



# DISASTER MANAGEMENT PLAN

## DIRECTORATE OF ENERGY

GOVERNMENT OF HIMACHAL PRADESH

Shimla 171001



# CONTENTS

1. About the Department .....	6
1.1 Organizational Structure .....	6
1.2 Purpose of the Plan.....	7
1.3 Scope of the Plan.....	7
1.4 Authorities, Codes, Policies.....	7
1.5 Institutional Arrangements for Disaster Management.....	8
1.5.1 State Disaster Management Authority .....	8
1.5.2 State Executive Committee (SEC).....	8
1.5.3 Advisory Committee of SDMA.....	9
1.5.4 District Disaster Management Authority .....	9
1.5.5 Disaster Management Setup in the Department .....	9
1.6 Plan Management (Implementation, Monitoring and Revision) .....	9
2. Hazards, Risk and Vulnerability Analysis .....	11
2.1 Risk Assessment of Himachal Pradesh.....	11
2.2 Assessment of Sectoral and Departmental Risk.....	11
2.2.1 Departmental Hazards .....	11
2.3 Gaps in Existing Capacity .....	14
3. Risk Prevention and Mitigation .....	15
3.1 Risks Prevention.....	15
3.2 Risk Mitigation .....	16
3.3 Matrix of Hazard Specific Mitigation Measures .....	16
3.4 Capacity Building for Disaster Management.....	17
3.4.1 Disaster Management Cell: .....	17
3.4.2 Training and Development of Skill:.....	17
3.4.3 Arrangement for Strengthening the Existing Infrastructure: .....	17

3.4.4 Material procurement and Services during Emergency: .....	18
3.4.5 Listing of Empanelled Contractors for Restoration of Power Supply:.....	18
4. Mainstreaming Disaster Risk Reduction in Development .....	19
4.1 Mainstreaming DRR into Development .....	19
4.2 Approaches for Mainstreaming .....	20
5. Disaster Preparedness .....	21
5.1 Strategies for Disaster Preparedness .....	21
5.2 Measures for Disaster Preparedness .....	21
5.2.1 Alert Notification: .....	21
5.2.2 Warning Notification: .....	21
5.2.3 Notification Responsibly: .....	22
6. Disaster Response and Relief .....	23
6.1 Response Plan.....	23
6.2 Emergency Support Function .....	24
6.2.1 Standard Operating Procedure .....	24
6.2.2 Constitution of Incident Response Team and delegation of Authority:.....	27
7. Disaster Recovery and Reconstruction .....	28
8. Financial Arrangements .....	29
ANNEXURE.....	30
NOTES .....	34



## 1. ABOUT THE DEPARTMENT

In today's techno-savvy era, energy is a vital factor in economic growth and human development of any region. Himachal Pradesh, the Power State of the country has emerged as one of the most advanced States of the Country with excellent Socio-Economic Indicators. The Directorate of Energy, Government of Himachal Pradesh, created in 2009 is instrumental in achieving State the title of Power State. The Directorate is headed by the Director and look after the work of Allotment of Hydroelectric Projects, Monitoring of Hydro Power Projects above 5 MW in Private Sector, Grant of Techno Economic Clearance (TEC), Issues related to Hydro Power Safety, Environmental Issues, Social Issues, Monitoring of Local Area Development Fund, Quality Control, Monitoring and Management of Power Flow, Sale of Government of Himachal Pradesh Power Share received from the Power Producers as Free Power and Energy Conservation besides other activities / functions related to Power Sector assigned from time to time by the Government of HP. The directorate functions as a bridge to in coordinating power utilities of the State, Central & Private Sector.

The Directorate of Energy endeavors to provide conducive policy framework and directions to promote, develop and harness optimally, the huge hydro potential of the State on the one hand and to coordinate/facilitate the programs/policies which leads to conservation of energy and its efficient use and also to maximize the revenue by sale of free / equity power of the state. The other main objectives of the department are:

- Examination of DPRs covering all engineering aspects viz freezing of project layout, hydro-meteorological and power studies, hydraulic design of project components including flood designs and cost estimation etc.
- Implementation of Energy Efficiency in the Power Sector.
- Implementation of Electricity Act.
- Implementation of Environmental & Social issues / aspect related to Hydro Power Development.
- Policy framing for Power Sector.
- Monitoring of LADF Viz Pre-commissioning LADF as well as Post-commissioning as per Policy Guidelines issued by GoHP.
- Monitoring Safety, Authority and Quality control of all the HEP's commissioned, under execution.

### 1.1 ORGANIZATIONAL STRUCTURE

Broadly the departmental set up is divided into two levels, viz. Secretariat and Directorate. The director is the head of the department under directorate level. He is supported by the Chief Engineer, who is the head of the office. The directorate set up is consists of Project Allotment, Monitoring & Policy Cell, Administration, Finance, Accounts & Legal Cell, Power Sale & Energy Conservation Cell, Techno-Economic Clearance Cell and Authority Safety & Quality Control Cell. The directorate had a total strength of 74 officials and staffs.

The office of Directorate of Energy is established in a private building which comprises four emergency exits and six fire extinguishers.

## 1.2 PURPOSE OF THE PLAN

Disaster management is a cyclic strategy consists of prevention, mitigation, preparedness, response and recovery to confront the adverse impacts of disasters. Integration of emergency plans at all levels is prerequisite for efficient disaster management. A robust energy infrastructure is one of the defining characteristics of a modern economy. Any disruption in the supply of this service would do considerable harm to economic growth and development of the state which is termed as Power State of the country.

The objectives of this plan are to facilitate the Directorate of Energy, Government of Himachal Pradesh in the following:

- Assessing and analyzing threats to, vulnerabilities of, and consequences to critical infrastructure of the department.
- Undertake prevention and mitigation measures to enhance the resilience of critical infrastructure by minimizing the adverse consequences of disasters.
- Undertake preparedness measures.
- Assign role and responsibilities for various tasks to be performed by the department in accordance with the State DM Policy and State DM Plan.
- Mount prompt and coordinated response and recovery at various levels in the post-disaster phase.
- Arrangement of tools and technologies to enhance situational awareness.

## 1.3 SCOPE OF THE PLAN

Energy Sector strongly emphasized the economic dimensions by way of environmentally and socially sustainable Hydropower Development in the state. Directorate of Energy of the state provides a conducive policy framework and directions to promote, develop and harness optimally, the huge hydro potential of the State. The department also coordinates / facilitate the programs / policies which lead to conservation of energy and its efficient use and also to maximize the revenue by sale of free / equity power of the state.

Himachal Pradesh is prone to various disasters. The devastation caused by these disasters posed a challenge before the Directorate of Energy to analyse each and every decision-making process to gear up the restoration of energy services during such situations as well as building up the capacity to face further calamities in future. The scope of disaster management plan for the department is as follows:

- To improve the state of preparedness to meet any contingency.
- To reduce response time in organizing the assistance.
- To identify major resources, manpower material & equipment needed to make the plan operational.
- Making optimum use of the combined resources.

