disaster Response, Role of Armed Forces, NDRF, Police and Civil Defence, Road, Rail Accident, Industrial and Chemical Disasters, Nuclear Emergencies, Pandemics, Incident Command System) presented and was chaired by by Prof. Santosh Kumar



Key Learning Points

- ◆ Disaster Response should be designed in the context of changing environment such as increasing population pressure especially in the urban areas, climate change, age of information, decentralisation and emerging role of NGOs, INGOs and Civil Society.
- ◆ Disaster Response should be designed in an integrated manner with community, civil society, local government, district, State and with National Response Mechanism.
- ◆ Disaster Response plan should go for paradigm shift from top down to bottom up approach.
- ◆ Policy intervention and comprehensive training and capacity building programme are critical for seamless integration of various disaster response mechanism.
- ◆ There is an urgent need for demystifying ICS at all levels and at the cutting age level in particular.
- ◆ Capacity for early detection in case of early leakage and information dissemination mechanism should be put in place.
- ◆ Emergency Operation Centres have played key role in training and institutionalization of ICS in Australia.

- ◆ The existing administrative machinery for disaster response needs to be strengthened and ICS is an effective tool which can be integrated in the existing administrative India.
- ◆ Limited application of ICS in managing Kosi Floods 2008 has shown that it Relief Management should be integrated as a separate function under ICS.
- ◆ Policy support at the apex level is needed for integrating ICS in the existing disaster management structure and system.
- ◆ ICS will require to be demystified particularly at the cutting edge level functionaries for its acceptance.
- ◆ Availability of Trainers and Trainees remain a critical element in pilot testing of ICS in districts.
- ◆ ICS application for management of disaster in India should be superimposed at the district level administrative setup.
- ◆ Policy interventions and comprehensive training & capacity development strategies are two critical components for seamless integration within the existing disaster response framework.
- ◆ ICS can effectively be utilized for organizing mega events and such application of ICS should be encouraged.

Role of Armed Forces, NDRF, Police and Civil Defence

- ◆ The Indian Armed Forces and Paramilitary forces have always done a commendable job, when called to aid civil authorities, especially, in the wake of natural calamities or man-made disasters.
- ◆ The armed forces are supposed to be called upon to intervene and take on specific tasks only when the situation is beyond the capability of civil administration, in practice, they have been the “core of the government response capacity” in a major disaster.
- ◆ National Disaster Response Force (NDRF) has been constituted with advanced training, equipments, communication and mobility to respond to any type of natural or man made disasters including nuclear, chemical and biological disasters.
- ◆ In the changed paradigm context, role of different forces are important. There is a need to specialize each force differently. The hierarchy of competence need to be worked out.
- ◆ Impediments such as over-centralisation in the decision making process, lack of political will, poor policy formation and plan implementation, ill trained and ill equipped police force, inability to get actionable intelligence, poor coordination and slow response of multiple agencies dealing with terrorism need to be revamped.
- ◆ The preventive physical security needs to be enhanced by improving physical security of important installation, creation of integrated geospatial plan, implementation of police reforms, setting up specialized counter terrorism training centres and creation of specialised counter terrorist forces for each state.
- ◆ The terrorists are likely to acquire NBC weapons by 2013. Security forces need to take suitable precautions. It is time for a well thought and deliberated national and mil start to be evolved to combat the growing menace of terror.
- ◆ The Police communication system is made available for transmission and receipt of

messages in connection with disaster. The police also regulate movement of victims, rescue and relief work, medical assistance and supplies. Their training and equipments in the field of disaster management needs up gradation.

- ◆ One of the most important tasks of NDRF is to continuously engage themselves in the Community Capacity Building and Public Awareness programmes in a big way which includes training of people (the first responders) and concerned government officials at different levels in the areas with high vulnerability.
- ◆ It is imperative that Civil Defence organization be revamped and prepared to enable to discharge its responsibility in all facets of disaster management.
- ◆ The onus on the NDRF is not limited to merely ensuring its own all-time preparedness to effectively cope with different disaster situations. It has really to gear itself up to effectively play a nodal role as the premier disaster response agency of the nation.
- ◆ The programs of community involvement should be linked with the corporate social responsibility programmes of the corporate who do adopt certain states, Districts and villages for this purpose.
- ◆ We therefore need to orchestrate a regional mechanism that will ensure our joint inter-national disaster response to be cogent by provisioning rapid response forces, resources, streamlining diplomatic / bureaucratic procedures and putting SOPs in place.

