

## **1. Introduction**

The High Powered Committee on Disaster Management, 2001 identified 14 Emergency Support Functions (ESFs), which are the essentials of emergency management comprising of various coordinating agencies, which manage and coordinate specific kinds of assistance common to all disaster types. It also introduced a concept of trigger mechanism, which was developed to ensure the smooth flow of response activities after disaster. The trigger mechanism has been envisaged as a preparedness plan whereby the receipt of a signal of an impending disaster would simultaneously energise and activate the mechanism for response and mitigation without loss of crucial time. This would entail all the participating managers to know the task assigned to them and the manner of response. Identification of available resources, including manpower, material, equipment and adequate delegation of financial and administrative powers are prerequisites to the successful operation of the trigger mechanism. Thus, in order to commence activities at various stages of a disaster, Standard Operating Procedures (SOP), which are in essence the trigger mechanisms, need to be developed for each of the 14 ESFs. This document provides Standard Operating Procedures in respect of the **Emergency Support Function -3 Power** .

Role of Primary and Supporting Agencies are listed. Necessary checklists and formats are attached. The actions to be taken by the concerned agencies before, during, after a disaster and during normal times are provided in this document.

This document has been developed keeping in view the guidelines provided by the following:

- i. "The Report of High Powered Committee (HPC) on Disaster Management, October 2001
- ii. "National Disaster Response Plan – Building a Culture of Prevention", prepared by the High Powered Committee (HPC) on Disaster Management, October 2001
- iii. "Disaster Management Act" passed by the Indian Parliament on 26 December 2005
- iv. Uttar Pradesh State Disaster Management Act 2005.

## **PRIMARY AGENCY**

Uttar Pradesh Power Corporation Limited (UPPCL) is responsible for coordinating the activities of ESF-3 and acting as a liaison between the various community agencies providing services in the field.

## **SUBSIDIARY AGENCIES**

The supporting agencies of ESF- 3 are - District Administration, five distribution companies of (UPPCL) :Pashchimanchal Vidhyut Vitran Nigam, Madhyanchal Vidhyut Vitran Nigam , Dakshinanchal Vidhyut Vitran Nigam, Purvanchal Vidhyut Vitran Nigam &KESCO and production units of UPPCL.

## **UTTAR PRADESH: POWER SCENARIO**

Uttar Pradesh is the most populated state of India. Area wise it is the third largest state of the country .The power supply is the vast geographical area(294411 sq

km), is being maintained through various food centers and approx 230300 km(1997) of transmission lines. The system comprises

1. 11 nos. of 400 kv
2. 33 nos. of 220 kv
3. 196 nos. of 132 kv sub station.

### **Distribution companies of UP together with zones:**

1. Pashchimanchal Vidhyut Vitran Nigam: Meerut, Saharanpur, Moradabad Distribution Zones and Noida Distribution Circle.
2. Madhyanchal Vidhyut Vitran Nigam: Bareilly, Lucknow, LESA and Faizabad Distribution Zones.
3. Dakshinanchal Vidhyut Vitran Nigam: Agra, Kanpur, Banda, and Jhansi Distribution Zones.
4. Purvanchal Vidhyut Vitran Nigam: Allahabad, Varanasi, Gorakhpur, and Azamgarh Distribution Zones.
5. KESCO (Kanpur)

Main thermal power plants are as follows

1. Anapara A
2. Anapara B
3. Obra thermal
4. Obra extension I
5. Obra extension II & III
6. Panki
7. Panki extension

8. Parichha
9. Harduaganj A
10. Harduaganj B
11. Harduaganj C

MAIN HYDEL POWER PLANTS ARE AS FOLLOWS:

1. NIRGAZNI
2. CHITORA
3. SALAWA
4. BHOLA
5. PALARA
6. SUMERA
7. BELKA
8. BABAIL
9. SHEETLA
10. RIHAND
11. MATA TILA
12. OBRA HYDEL
13. KHARA