## 1.4 AUTHORITIES, CODES, POLICIES

Following are the specific guidelines for the Department:

- Energy Conservation Act, 2001
- Electricity Act, 2003
- Clean Development Mechanism
- Hydro Power Policy, 2006

- Local Area Development Fund Policy
- R & R Plans

For the functions related to Disaster management following guidelines are to be followed:

- Disaster Management Act, 2005
- National Disaster Management Plan, 2016
- Himachal Pradesh Disaster Management Plan, 2012
- National Guidelines issued by the NDMA
- Guidelines and provision for State Disaster Response Fund (SDRF)
- Guidelines for administration of the National Disaster Response Fund (NDRF)

## 1.5 INSTITUTIONAL ARRANGEMENTS FOR DISASTER MANAGEMENT

The State Government has adopted the Disaster Management Act 2005 as enacted by the Govt. of India for providing an effective mechanism for Disaster Management in the State of Himachal Pradesh.

### 1.5.1 STATE DISASTER MANAGEMENT AUTHORITY

As per clause b of sub-section (2) of Section 14 of the Disaster Management Act 2005, the Himachal Pradesh Disaster Management Authority under the chairperson of the Honourable Chief Minister was constituted on 1<sup>st</sup> June 2007 with the following persons as a member of the Himachal Pradesh Disaster Management Authority (HPSDMA):

Table 1: Members of State Disaster Management Authority

#	Member	Designation in HPSDMA
1	Hon'ble Chief Minister	Chairman
2	Hon'ble Revenue Minister	Co-Chairman
3	Chief Secretary	Member
4	Principal Secy. (Rev)	Member
5	Principal Secy. (Home)	Member
6	Principal Secy. (PWD)	Member
7	Principal Secy. (Health)	Member
8	Director General of Police	Member
9	Secretary/Additional Secretary (Revenue)	Member Secretary

### 1.5.2 STATE EXECUTIVE COMMITTEE (SEC)

As per sub-section (1) of section 20 of the Disaster Management Act 2005, the State Executive Committee under the chairmanship of Chief Secretary was constituted by the Government of Himachal Pradesh. SEC coordinates and monitors the implementation of the National Policy, the National Plan and the State Plan



in addition to management of disasters in the state. It monitors the implementation of disaster management plans prepared by the departments of the Government of the State and District Authorities.

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### 1.5.3 ADVISORY COMMITTEE OF SDMA

As per Sub Section (1) of section 17 of the Disaster Management Act 2005, the chairperson of Himachal Pradesh State Disaster Management Authority nominates members of the Advisory Committee to assist the Authority and to make recommendations of different aspects of Disaster Management.

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### 1.5.4 DISTRICT DISASTER MANAGEMENT AUTHORITY

As per Section 25 of the DM Act 2005, District Disaster Management Authority has also been constituted in every district of Himachal Pradesh which is chaired by the Deputy Commissioner of the district.

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### 1.5.5 DISASTER MANAGEMENT SETUP IN THE DEPARTMENT

The Additional Superintending Engineer (Civil) of Department is presently the nodal officer for the disaster management activities. The disaster management cell established in the directorate has the strength of eight staff. The role of disaster management cell is to implement the guidelines of state government regarding disaster management.

In case of an emergency, the department can be contacted on 0177-2673552 & 8988297204.

## 1.6 PLAN MANAGEMENT (IMPLEMENTATION, MONITORING AND REVISION)

The director of Directorate of Energy will have to ensure the planning, coordination, monitoring and implementation of the Disaster Management Plan. The nodal officer nominated will have the overall responsibility for implementation, monitoring and revision of all the activities related to disaster management.

As per mandate of the DM Act 2005 the plan should be revised annually. Any changes in guidelines under the national and state level shall be incorporated in the plan as and when such changes are made. The introduction of new technology for hazard risk mitigation shall also be incorporated as when the same is tested and found feasible and acceptable in particular geographical area of the State.

The role and responsibilities of a Nodal officer of the department will be as follows:

- Act as focal point for disaster management activities of the Department. The department may ensure that he / she has the mandate to work immediately without waiting for directions from above. This will save time in the event of any disaster.
- Provide his / her contact details and contact details of alternate person to SDMA / DDMA and Revenue department, State & District Emergency Operation Centres, all line departments & agencies.
- Accountable to any communication /actions related to disaster management of the department.
- Take lead to update the department disaster management plan, emergency support function (ESF) plan, and standard operating procedure (SOP).

- Constitute the quick response Team (QRT) in the department as per the need and organize training for the members.
- Provide regular information on disaster or related task assigned to him to SEOC / Revenue department during & after disasters in consultation with the department head.
- Attend disaster management meetings, training, workshops or any related programme on behalf of the Department.
- Identify an alternate Nodal Officer and build his / her capacity.
- Organize regular awareness programmes in the Department, etc.

## 2. HAZARDS, RISK AND VULNERABILITY ANALYSIS

### 2.1 RISK ASSESSMENT OF HIMACHAL PRADESH

Himachal Pradesh is a mountainous state situated in the western Himalayas with an elevation ranging from 350 meters to 6000 meters. Thus, there is a great variation in the geo-climatic conditions of the state due to the extreme variation in the elevation. The climate varies from hot and sub-humid tropical in the southern tracts to cold, alpine and glacial in the northern and eastern mountain ranges with increasing elevation. These conditions make the state prone to various hazards both natural and manmade. Main hazards consist of earthquakes, landslides, flash floods, snowstorms and avalanches, droughts, dam failures, fires - domestic and wild, accidents - road, rail, air, stampedes, boat capsizing, biological, industrial and hazardous chemicals etc.

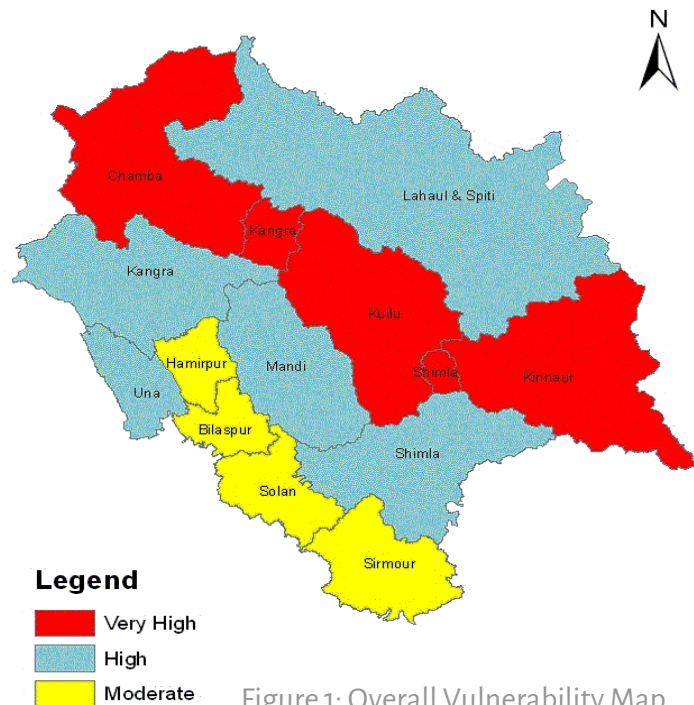


Figure 1: Overall Vulnerability Map

The districts of Chamba, Kinnaur, Kullu and part of Kangra and Shimla fall in very high vulnerable risk (Figure 1). Similarly, districts of Kangra, Mandi, Una, Shimla and Lahaul and Spiti fall in high vulnerable risk status. The district Hamirpur, Bilaspur, Solan and Sirmour falls in moderately vulnerable risk status. The disaster management strategies and infrastructure required to be evolved by taking the factor of vulnerability into consideration.