Industrial and Chemical Disasters

- ◆ The subject of industrial and chemical disasters has to be considered in the broader sense covering all the hazards/accidents and disasters occurring within industrial premises, related to industrial products and processes, and disasters/mishaps affecting industries and production. Thus, it includes chemical, manufacturing, automobile, mining, power, agro-industries, waste handling, laboratories and research institutes, etc. Focus of industrial disaster management has to stem with the philosophy of ‘zero tolerance’ and it means preventing and containing the trigger event or the hazards and vulnerability rather than only preparing for worst-case scenarios. It requires an overhaul of the industrial risk management philosophy.
- ◆ Land-use and location planning is the first level risk reduction in industrial disaster management and has to be highlighted in the regional developmental planning and spatial environmental planning of urban/industrial areas. Zoning atlas and environmental risk mapping approach have to be revisited in the context of disaster risk reduction.
- ◆ A four tier framework of disaster management for industrial disaster management has been setup under the Environmental Protection Act 1996 and a legal framework has been provided for consent, authorisation, emergency preparedness/response and insurance/compensation, etc. However, with the Disaster Management Act 2006, the establishment of Disaster Management Authorities at various levels, call for the mechanism of integration between the constitution as well as functioning of the two. The gap also exists in the capacity development and decision support systems for the two, and is a serious lapse.
- ◆ Concerns of factories are dealt under Factories Act, 1948 and transport under The Motor Vehicle Act, however, runs parallel to the environmental management and also

the disaster management system. There is lack of interdisciplinary expert input to the management of industrial disasters especially in geosensitivity assessment and site clearance, atmospheric dispersion, toxic effects, information and reporting system, GIS & GPS and web-application, environmental/corporate laws, and community issues. Multi-hazard mapping and vulnerability have to be revised to integrate industrial and chemical disasters which is at present a major lacunae.

- ◆ Focus on industrial disasters at the nodal DM institutions like NIDM and Disaster Management Centres at State-ATIs is very weak due to giving stress on only worst-case scenarios (which usually occurs in less probability). This needs to be strengthened and reinforced. NIDM being the national institute may serve as a focus point in developing and maintaining a consortium for various agencies/institutions and Ministries that work on different aspects of industrial and chemical disasters.
- ◆ Need to think away from the conventional relief initiatives of the aid agencies and planning for innovation in relief provision to make it more viable and cost effective and fast responding to the local needs.
- ◆ Able to catalyze analysis and action planning by communities, which has led to volunteerism from communities. In Myanmar, this is crucial in maintaining and promoting communities' existing spirit of dignity, independence and self-reliance.
- ◆ Need for CSOs to go beyond this conventional role by undertaking direct interventions in the key governance functions of disaster management.
- ◆ Practical experiences of institution in community based relief and early recovery stage of the DRR in affected areas.
- ◆ Strengthened capacities of communities, local self governments and districts to prepare, mitigate, prevent and respond to natural and man-made.
- ◆ Extend our co-operation to the Government & other NGOs to work together and coherently for better planning.
- ◆ Lots of lessons to be learnt from the cyclone preparedness programme of Bangladesh in order to improve capabilities to meet disaster challenges.
- ◆ To develop, in conjunction with other disaster professionals and micro- insurance providers, recommendations for future replication in the region or policy changes.
- ◆ Setting of new inclusive benchmarks and indicators of progress at national, regional and local levels to provide information, inculcate awareness and impart education by evolving innovative methodologies.
- ◆ To emphasize on an effective day to day professional policing coupled with transparent community involvement as part of Search, Rescue and Evacuation operations by police during disaster.
- ◆ Climate change issues for both vulnerable communities and policy makers can come together to manage and adapt with this impending phenomenon.
- ◆ To create a window of opportunity for policy makers to learn about the barriers of disaster management, as well as, address the key social, physical and economic components of the vulnerable communities and strengthen local government agencies for facilitating adaptation practices.