## Salient Features: U.P. Power Corporation Ltd. As on 31<sup>st</sup> March, 2007

### Generation

	Installed capacity MW	Derated Commercial capacity MW	Total (Gross) Generation 2006-07	Auxiliary consumption 2006-07 MU	Net Generation/Import 2006-07 MU
Thermal (UPRVUN)	4160	3987	20741.358	2123.652	18617.706
Hydro (UPJVN)					
Total (Main Capacity)	516.50	516.50	1426	4.948	1421.052
Micro Hydel	9.6	9.6	4	0.065	3.63
<b>TOTAL CAPACITY</b>	<b>4686.1</b>	<b>4513.1</b>	<b>22171.358</b>	<b>2128.665</b>	<b>20042.693</b>
U.P. share in Central schemes	4547				26480.53
Import from other sources					4712.987

### Aim

The aim of the sop for the power sector is to provide necessary guidelines for assistance to organizations engaged in generation, transmission and distribution of electrical power for ensuring safety of people, protection of environment, protection of installations and restoration of power supply.

### Scope

The scope of sop gathers , assesses, and shares information on energy system damage and estimations on the impact of energy system outages within affected

areas. Damage to an energy system in one geographic region may affect energy supplies in other regions that rely on the same delivery systems. Consequently, energy supply and transportation problems can be intrastate, interstate, and national level. The vastness of the area affected varies from place to place

## **Objectives**

- a) To improve state of preparedness to meet any contingency
- b) To reduce response time in organizing the assistance.
- c) To identify major resources, man power, materials & equipments needed to make the plan operational
- d) Making optimum use of the combined resources.

## **Activation**

Based on the information received by the SDO (Sub Divisional Officer), the Principal Secretary (Department of power ) will issue a alert to manage the power disaster. Immediate actions to be taken accordingly.

## **Disaster Conditions**

Power sector is backbone for any economy; if it is affected due to any disaster, it will lead to disruption in generation, transmission and distribution of electricity. It is therefore, becomes extremely important to evolve disaster management plan to restore the generation; transmission and distribution of power in the affected areas in the shortest possible time.

## **Planning Assumptions**

- There is no substitute for maintaining standards of services and regular maintenance during the normal times. This affects the response of the department of any disaster situation.
- The department is required to study operating procedures for mobilizing community participation during various stages of disaster management and adapt appropriate measures to ensure that community participates substantially
- For effective preparedness, the department must have disaster response plan or disaster response procedures clearly defined in order to avoid confusion, improve efficiency in cost and time.
- Orientation and training for disaster response plan and procedures accompanied by simulated exercises will keep the department prepared for such eventualities. Special skills required during emergency operations need to be imparted to the officials and the staff.
- To the extent possible, preventive measures as recommended in the preparedness and mitigation document of DDMAP should be undertaken to improve departmental capacity to respond to a disaster.

### **Structure of Disaster Management System for Power Sector.**

A 4-tier structure is proposed for the purpose —State level, Regional level, Zone level and Plant unit level with intervention and response depending on the severity of the disaster/calamity. While the state & regional level interventions are necessitated for major calamities, the zone and, local agencies should respond

to minor incidents. A well-defined and comprehensive disaster management plan should typically involve the following three types of response elements:

- a) **Operational response**- to get the disruption under control as quickly as possible so that normal operation is resumed.
- b) **Management response**- to allocate resources and making critical decisions needed to resolve the situation.
- c) **Communication response**- to communicate with employees, their families, officials, other agencies and media.

**The various activities in response to a disaster shall include:**

- a) Exchange of information in terms of event description, its severity and action plan.
- b) Identification of resources need and their deployment viz, technical experts, manpower, equipment, spare parts & other material.
- c) Early restoration and to facilitate re-inspection as needed.
- d) Field/Site surveys, damage assessment
- e) Post event investigation & analysis and strategy for the future.

## **Constitution of Disaster Management Groups**

### **State Level Disaster Management Group (SDMG)**

Responsibilities:



- a) To facilitate development of comprehensive disaster management plan & policy formulations
- b) To interact with the national Disaster Management Group.
- c) To facilitate support from other national & state level agencies.
- d) To coordinate for any assistance in terms of men and materials at national level.
- e) To act as information source desk for all related developments in the event of a disaster.
- f) To provide inter-state emergency & start up power supply

### **Regional Level Disaster Management Group (RDMG)**

#### Responsibilities

- a) To coordinate early restoration of transmission system
- b) To participate in damage assessment.
- c) To facilitate resource movement to affected state(s) from other regional states.
- d) To mobilize material and financial resources in case of big fault.