### 2.2 ASSESSMENT OF SECTORAL AND DEPARTMENTAL RISK

The sectoral risks of disasters consist of the risks for the entire sector that the department represents. For example, Directorate of Energy may assess the potential risks to hydro project sites due to certain hazard like earthquakes, landslides and floods in the specific region. The departmental risks of disasters consist of the risks arising out of the exposure of vulnerable departmental assets to the natural or manmade hazards.

#### 2.2.1 DEPARTMENTAL HAZARDS

The power sector is one of the important infrastructures which may get affected due to any crisis/disaster leading to disruption in generation, transmission and distribution of electricity. It, therefore, becomes extremely important to evolve crisis / disaster management plan to restore the generation, transmission, and distribution of power to the affected areas in the shortest possible time. Table 2 provides the status of Hydro Potential of the state.

Table 2: Status of Hydro Potential in Himachal Pradesh (as on 31st Oct. 2017)

#	Sector		Commissioned		Under Construction		At Various Stage of Clearance & Investigation		Disputed / Cancelled		Foregone		Grand Total	
			No. of Projects	Capacity in MW	No. of Projects	Capacity in MW	No. of Projects	Capacity in MW	No. of Projects	Capacity in MW	No. of Projects	Capacity in MW	No. of Projects	Capacity in MW
1	HIMURJA	State	10	2.37	0	0.00	8	34.00	0	0.00	0	0.00	18	36.37
		Private	77	289.05	40	132.84	644	1370.58	0	0.00	0	0.00	761	1792.47
2	HPSEBL		23	487.55	1	100.00	7	92.00	0	0.00	0	0.00	31	679.55
3	HPPCL		2	165.00	3	691.00	17	2300.0	0	0.00	0	20.00	22	3176.00
4	Central & Joint		12	7457.73	1	800.00	4	956.00	0	0.00	0	0.00	17	9213.73
5	Yamuna Projects (Himachal Share)			131.57									0	131.57
	Ranjeet Sagar Dam (Himachal Share)			27.60									0	27.60
	Kishau Dam (660 MW) (Himachal Share)							324.00					0	324.00
6	Private		21	1955.90	21	673.10	54	3048.20	9	1425.50	6	735.00	111	7837.70
Total Allotted			<b>145</b>	<b>10516.77</b>	<b>66</b>	<b>2396.94</b>	<b>734</b>	<b>8124.78</b>	<b>9</b>	<b>1425.50</b>	<b>6</b>	<b>755.00</b>	<b>960</b>	<b>23218.99</b>
<b>Total Identified Hydro Power Potential in the State</b>													<b>27436.00</b>	

Disaster in power sector can occur due to natural calamities such as:

- Earthquakes
- Floods / GLOF
- Landslides / Avalanche

And crisis situation can arise in power Sector in the event of:

- Terrorist threats / attack & sabotage
- Bomb threats & bomb explosions
- Strike
- Fire
- Cyber attack

#### 2.2.1.1 FLOODS / GLOF

Floods are main water-related natural disasters, thus can adversely impact the functioning of the energy sector. The state is prone to floods that are resultant of glacial lake outburst, popularly known as glacial lake outburst floods (GLOFs). According to the TARU report 2015, Himachal Pradesh is home to 1,239 glaciers of varying types and dimension, covering an area of approximately 2,473 km<sup>2</sup> which account for 4.44% of the state's area. The Satluj basin with 52.4% has largest numbers of glaciers followed by Chenab

(14%), Beas (13.3%) and Ravi (12.8%). GLOF has the potential to cause damage to life and infrastructure, with short to medium term impact on livelihood. Hydropower generation is one of the key sectors for the economic growth of the state. The sector is highly dependent on the glacial ice melt which fed the rivers. The occurrence of phenomena of GLOF will certainly hinder the performance of energy department.

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#### 2.2.1.2 LANDSLIDES / AVALANCHES

The Hydro Power state of the country is donned with around 118 Hydropower station which includes Mini, small, large and Mega hydropower stations. The capacity of these hydropower stations varies from 101 KW to 1500 MW. According to the analysis carried by TARU in 2015, 67 hydropower stations are under threat of landslide Hazard risk. It was also reported that 10 Mega hydropower stations are in the medium and high-risk landslide area. The hydropower stations such as Karcham wangtu, Nathpa jhakri and Bhakra Dam have a major role in meeting the growing need of the power for industries, agriculture and rural electrification but are under maximum threat so immediate major steps should be taken to eradicate the risk associated with these major hydropower stations.

Avalanches also possess a huge threat to the energy sector of the state. Almost 1.2% area of Himachal Pradesh falls under the category of high avalanche probability zone, whereas 14.5% area has moderate probability. Rests of the region (i.e. 84.3%) have low to nil snow avalanche probability.

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#### 2.2.1.3 EARTHQUAKES

Himachal Pradesh is highly seismic sensitive state as over the years a large number of the damaging earthquake has struck the state and its adjoining areas. Large earthquakes have occurred in all parts of Himachal Pradesh, the biggest being the Kangra earthquake of 1905. The Himalayan Frontal Thrust, the Main Boundary Thrust, the Krol, the Giri, Jutogh and Nahan thrusts are some of the tectonic features that are responsible for shaping the present geophysical deposition of the state. Chamba, Kullu, Kangra, Una, Hamirpur, Mandi and Bilaspur Districts lie in Zone V i.e. very high damage risk zone and the area falling in this zone may expect earthquake intensity maximum of MSK IX or more. The remaining districts of Lahaul and Spiti, Kinnaur, Shimla, Solan and Sirmour lie in Zone IV i.e. the areas in this zone are in high damage risk with expected intensity of MSK VIII or more.

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#### 2.2.1.4 TERRORIST THREATS & ATTACKS

Power generating plants, dams, substations, Transmission Lines and Load dispatch centres form a prime target for such terrorist groups. These installations need to be protected against acts of terrorism. The terrorist-related aspects could be dealt with by making use of advancement of technology in the areas of surveillance and proper intelligence network.

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#### 2.2.1.5 BOMB THREATS, HOAX & BOMB EXPLOSIONS

Bomb explosion in Generating stations / sub-stations/ Load Dispatch centres, etc., can lead to the major crisis through a disturbance in grid & disruption in power supply In the event of a bomb explosion or a bomb threat, special measures need to be adopted under the expert's guidance.

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#### 2.2.1.6 STRIKES

Strike by any section of the employees in a generating station / substation / load dispatch centres or construction workers could lead to a crisis and can bring the system to a grinding halt if adequate steps to

run the generating station/sub-station / load dispatch centres are not taken. This could ultimately lead to blackout in areas, which could be as small as a locality or as large as a State or Region.