- ◆ To intend inform policy decisions, develop school safety measures, and spread awareness to a broad audience of concern agencies.
- ◆ Need to acknowledge and incorporate NGOs in the governmental disaster management programmes.
- ◆ Involving the interactive community's participation, which involves physical participation as educating, motivating, organizing, guiding and preparing people for agro-forestry programmes, may be a major bridge for reducing the risks of climate change induced natural disasters.
- ◆ Community based disaster risk management plans for villages.
- ◆ Needs of capacity building of NGOs in disaster management.
- ◆ Lessons from various sectoral perspectives (shelter, livelihood, education, children protection, gender, water and sanitation, early warning systems) in post-tsunami reconstruction

Road /Air Accidents

- ◆ An integrated approach with disaster planning and preparedness is required to strengthen trauma care, especially in rural areas. Enforcement, Engineering, Education, Emergency care and Evaluation of these approaches are urgently required in India to reduce the growing toll of road deaths and injuries.
- ◆ Road safety and fatalities of pedestrians and non-motorised transport users in Indian cities should be given priority in road safety and traffic planning.
- ◆ Traffic signals and vehicles signals are to be revisited.
- ◆ It is imperative for laying down improved guidelines in the law and leave less scope for the field officers to continue wrong practices, resulting stricter regime for driver licensing and vehicle certification and ultimately improving the road safety scenario.
- ◆ Air disaster is the outcome of human error and this is the consequence of inappropriate by managed risk. This can be brought down by designing technological and sociological interventions with good quality of training and technology.
- ◆ For a pedestrian there is practically no space to walk on. The footpaths which are meant for walking have been encroached on by various activities. This encroachment includes shopkeepers, hawkers, vendors, vehicle parking, animals, washing and cooking activities etc. Though isolated instances of Government putting in a huge effort to save individual lives are seen from time to time, a concerted effort to do the same on a mass scale is absent.
- ◆ Provisions as laid down in Central Motor Vehicle Rules, 1989 related to carriage of hazardous chemicals covering the driver, vehicle cleaner, chemical consignor, consignee and transporter need to be revisited and revised as per today's need.
- ◆ A toll free number to give suggestions/complaints information of accidents of Vehicles should be introduced at all India level.

Nuclear Disaster

- ◆ India in future, is likely to have Technology developed in USA, USSR and France which are different from the current technology which we are using. Hence there is a need to develop new technology.

- ◆ For thorium deposit in India which is very large, we need to develop technology based on thorium.
- ◆ Nuclear based is long term issue so the focus should be on R&D for waste disposal.

Policy Planning & Crosscutting Issues

This covered the thematic sessions on Disaster, Development and Governance, Education, Training and Capacity Building, Social and Economic Issues, Emergency Health Management, Emerging Issues and Concerns, Corporate Sector in Disaster Management, Media and Disaster Management, Post Disaster Recovery and Reconstruction: International Experiences and Best Practices. The session was chaired by Dr. P. K. Mishra

Total No of 230 abstracts were submitted for these sessions, out of which 150 papers were presented orally.

Key Issues

Mainstreaming DRR:

Natural as well as human induced disasters create lot of tremendous impact on the development process. Disasters triggered by natural hazards put development gains at risk. At the same time, the development choices made by individuals, communities and nations can pave the way for unequal distributions of disaster risk. Development and disasters interlinked.

- ◆ Development programmes/ schemes should be revisited so as to examine minimize its potential contribution to disaster risk/vulnerability.
- ◆ Development plan of a ministry/department should incorporate elements of impact assessment and risk reduction.
- ◆ There is a need to have research / case studies on how a disaster creates differential impact on the people and their livelihood depending on development choice.
- ◆ We need to develop indicators for resilient development which can give clear picture of safe development at the programme and policy levels as well as indicators at the community, different economic tools for understanding the cost benefit of the mainstreaming DRR projects and also provide support to the research and development institution engaged in the sector.
- ◆ Poverty reduction is the key and should be the central theme for reducing vulnerability of the poor people from various disasters. Hence all the poverty alleviation programme should have special focus on DRR issues indicating how the assistance given to them is actually helping in risk reduction also. Govt. Schemes such as NERGA/JNURM/IAY may be revisited from this perspective.