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#### 2.2.1.7 FIRE ACCIDENTS

Like natural calamities, fires are a big threat and cause loss to human life and property. However, disasters due to fire normally remain localized to a particular installation until and unless tripping of the entire power plant causes a disturbance in the transmission grid by way of overloading and leading to tripping of other power stations/ transmission lines connected with the grid. The most common cause of the fires is known to be electrical short circuits and fire triggered by the inflammable materials. The damages caused by the fire accidents generally take excessive time for restoration.

Analysis of causes of fire incidents reveal that majority of the fires could perhaps be prevented and extent of damage minimized if fire safety measures were strictly enforced. Early detection of fire and swiftness in fighting it can definitely turn major disaster to minor accidents. In power sector accidents taking place on account of human error or due to malfunctioning of any equipment are also causes of crisis situations.

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#### 2.2.1.8 CYBER ATTACK

The impact of cyber vulnerabilities is proportional to the criticality of the functions and systems being impacted. The cybersecurity vulnerabilities in generation sector are localized and its impact can shut down one unit or plant. The effect of vulnerabilities in centralized systems e.g. SCADA etc used in transmission sector is wide and has a potential impact on the synchronous operation of entire Power System leading to Grid collapse. As far as distribution sector is concerned, where the bulk of Smart Grid activities are visible, the impact of a compromise of a centralized SCADA / DMS can lead to disruption of services to critical customers like hospitals, metro etc. which is critical for the units involved but at the same time not global and widespread.

### 2.3 GAPS IN EXISTING CAPACITY

Officers and staff and elected representatives of the department should be well informed in the basic knowledge of disaster management and response. Human resources of the department need training on management and mitigation of different type of disasters including relief, rescue and rehabilitation. Department also needs to establish a monitoring mechanism at zone level to check the Disaster management plans. For this, a pool of resource persons is needed in each zone to help in preparation of safety plans. It will also be helpful in the auditing of these plans at grass root level to ensure the implementation of the concerns of risk reduction. Adequate financial powers need to be vested with the different level of the department to manage the crisis and setting up of adequate safety measures in the premises, such as Disaster Preparedness Kit, Fire Extinguishers etc.

### 3. RISK PREVENTION AND MITIGATION

#### 3.1 RISKS PREVENTION

Disasters occur with unfailing regularity in India and Himachal Pradesh causing loss of life, assets and livelihood. The increasingly shifting paradigm from a reactive response orientation to a proactive prevention mechanism has put the pressure to build a fool-proof system, including within its ambit, the components of prevention, mitigation, rescue, relief and rehabilitation.

Pre-disaster planning is crucial for ensuring an efficient response at the time of a disaster. A well-planned and well-rehearsed response system can deal with the exigencies of calamities and also put up a resilient coping mechanism. Optimal utilisation of scarce resources for rescue, relief and rehabilitation during times of crises is possible only with detailed planning and preparation.

Risk prevention encompasses all techniques and management practices that help to prevent unnecessary or foreseeable risks. Fundamentally, risk prevention is strategies that increase the resilience of area prone to disasters.

The departmental risks involved may be classified as under;

- Collapse of structures due to the earthquake.
- Conductor snapping due to mechanical failure, wind pressure, insulator failure.
- Insulator failure due to a lightning strike, mechanical damage, sabotage, surge voltages.
- Road blockage on account of conductor snapping or tower collapse near road crossings or road proximity.
- Fire hazards due to transformer oil burning, a short circuit in S/Y, control room, battery room, A/C D/C room etc.
- Electrical accidents
- Flooding of cable trench due to heavy rainfall.
- Besieging of EHT control room by terrorists.
- Bomb threat.

The departmental risk prevention measures are given in the table below:

Table 3: Risk Prevention Measures

Hazard	Prevention
Earthquake	Earthquake as such is unpreventable but its impact in the form of destruction of structures which could be prevented by designing resilient structures to earthquake impacts. All the departmental structures such as buildings, hydro project sites etc. should be designed, taking into consideration the loads/forces generated by the earthquake as prescribed by latest BIS Codes.
Landslides	Landslides can be prevented by a plantation of trees in the form of afforestation, creating stormwater drainage system, slope analysis etc. The department should avoid construction of its infrastructure in landslide-prone areas, if inevitable then proper prevention measures should be taken.

GLOF and Flash Floods	The Early warning system can prevent loss of livestock and property to the great extent. Further Department is also carrying out flood management in the areas which prone to flood.
Avalanches	The impact could be reduced by study and analysis of avalanche-prone zones by relevant agencies.

### 3.2 RISK MITIGATION

Risk mitigation is reducing the risks of disasters that are already there due to exposure and vulnerabilities to the hazards. Mitigation projects reduce the level of exposures or the depth of vulnerabilities or both through a combination of various structural and non-structural measures. Mitigation projects are always costly and therefore these have to be planned with proper Cost Benefit Analysis (CBA) to ensure that the benefits of the projects outweigh the costs. On the basis of its developmental responsibility, the department can liaise with other line departments and agencies for a coordinated mitigation approach.

The primary objective of mitigation efforts would be:

- To identify, delineate and assess the existing and potential risks to the energy sector and to work towards reducing potential casualties and damage from disasters.
- To substantially increase public awareness of disaster risk to ensure a safer environment for communities to live and work.
- To reduce the loss of energy sector due to disasters.

### 3.3 MATRIX OF HAZARD SPECIFIC MITIGATION MEASURES

HAZARD	MITIGATION MEASURES	
	STRUCTURAL	NON-STRUCTURAL
Earthquake	<ul style="list-style-type: none"> <li>• Revision and adoption of model building bye-laws for the construction of departmental assets.</li> <li>• Undertaking mandatory technical audits of structural designs of major projects by the competent authorities.</li> </ul>	<ul style="list-style-type: none"> <li>• Seismic hazard risk mapping pertaining to departmental assets.</li> <li>• Developing appropriate risk transfer instruments by collaborating with insurance companies and financial institutions.</li> <li>• Launching public awareness campaigns on seismic safety risk reduction and by sensitizing all stakeholders to earthquake mitigation measures.</li> <li>• Carrying out the vulnerability assessment of earthquake-prone areas and creating an inventory of resources for effective response.</li> </ul>
GLOF and Flash Floods	<ul style="list-style-type: none"> <li>• The department should demarcate the flood-prone area and no construction related to the department should be done there.</li> </ul>	<ul style="list-style-type: none"> <li>• Flood mapping pertaining to departmental assets.</li> <li>• Mitigation plan should be in place to safeguard the departmental infrastructure/ inhabitants from the flash flood.</li> </ul>



Landslides / Avalanches	<ul style="list-style-type: none"> <li>• Risk audit of the infrastructure</li> <li>• Selecting alignments for construction of structures which are less prone to landslides.</li> </ul>	<ul style="list-style-type: none"> <li>• Landslide hazard risk mapping pertaining to departmental assets.</li> <li>• Developing an inventory of the existing built environment in areas around existing landslides and in high hazard zones as per the LHZ maps and along strategic roads.</li> </ul>
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### 3.4 CAPACITY BUILDING FOR DISASTER MANAGEMENT

#### 3.4.1 DISASTER MANAGEMENT CELL:

There is need of setting up of Disaster Management Cell (DMC) in each division and corporate office. Emergency T&Ps and other electrical equipment will be kept in stock under the aforesaid DMCs to meet the crisis. The details of equipment are:

- First Aid Box
- Truck mounted crane.
- Hydraulic Pulling machine.
- Cable Crimping Tools
- Chain Pulley block
- Snatch Pulley
- Triofor (2T capacity)
- Gum Boot
- Rain Coat

#### 3.4.2 TRAINING AND DEVELOPMENT OF SKILL:

As per the CEA guideline relating to Safety and Electric Supply, there is need of Training and Development of Skill level of the human resources. In this regard, DOE has developed training cell and conducting training program for all the field engineers and workers on a rotation basis. Disaster Management is a part of the said Training programme. Further Mock Drill on Disaster Management shall be conducted twice in a year as preparedness exercise.