- ◆ Traditional knowledge has helped in building the community resilience and enhancing their coping mechanisms. It is important to recognize the value of indigenous knowledge and create enabling mechanisms wherein this could be integrated in disaster risk reduction measures especially at the community level.
- ◆ This knowledge needs to be effectively synergized with the scientific knowledge and disseminated in the form and manner that a community acts upon with the greater sense of empowerment especially in the context of disaster risk reduction.
- ◆ Strengthening of the PRIs capacity for better disaster risk reduction.
- ◆ The research-practice interface is important. The focus so far is on, emergency and relief, the most neglected phase ‘rehabilitation’ calls for ethnographic, longitudinal research to understand the process and interface of disaster and development.
- ◆ A realistic understanding of the limits to mainstreaming is essential to prioritize the interventions.
- ◆ There is a need for the creation of ex-ante funding for disaster risk reduction at all the levels from community to the national levels.
- ◆ The ex-post funding is largely available in the form of CRF/ NCCF for relief. There is need to have a mechanism for disaster recovery and reconstruction fund. This will reduce the dependency on multi-lateral support.
- ◆ Insurance market can be utilized for risk transfer mechanisms and Insurers should be encouraged to come with more products which are affordable and suitable for the people who are exposed various kind of risks.
- ◆ Micro finance and micro insurance can help reducing vulnerability of the poor. Institutional support and flexible norms should be developed for these institutions in the hazard prone areas.

Community

- ◆ Experiences from past disasters have show the importance of involving local communities and civil society organizations for effective knowledge management and disaster risk reduction.
- ◆ There is a need for strengthening community based institutions for disaster management and hence we need to create community based disaster mitigation fund.
- ◆ Creation of community based knowledge platform where initiatives taken by civil societies, NGOs and PRI could be shared and disseminated.
- ◆ Capacity development of Panchayati Raj Institutions along with the civil societies should be undertaken on a priority basis.
- ◆ Community level warning system should be developed with the help of the scientific community.
- ◆ Concept of community radio can be encouraged for early warning, mitigation, and in educating the community by giving useful information.

Role of Media in Disaster Management

- ◆ Timely mass media communication about impending disasters can lead to individual

and community action, which is the key to implementing effective prevention strategies including evacuation and survival of people. Such communications can educate, warn, inform, and empower people to take practical steps to protect themselves from natural hazards.

- ◆ The role of media, both print and electronic, in informing the people and the authorities during emergencies is critical. Govt. & media can form a collaborative mechanism for dissemination of information to each other. This would enable media in contributing to awareness raising and preparedness through educating the public about disasters; warning of hazards; gathering and transmitting information about affected areas.
- ◆ However, during an emergency, the media should be sensitive to the needs of the public in affected areas.
- ◆ Media must avoid misinforming and broadcasting unconfirmed reports that may lead to despair and panic.
- ◆ Mechanism for giving correct and reliable information from the govt. to the media is an important instrument for balancing the possible effects of incorrect, misleading or even willfully distorted information.
- ◆ Media Ethics is an important aspect of media reporting during any disaster event. It assists media workers in determining what is right and choosing the best from several alternatives. Thus, ethics should set guidelines, rules, norms, codes and principles to lead journalists and other media workers to make moral decisions. A code for media for covering a disaster situation, on the pattern of covering terrorist attack, may be prepared by NIDM/NDMA and be circulated to media houses by competent authority.
- ◆ There should be a designated person at the district level for informing disaster about disaster with whom media can interact. And, this person should be well versed with the disaster risks, vulnerability and management system related to the incident.
- ◆ Institutions like NIDM and NDMA should display the list of professionals on their website with their specialisation and contact details, especially at the time of disaster, so that media can interact with them. The person would give technical and professional opinion on the event.
- ◆ Information regarding any impending disaster given to media by IMD or any other specialized agency of the govt. must be in common person's language.
- ◆ VIP visiting to the affected site must be stopped and a code of conduct for visiting on site must be circulated. This not only disrupts the process but also make the task of response agencies tougher which ultimately sufferer get the brunt.