#### 3.4.3 ARRANGEMENT FOR STRENGTHENING THE EXISTING INFRASTRUCTURE:

It can be seen that DoE is an organization well prepared to meet all types of emergencies. One can be sure that Distribution Divisions of DOE will carry out whatever is expected of it, as per the nature of the disaster and the needs of the situation. Since disaster is a natural phenomenon, so following long terms measures have already taken by DOE towards the quick restoration of power supply to the essential institutions with the good financial support of state Govt. DOE has maintained a minimum stock towards the restoration power supply on account of the disaster, such as:

- 33 KV line: 3.0 KM
- 11Kv Line: 3.0 Km
- Different size of conductor: 50Km o LT Line: 5.0Km
- 11/0.4Kv Substation: 20 nos

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#### 3.4.4 MATERIAL PROCUREMENT AND SERVICES DURING EMERGENCY:

A special delegation of power to the officers for the purchase of emergency materials, obtaining services of manpower for execution of the restoration works are to be given from Head Quarter of DOE.

The Superintending Engineers and Executive Engineers of the respective zone shall be authorized to take into account the materials laying in stock in the various store of DOE. Only after the review of the stock of emergency materials, they will take procurement action for the balance required materials. However, they will give a certificate to Technical Head of DOE on non-available materials in store before taking procurement action.

A token of the emergency budget will be allowed by the General Manager (Finance) DOE to each division / circle.

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#### 3.4.5 LISTING OF EMPANELLED CONTRACTORS FOR RESTORATION OF POWER SUPPLY:

At the time of disaster, there will be a requirement of more number of squads and manpower with T&Ps for quick restoration of power supply. Accordingly, DOE has exercised and enlisted the HT contractors equipped with T&P and sufficient manpower.

## 4. MAINSTREAMING DISASTER RISK REDUCTION IN DEVELOPMENT

Mainstreaming disaster management into the development planning process essentially means looking critically at each activity that is being planned, not only from the perspective of reducing the disaster vulnerability of that activity but also from the perspective of minimizing that activity's potential contribution to the hazard.

Every development plan in the state would require incorporating elements of impact assessment, risk reduction, and adoption the 'do no harm' approach. The measures such as urban planning and zoning, upgradation of building codes their enforcement, adoption of disaster-resilient housing designs and flood proofing, response preparedness planning, insurance, the establishment of early warning systems generating community awareness, creating technical competence and promoting research among engineers, architects, health experts will be taken on priority.

### 4.1 MAINSTREAMING DRR INTO DEVELOPMENT

Mainstreaming DRR in Development has the following three purposes to achieve:

- To make certain that all the development programmes and projects that originate from or funded by Government are designated with evident consideration for potential disaster risks to resist hazard impact.
- To make certain that all the development programmes and projects that originate from or are funded by Government do not inadvertently increase vulnerability to disaster in all sectors: social, physical, and economic and environment.
- To make certain that all the disaster relief and rehabilitation programmes and projects that originate or are funded by Government are designed to contribute to development aims and to reduce future disaster risk.

DRR refers to the measures used to reduce direct, indirect and intangible disaster losses. The measures may be technical, economic or social. DRR encompasses the two aspects of a disaster reduction strategy: 'mitigation' and 'preparedness'. Mitigation refers to measures aimed at reducing the risk, impact or effects of a disaster or threatening disaster situation, whereas, preparedness refers to the measures undertaken to ensure the readiness and ability of a society to forecast and take precautionary measures in advance of imminent threat, and respond and cope with the effects of a disaster by organizing and delivering timely and effective rescue, relief and other post-disaster assistance. 'Mainstreaming DRR' describes a process to fully incorporate the concerns of disaster preparedness, prevention and mitigation into development and post-disaster recovery policy and practice. It means completely institutionalizing DRR within the development and recovery agenda. Accordingly, the following broad objectives of mainstreaming DRR into Development will be encouraged:

- Ongoing schemes and projects of the Ministries and Departments of Gol and State Governments, as well as of all Government agencies and Institutions, including Public Sector Undertakings, will be selectively audited by designated government agencies for ensuring that they have addressed the disaster risk and vulnerability profiles of the local areas where such schemes and activities are being undertaken.
- At conceptualization or funding stage itself, the developments schemes will be designed with consideration of any potential hazardous impact associated with it and incorporate measures for mitigation of the same.

- All the development schemes will be pragmatic, incorporating the awareness of local disaster risk and vulnerability, and ensuring that the schemes have addressed these concerns and included specific provisions -for mitigating such disaster concerns; and
- DDMA's will ensure that all the disaster relief and recovery programmes and projects that originate from or are funded by any agency satisfy developmental aims and reduce future disaster risks.

## 4.2 APPROACHES FOR MAINSTREAMING

There are three suggested approaches of mainstreaming disaster management into the development process and disaster management plans-

- Structural Measures
- Non- Structural Measures
- Disaster Mitigation Projects

Based on the suggested approaches the specific action would involve:

- Adopting a sectoral approach and identification of Key sectors for mainstreaming.
- Within each sector, key programmes/projects would have to be identified.
- This has to be followed by identifying the entry points within the programmes / projects for integration.
- It would also involve work at the policy and planning level be it national, state and district level.
- It would also need a close coordination with State Planning Commission and Finance Department for promoting DRR into all development programmes and involve working with different departments to mainstream DRR into the Departmental Plans and policies.
- Advocacy would have to be done for allocation of dedicated budget for DRR within the departmental plans.
- Further appropriate guidelines for different sectors would have to be developed and for it to be effective and sustainable, it has DRR would have to be ultimately integrated to the development plans of various departments at the district and sub-district levels.

## 5. DISASTER PREPAREDNESS

Disaster preparedness has been defined as “*the state of readiness to deal with a threatening disaster situation or disaster and the effects thereof*”. The Department may review their “state of readiness” and prepare a strategic action plan to deal with possible disaster situations.