Capacity Building, Education and Training

- ◆ Capacity development has to be understood with a broader perspective to include (a) knowledge (b) skills (c) resources (d) motivation and (e) attitude in an integrated manner for professional development, governance and community. Research and innovation has to have higher priority with adequate support and encouragement. Models need to be developed as per regional/indigenous requirements rather than importing from elsewhere.

- ◆ There are important aspects of capacity development and education that are crucial for sustainable development:- (a) economic and welfare (b) environment and natural resources (c) industrial safety and health (d) disaster preparedness and emergency response, at various levels of governance including state to district and community/panchayat institutions. The capacity plan and integrated approach for disaster management inclusive of risk mitigation, has to focus on interdisciplinary approached rather than the multi-disciplinary segregation within governance.
- ◆ Higher education can play a significant role in disaster management and research/innovation. Interdisciplinary subjects like ecology, economics, environmental science that have the characteristics to accommodate the knowledge and skills of various natural and social sciences, medical, engineering, etc. in infusion mode, can promote specialisation modules on disaster management.
- ◆ UGC may be asked to mobilise the Universities and Colleges to integrate the topics of disaster management within the relevant disciplines. There is section IV of UGC compulsory module of environmental studies for UG course, as per Hon'ble Supreme Court's decision, totally devoted coverage on natural hazards and disaster management. This needs to be highlighted and strengthened with project work/case studies, etc to be assigned to the students.
- ◆ Various training networks like the master-trainers of National Green Corps (NGC), National Service Scheme (NSS), NCC and Eco-clubs, besides training institutions for rural development, forestry, watershed, agriculture, disaster management, environment, safety, at state, district and local levels have to be integrated by developing an inventory of the network and launching an organised mission of knowledge propagation through the channel of master trainers and management. Modules must be developed with region-specific challenges and strategies and adapted to the need of the time.
- ◆ Environmental degradation and climate-change could aggravate not only hazards but also the vulnerabilities, thus, making a disaster causing more serious impacts. There are already missions and programmes for environmental management, social welfare and development, which indirectly, address both-disaster risk reduction and development including livelihood, health, amenities, etc. There is a need to develop integration of disaster management infusion along the training and education network for environment and development programmes, especially in the regions.
- ◆ Industrial/commercial development along the urban areas, human interventions in coastal and mountain areas, river-basin challenges, specialised interventions for disaster management. There is a need to focus on developing case studies for different environment types and economies in order to under these hazards and vulnerability, enabling to evolve region-specific strategies of disaster management training and education.
- ◆ National/state agencies like - University Grants Commission, Higher Education Department (Ministry of Human Resource Development), Council of Scientific and Industrial Research, Ministry of Environment & Forests (Research Division), Council of Social Science Research, Ministry of Science & Technology, Indian Science Congress Association, and related institutions may take up initiative for promoting disaster

management aspects in higher education, research and innovations.

- ◆ School safety is an important subject. However, schools relevance to disaster management may be looked more than the aspects of safety of children but also ‘schools’ as the resource for training, awareness, knowledge management, forewarning, and capacity development in masses. School safety must include the aspects of laboratory safety, electrical, chemical safety to make the programme holistic.
- ◆ Training must focus on multi-tier, multi-sector, multi-layer approach - targeting (a) professional and research development (b) policy analysis and decision making (c) planning and deliveries (d) educators and trainers (e) primary responders and receptors. A disaster management training policy must be formulated to guide the training need analysis, design, module development and human resource planning at different levels. Preference must be given to interdisciplinary knowledge over the hard-core sector specialists. Besides, multi-disciplinary support professionals may be identified from the existing systems to facilitate the core disaster management systems.



Valedictory Session



Dr. A. P. J. Abdul Kalam, former President of India being received by Mr. P. G. Dhar Chakrabarti, Executive Director, NIDM.