### 5.1 STRATEGIES FOR DISASTER PREPAREDNESS

#### **Pre-Disaster Actions:**

This stage occurs when the prior information is available about a situation that may lead to a disaster in near future: Organizing Public Awareness Programmes is very important. The people living around the project can play a vital role in event of a disaster. For this purpose, public Awareness programme should be conducted regularly to make the general public awareness of potential hazards likely to occur in the project area. Emphasis may be given to the following aspects:

- Pamphlets and booklets constraining details Dos & Don'ts in the event of crisis / emergency situations and hazards associated with electricity generating stations be prepared and be made available to the general public.
- Permanent notice boards are fixed at all the suitable places in the area displaying information maps, escape routes, precautions to be taken and emergency communication details of nodal officers be displayed.
- Help from local youth organizations voluntary organizations educational institutions be sought to conduct an educational session to make people aware of the safety measures and rescue operations in the event of a disaster.
- The Emergency' management Group (EMG), depending upon the nature of emergency should be put on high alert.

#### **Pre-alert Notification:**

This type of notification is mainly used for disseminating an important piece of information concerning slowly developing emergencies which can either be rectified or would take some time before they turn into a crisis/disaster.

### 5.2 MEASURES FOR DISASTER PREPAREDNESS

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#### 5.2.1 ALERT NOTIFICATION:

An alert notification implies that although a crisis / disaster is not imminent, aggravation of the situation could lead to crisis unless condition improves / plant Level EMG and Local Officials should be alerted that an unsafe situation is developing.

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#### 5.2.2 WARNING NOTIFICATION:

A warning notification implies that a crisis / disaster is imminent and advance action may be initiated for minimizing the damage / rescue operations. The warning notification indicating the magnitude of crisis / disaster should be communicated to other power Station in the region and in case of hydropower projects,

to the authorities concerned with the important structures located on the downstream stretches of the river.

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### 5.2.3 NOTIFICATION RESPONSIBLY:

In case of developing crisis situation, the project authorities shall be responsible for issuing a proper notification to District / state / Central level agencies, depending on the severity of the crisis/disaster. Advance preparedness for effective preparedness to face the disasters and to avoid last-minute arrangements in panic conditions. The following aspects shall be covered as an organizational practice:

1. Well-documented emergency plans.
2. Data on availability of resources and buffer stock of restoration materials
3. Identification of key personnel: with their skills and experience of the disaster management.
4. Allocation of budget for emergencies.
5. "Delegation of power" at various levels for disaster conditions.
6. Mutual assistance agreements signed by all power utilities for sharing men and material resources on demand.

#### **Post-disaster Response and Recovery stage:**

Following features need to be kept in mind for efficient recovery with a clear hierarchy of command system for mobilization of damage assessment teams.

1. Mobilization of teams for the establishment of base camps / infrastructure.
2. Officer for communication with the outside environment / press etc.
3. Predefined staff for coordination with other agencies on restoration, front.
4. Management of funds and resources at the disaster front.

## 6. DISASTER RESPONSE AND RELIEF

### 6.1 RESPONSE PLAN

Natural calamities may be broadly grouped into major & minor types depending upon the potential to cause damage to human life & properties. While the Central & State Level interventions are necessitated for major calamities, local agency should respond to minor incidents. There will be three types of response elements involved in this plan:

1. **Operational response** to get the disruption under control as quickly as possible so that normal operation is resumed.
2. **Management response** to allocating resources and making critical decisions needed to resolve the situation.
3. **Communication response** to communicating with employees, their families, officials, other agencies and media.

#### **Constitution of Disaster Management group:**

- State level Disaster management group
- Principal Secretary / Secretary (Energy) of the State
- CEOs / CMDs of generating, transmission & distribution companies
- Representative of health & welfare agencies
- Chief Fire safety
- Inspector general Police

#### **Responsibilities**

- To mobilize resources for restoration
- To ensure that disaster management plans are in place
- To mobilize financial resources
- To facilitate inter-agency support
- To coordinate information
- To facilitate damage assessment

#### **Plant level Emergency Management Group (EMG)**

- In charge of the installation
- Plant safety manager
- Chief Plant Operation Administration

#### **Representative of District Administration Responsibilities:**

- To direct action within the affected area taking into consideration the priorities for the safety of plant personnel, minimize damage to plant property and the environment.
- To direct fire and security personnel for immediate action.
- To ensure that all non-essential workers / staff in the affected area are evacuated to safer places.
- Set up communication points.

- Report all development and requirements / assistance needed
- Preserve all evidence so as to facilitate an inquiry into the cause and circumstances which cause or escalated the emergency
- To coordinate with District Administration for necessary finance, medical law & order etc.

**EMG shall maintain the following:**

- Safety data pertaining to all hazardous materials likely to cause an emergency.
- The procedure of major and special fire-fighting materials likely 10 causes etc.
- Procedures for tackling harmful gases and other chemical leakages.
- Emergency calls out the list of persons drafted for emergency control, key personnel, fire safety, Fire safety, First aid, Medical, Security, police and District Admin. Authorities.
- Emergency manuals, Blown up area maps, District Public address system. Emergency lights etc.
- Identification of personnel for Mock drills & training Inter-group relationships in Disaster Management System.

## 6.2 EMERGENCY SUPPORT FUNCTION

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### 6.2.1 STANDARD OPERATING PROCEDURE

The role of Shift Personnel on duty during the occurrence of the incident is vital. Because this team will isolate the hazardous area and communicate news to all concerned and is to take initial steps to meet the emergency, till the emergency team members arrive at the site.

Measures to be taken by Operation Personnel (Action Team-A) during the disaster are given below:

#### **A. Fire Alarm (Siren):**

##### **i. In case of Fire, in any part of the Power House premises**

To put “ON” the SIREN to inform all the personnel including Power House Colony. The siren under such situation is the continuous type which is distinguishable from normal shift change siren used during starting of Generating units.

##### **ii. Fire in Cable Gallery**

In case of fire in Cable Gallery, make all AC / DC system “OFF”. Subsequently, the emulsifier system operates automatically. But in case of an operation of auto mode, manually operate from the panel or deluge valve immediately. In case of failure of auxiliary supply to make up Pump, operate the D.G. Set of filter house. In addition to this, use fire breakers in cable gallery to protect from fire.

##### **iii. Fire in Store / Fire in Other Auxiliary Equipment / Panel**

- Disconnect all the electrical lines. Isolate the AC / DC supply.
- Apply portable fire-fighting cylinders / fire buckets immediately.
- Take out carefully the unaffected portable & costlier materials, while fire-fighting is going on.
- Apply hydrant system from the nearest cabinet.
- Call for fire brigade immediately.



**iv. In case of Fire in Cable Galleries / Generators:**

- Trip all Running Generator Breakers and all line breakers.
- Trip the Field Breaker
- Stop the Machine
- Pull the Fire Button provided at Control Desk or in the Unit Control Board
- Open the Butterfly Valve near the Shaft Seal Panel at Turbine Floor
- Switch off all Ventilation Blower and Switch on all Exhaust Blower

**v. In case of Fire in Generator Transformer / SST / UAT**

- Heat Detectors provided in the Transformer for sensing the heat operates the emulsifier system immediately.
- Stop the machine and isolate the transformer from the bus along with control supply of AC /DC.
- Run the emulsifier system of adjacent transformers as a precaution along with the burning transformer.
- Trip all running generator breakers and all line breakers

**vi. In case of supply failure from all sources**

Start DG Set at Power House for operating the Dewatering Pumps. In case of abnormal water leakage in Power House from Spiral Casing, Main Inlet Valve (MIV), on downstream side,

- Stop Running Machine be stopped
- Lock up MIV & Guide Vane
- Close Bye Pass Valve
- Lower the Draft Tube Gate
- Start De-Watering

**vii. In case of heavy leakage from the upstream side of MIV, following action need to be taken immediately:**

- Stop Running Machine
- Lock up MIV & Guide Vane
- Close Bye Pass Valve
- Lower the Surge Shaft Gate
- Lower the Intake Gate
- Start De-Watering

**viii. In case of failure in tunnel, following action need to be taken immediately**

- Stop Running Machines
- Lock up MIV & Guide Vane
- Close Bye- Pass valve
- Lower the Surge Shaft Gate
- Close the Intake Gate
- Start De-Watering of the tunnel.