Mr. P. G. Dhar Chakrabarti, Executive Director, NIDM welcomed Bharat Ratna Dr. APJ Abdul Kalam, former President of India. He recalled Dr. Kalam's Vision of India 2020 as a strong, vibrant, self-reliant and resilient nation and said that this vision was one of the guiding principles for deliberations in the three-day Congress. The country cannot develop as per his vision unless it has the capacity and ability to manage disasters in all their dimensions. The knowledge on disasters and on the holistic management of disasters is expanding in a very fast pace. There are at least 50 major disciplines across earth, material, engineering, social, behavioral and management sciences that concern disaster management. Yet there are significant knowledge gaps within discipline, among disciplines, between disciplines and the practices. At the same time the knowledge on disaster management is getting fragmented, and compartmentalized in sub-disciplines, micro-disciplines. A large number of actors within the government, non-government and inter-government organizations are involved in disaster management and there is not much of interaction between



research in the universities and R&D institutions and action at the field level. The three day long Second India Disaster Management Congress provided excellent opportunities for interaction among the researchers and scholars and practitioners and these are reflected in the four outcome documents that have come out of these sessions. He informed that the recommendations of all the thematic sessions have been compiled in four main thematic clusters and shall be submitted to the government for consideration.

The coordinators of the four main thematic clusters – Dr. R.K.Bhandari, Dr. D.R.Sikka, Dr. Santosh Kumar and Dr. P.K.Mishra - presented the draft Outcome Documents of these clusters.

Dr. Mohan Kanda, Hon'ble Member, NDMA, in his address gave an overview of the paradigm shift that has taken place after the enactment of the DM act and DM policy which has been recently announced by the Government. Consequently from the policy, flow the guidelines on different disasters and from these guidelines plans are supposed to flow for central ministries and states. Subse-



quently, these would entail structural and non-structural measures. Planning Commission has assured that funds for implementation of these structural and non-structural measures for mitigating the risks of disasters would not be a constraint. At the same time, in order to ensure that new development projects do not create further disasters, a comprehensive set of guidelines for mandatory disaster preaudit has been issued without which no new development project shall be sanctioned by the Government of India. The State governments have also been requested to adopt these guidelines.

In his valedictory address, Dr. Abdul Kalam expressed his happiness in participating in the Congress and congratulated NIDM for contributing in a big way in research and teaching in the field of Disaster Management.

He expressed his belief in facilitating evolution of better management techniques for disaster prevention, mitigation, preparedness, relief-rehabilitation and reconstruction. In this regard, he advocated the utmost necessity of maintaining a database with respect to various disasters taking place in the country. He highlighted the four essential components of disaster management. These are accurate forecasting system, appropriate technology deployment, fast response action and capacity building.

While sharing his experiences in DRDO in coordinating relief operation during Latur earthquake, he emphasized that the knowledge of availability of resources and its optimum deployment in a coordinated manner can reduce the pains of disaster and bring in effective response and relief to the affected people. He also mentioned about training the huge manpower available in the country such as scouts, NCC and NSS volunteers etc.



Creation of a database of available facilities needed for disaster management operations in district level, state level and national level can give the resources to the disaster management teams at a critical time.

He shared his experience of Switzerland Humanitarian Aid and urged participants to discuss the uniqueness of the Swiss rescue system and methods so that the best features can be adopted for our future disaster management process. He further elaborated as to how District Collector, Nagapattanam handled the relief operations during 2004 Tsunami to bring about normalcy. Both are good examples of how the available resources can be identified, used and kept in a state of readiness.

In his concluding remarks, he mentioned about his vision of disaster management which should include developing a capacity for early warning and forecast system so as to facilitate evacuation of affected people well in time to prevent human casualties, disaster prevention becomes a leading criteria for planning and development and education at all levels provides adequate knowledge to students to handle both natural and man-made disasters timely and effectively. Lastly, he reiterated his idea of linking rivers and water bodies which will reduce flood intensity and also the water shortage. He wished all the participants for success in the mission of enhancing the effectiveness of the disaster management to knowledge sharing.

The Second India Disaster Management Congress concluded with a vote of thanks to the participants, partners, facilitators and all those who worked directly or indirectly to make it a success.



Sh. P. G. Dhar Chakrabarti, Executive Director, NIDM thanked the faculty and staff of NIDM for their untiring hardwork and dedication.

Supported by:



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Congress Secretariat

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