**ix. In case of heavy flood in the river, following actions needed to be taken immediately**

- Stop the Running Machines
- Close TRT Gate
- Close Draft Tube Gate
- Start De-Watering of seepage/leakage water through the main portal

**B. Trigger Mechanism for Response:**

- To inform the Safety Officer & Security Officer and all others concerned. To stop the Plant quickly, if necessary.
- To isolate the live parts of Electrical equipment, if any.
- To release the pressure from the affected equipment.
- In case of fire, apply/ensure operation of Fire Fighting System till the fire is arrested or the Fire Brigade arrives to minimize the effect of fire.
- Treat the affected personnel in case of Electrical Shock.
- Get the Fire Victim immediately laid on the ground when cloths have caught fire.
- Ask the Fire Victim, not to the role but lie down quietly without any movement.
- Approach the Fire Victim with a wet towel, a thick cloth, mattress or blanket (if available readily) and cover the body.
- Apply First Aid to injured personnel.

**C. Response Plan for responding effectively & promptly:**

Following facilities are available in the Main Control Centre i.e. Main Control Room to respond effectively & promptly to any threatening Disaster situation.

- On site Emergency Disaster Management Plan.
- The location chart of Emulsifier System, Fire Hydrant, and First Aid box, Exit Places, etc at different floors.
- The list of safety Appliances available with respective Power Stations.
- The list of personnel to be engaged for a different type of disaster with their address & phone numbers.
- Emergency vehicle stationed at Power station on regular basis.

**D. Appointment of Nodal Officer to perform Emergency Support Functions:**

The Sub-Divisional Officer of Generation Division is the Safety Officer in respective of the Power Station. He also acts as Nodal Officer to perform emergency support function in case of any Disaster happening in any Power Station. He is the most important functionary in respect of Prevention, Mitigation, Preparedness, and Restoration & Rehabilitation leading to Disasters.

In case of any Emergency / Disaster / Crisis, SDO Generation will act Emergency Leader / Nodal Officer and will immediately take over charge of Rescue / Restoration work. The control Centre will be opened immediately in the main Control Room in the Power Station building. If the total powerhouse is affected by the incident, then the Chamber of the Technical Wing Head acts as Control Center.

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## 6.2.2 CONSTITUTION OF INCIDENT RESPONSE TEAM AND DELEGATION OF AUTHORITY:

All the Power Stations have incident response teams as detailed below with specified delegation of authority to take actions for Restoration & Rehabilitation during Disasters.

**Action Team 'A':** - This team immediately rushes to the spot to control the situation till the emergency team members arrive at the site. They communicate the news of incident to all concerned. They isolate all the electrical connections from the affected site including a complete shutdown of power plant if necessary. They evacuate persons affected due to Disaster.

**Action Team 'B':** Maintain the communication network in working condition. Attend urgently repairs in the communication system if required. Contact Statutory Authority. Arrange for relievers and catering facilities. Give information to media. Arrange shelters for affected persons in contact with Medical Centre. Communicate the news of the Disaster to all concerned and liaisons with statutory Authorities and District Administration for help, towards rescue, restoration and rehabilitation. Pass information to the kith and keep fatal & injured persons.

**Action Team 'C':** This team is trained in Fire Fighting / Flood Control / Natural Calamity Rescue Operations. The team takes over charge soon after the occurrence of an incident due to Fire, Accident, and Equipment Failure, Terrorist Attack, Sabotage or any other reason. In case it is not possible to control the fire with the existing system, then they take help of fire brigade and also they seek the help of nearby Power Station.

**Action Team 'D':** Arrange First aid material, stretcher and reach accident site quickly. Arrange for immediate medical attention. Arrange for sending the casualties to various hospitals and Nursing Homes etc. Arrange for urgently required materials through a cash purchase. Arrange for Funds for various relief measures as well as the emergency purchase of materials. Sending employees for an emergency purchase.

**Action Team 'E':** This team is trained in Restoration & Rehabilitation. Organize all support services. Soon after the emergency, this team takes charge of the affected areas for Restoration & Rehabilitation work and shall be present at the site until completion of the work. The concerned Manager of the Division of the affected area leads the team and the Safety Officer coordinates the Restoration & Rehabilitation work.

**Action Team 'F':** Man all the gates. Bar entry of unauthorized persons and non-essential staffs. Permit with minimum delay the entry of all key personnel of outside agencies, vehicles, Ambulances, Evacuation vehicles without normal checks etc. who have to provide assistance. Send mechanic to the Disaster site for attending the minor defects in Ambulance & other vehicles. Arrange Petrol & Diesel supply. Arrange Safety requirement. Record location. Account for personnel. Help in search of missing personnel. Collect & preserve evidence in connection with the accident, guide authorities on all safety-related issues.

**Action Team 'G':** This team looks after the miscellaneous works i.e. the works not assigned to any team. This team is headed by Manager Utility Division and assisted by SDO, Utility (Civil) Sub-Division and SDO, Utility (Electrical supply) Sub-Division. This team ensures Water Supply, Temporary Electrification and Supply of Food Packets etc. during the Restoration & Rehabilitation period.

**Action Team 'H':** They inform all executives of the Project and external agencies about the occurrence of the Disaster & Status of Disaster Management activities. This team discusses regarding the reason for occurrence of the disaster and came to a final conclusion on the matter of intimating the outside agencies regarding the Disaster & informs accordingly. The team takes action for the opening of the Main Control Center & Sub-Control Centre and to keep constant touch with different incident Response Team and convey the same to the concerned external agencies. While doing so, the members of the Liaisoning team should be careful to get the accurate information.

## 7. DISASTER RECOVERY AND RECONSTRUCTION

The occurrence of any disaster will be immediately communicated to the district control room and District Disaster Management Authority. The responsibility of communication lies with the warning and information cell. Search and rescue team will start evacuation followed by first aid treatment. This cell should immediately apprise the district headquarters of the calamity and the action which has already been taken. Gram Panchayat should also ask for more assistance from the district headquarters and should not hesitate to bring to the notice of district officers about their difficulties. If there is a disruption in telecommunication facilities, the special messenger should be sent to communicate with district headquarters. In case of severe nature of calamity, the Deputy Commissioner of the concerned district should get in touch with the State Disaster Management Authority. He/ she will brief the State Disaster Management Authority about the nature of the natural calamity and the action which he has already taken and further assistance required by him. This should be done without any loss of time.

An initial assessment of damages caused to the electrical infrastructure due to the disaster will be given by the nodal officer/team. Based on this, restoration of electrical power in the possible affected area will be planned, coordinated and executed. Supply will be restored after ensuring all safety and technical aspects.

In consultation with SDMA officials, the need of the Department Operation Center will be ascertained for its continuance or withdrawal. Once the disaster is subsided and after ensuring power supply normalcy in the affected areas, the Emergency Operations Center activities would be closed and the diverted officers/staff will be sent back to carry out their routine works.

## 8. FINANCIAL ARRANGEMENTS

Section 40(2) of the Disaster Management Act stipulates that every department of the State Department while preparing the DM Plan, shall make provisions for financing the activities. Normally the funds required for risk assessment and disaster preparedness must be provided in the budgets of every concerned department. Such funds are not very sizeable and departments should be able to allocate such funds within their normal budgetary allocations. This budget can be used to work upon the already suggested mitigation and preparedness measures, as response and relief are already being taken care of by the SDRF and NDRF.

Funds for disaster response, relief and rehabilitation are provided in State Disaster Response Fund (SDRF) which the departments can access without any problem. In case such funds are not adequate the additional demands can be projected by the State Government which can be met from the National Disaster Response Fund (NDRF).

No separate fund is available with Directorate of Energy for disaster management activities. The directorate should make financial allocations in preparing and executing the disaster management plan. The finance officer should plan for the following:

1. Funds for Prevention and Mitigation Activities
2. Funds for Preparedness and Training Activities
3. Funds for Response Activities (including pre-authorization to draw money from treasury in the event of an immediate emergency)
4. Funds for Disaster Risk Insurance.

## I. Standard Operating Procedure (SOP)

SOPs should be prepared for various personnel for effective response to emergencies and disasters.

### Action before Disaster:

- Communicate with Govt., SDMA and other related departments about the course of disaster and action.
- Do not allow leave to the staff.
- Cover the endangered tower footing.

### Action during Disaster:

- Planning for restoration for various kinds of probable damage.
- In case of fire due to any fault, the help of automatic water spraying/gas injection technique to be relied upon.
- Do not try to engage manpower for restoration activities.

### Action after Disaster

- Arrange materials according to information received from different areas affected by disaster on the extent of the damage.
- Assess the damage by line patrolling.
- Take the help of Govt. for an aerial survey of the affected lines. Mobilise manpower and materials to the affected locations.
- Communication between SLDC, related grid s/s and Management to be maintained.

Do not charge lines without confirmation.

## **II. Safety Practices, Audit & Training**

### **First Aid Box:**

The control rooms will be equipped with first aid boxes containing the following items for initial treatment of occupational hazards which may vary from small cuts, broken hands / legs, injuries to the head or spinal cord, diarrhoea, fever to snake bite. The first and foremost necessity at that time is first Aid which may include CPR (Cardio Pulmonary Resuscitation) or heart defibrillator. So, all Grid S/S are equipped with first aid boxes containing essential medicines which may be administered before transferring the patient to the hospital.

#### Contents of First Aid Box:

1. Combiflam Tablet
2. Cetirizine 10 mg Tablet
3. Colimex Tablet
4. Dispirin Tablet
5. Domstal Tablet
6. Paracetamol 500 mg Tablet
7. Rantac 150 mg Tablet
8. Relispray
9. Band Aid 10 nos
10. Cotton Roll 20 gms
11. Gauze Roller 7.5 cms
12. Sterile Gloves no.7 ½
13. Betadine ointment 20gms
14. Dettol 100 ml
15. Sterilized Gauze Swabs 5x5 cms
16. Tape Micropore 1 inch

### **Safety & Fire drill:**

Mock Safety exercise programme concentrates on:

1. Mock First-aid exercise
2. Mock Fire Extinguishing exercise
3. Mock exercise of standard operating procedure for Line Clearance (L / C) requisition / issue / return / cancellation along with the procedure for maintenance work after availing L / C.

### **Safety Audit:**

The department should conduct safety audit in grid sub-stations from time to time to have a check and instil awareness about sticking to the safety norms and standards.

### III. List of Hydro Electric Projects in Himachal Pradesh

Name	District	Basin	River
Allain Duhangan Hydroelectric Project	Kullu	Indus up to International Border	Allain and Duhang
Andhra Hydroelectric Project	Shimla	Indus up to International Border	Andhra Khad
Baira Siul Hydroelectric Project	Chamba	Indus up to International Border	Baira
Baner Hydroelectric Project	Kangra	Indus up to International Border	Baner Khad
Baspa Hydroelectric Project Hydroelectric Project	Kinnaur	Indus up to International Border	Baspa
Bassi Hydroelectric Project	Mandi	Indus up to International Border	Beas
Bhakra Hydroelectric Project	Unna, bilaspur	Indus up to International Border	Satluj
Binwa Hydroelectric Project	Kangra	Indus up to International Border	Binula
Chamera - I Hydroelectric Project	Chamba	Indus up to International Border	Ravi
Chamera - II Hydroelectric Project	Chamba	Indus up to International Border	Ravi
Chamera - III Hydroelectric Project	Chamba	Indus up to International Border	Ravi
Dehar Hydroelectric Project	Rampur / Shimla	Indus up to International Border	Beas
Gaj Hydroelectric Project	Kangra	Indus up to International Border	Gaj Khad
Ghanvi Hydroelectric Project	Shimla	Indus up to International Border	Satluj
Giri Hydroelectric Project	Sirmaur	Indus up to International Border	Giri
Karcham Wangtoo Hydroelectric Project	Kinnaur	Indus up to International Border	Satluj
Keshang Hydroelectric Project		Indus up to International Border	Satluj
Koldam Hydroelectric Project	Shimla	Indus up to International Border	Satluj
Largi Hydroelectric Project		Indus up to International Border	Beas
Malana Hydroelectric Project	Kullu	Indus up to International Border	Malana
Nathpa Jhakri Hydroelectric Project	Shimla	Indus up to International Border	Satluj
Parbati II Hydroelectric Project	Shimla	Indus up to International Border	Parbati
Parbati III hydroelectric project		Indus up to International Border	Parbati
Pong Hydroelectric Project	Kangra	Indus up to International Border	Beas
Rampur Hydroelectric Project		Indus up to International Border	Satluj



Ranjit Sagar Dam Hydroelectric Project	Shahpurkandi (Pathankot)/ Gurdaspur	Indus up to International Border	Ravi
Sanjay Vidyut Pariyojna (Bhabha) Hydroelectric	Kinnaur	Indus up to International Border	Bhaba
Shanan Hydroelectric Project		Indus up to International Border	Uhl
Sorang Hydroelectric Project	Kullu	Indus up to International Border	Sorang
Tangnu Romai Hydroelectric Project		Indus up to International Border	Pabbar
Thirot Hydroelectric Project	Lahaul Spiti	Indus up to International Border	Thirot
Uhl - III Hydroelectric Project	Kangra	Indus up to International Border	Rana Neri khad
Yamuna Hydroelectric Project	Dehradun	Ganga	Yamuna