### **Zone Level Disaster Management Group (ZDMG)**

#### Responsibilities:

- a) To mobilize resources for restoration

- b) To ensure that disaster management plans are in place.
- c) To facilitate inter-agency support.
- d) To coordinate information.
- e) To facilitate damage assessment

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

#### Responsibilities:

- a) To direct actions within the affected area taking into consideration the priorities for safety of plant / installation, personnel, minimize damage to plant & equipments, property and the environment.
- b) To direct fire and security personnel for immediate action.
- c) To ensure that all non-essential workers / staff in the affected area are evacuated to safer places
- d) Set up communication points
- e) Report all developments and requirements / assistance needed.
- f) Preserve all evidences so as to facilitate any inquiry into the cause and circumstances which caused or escalated the emergency
- g) To coordinate with District Administration for necessary finance, medical, law & order etc.

### **EMG shall maintain the following:**

- a) Safety data pertaining to all hazardous materials likely to cause emergency.
- b) Procedure of major and special fire fighting, rescue operations, first aid etc.
- c) Procedures for tackling harmful gases and other chemical leakages.
- d) Emergency call out list of persons drafted for emergency control, key personnel, Fire safety, First aid, Medical, Security, Police and District Administration and other Authorities.
- e) Emergency manuals, Blown up area maps, District Phone directory, public address system, Emergency lights etc.
- f) Identification of personnel for Mock drills & training

### **PRIMARY AGENCY**

Uttar Pradesh Power Corporation Limited (UPPCL) is responsible for coordinating the activities of ESF-3 and acting as a liaison between the various community agencies providing services in the field. As the Primary Agency for ESF-3, the responsibilities include:

- a) Notification, activation and mobilization of all agencies assigned to ESF-3.
- b) Organizing and coordinating the various assignments and staffing of facilities at which ESF-3 is required to be located.
- c) Coordination of all support agency actions in performance of missions

assigned to ESF-3.

- d)** Responsible for maintaining and updating the Power inventory (personnel, equipment, vehicles, contracts, etc.).
- e)** Serves as the focal point for issues and policy decisions relating to energy in all response and restoration efforts.
- f)** Monitors energy system damage and repair work.
- g)** Collects, assesses, and provides information on energy supply, demand, and prices; and contributes to situation and after-action reports.
- h)** Identifies supporting resources needed to restore energy systems. Deploys DOE response teams as needed to affected area(s) to assist in response and restoration efforts.
- i)** Reviews and sponsors the energy industry's requests for Telecommunications Service Priority (TSP) assignments to provision new services.

## **SUBSIDIARY AGENCIES**

The supporting agencies of ESF- 3 are - District Administration, five distribution companies of (UPPCL) :Pashchimanchal Vidhyut Vitran Nigam, Madhyanchal Vidhyut Vitran Nigam , Dakshinanchal Vidhyut Vitran Nigam, Purvanchal Vidhyut Vitran Nigam &KESCO and production units of UPPCL.

Uttar Pradesh Power Transmission Corporation (UPPTC).

All support agencies of ESF- 3 will perform following generalized functions.

- a.** Notifying, activation and mobilizing all personnel and equipment to perform or support assigned functions designated with the Basic Plan of this document or the response actions of this Annex.

- b. Coordination of all actions of the support agency with the primary agency in performing assigned missions of ESF-3.
- c. Identifying all personnel and resource requirements to perform assigned missions which are in excess of the support agency capabilities.

### **PREVENTING DAMAGE TO THE SYSTEM**

- a) Modify the Physical System
- b) Increase Spinning Reserves
- c) Stockpile Critical Equipment
- d) Assure Adequate Transportation Capability
- e) Monitor Domestic Manufacturing Capability
- f) Less Vulnerable Technologies
- g) Decentralized Generation
- h) Stockpile Transformers

### **Actions Before Disaster**

### **UPPCL AND ITS SUBSIDIARY COMPANIES**

UPPCL AND ITS SUBSIDIARY COMPANIES will take following action before disaster:

- ✓ All Zonal level officials of the department would be asked to report to the work stations.
- ✓ Appoint one officer as “NODAL OFFICER – Power Supply (Principal Secretary)” at the state level.

- ✓ In absence of the Principal Secretary, Managing Director (MD) will be responsible at the state level.
- ✓ Appoint one officer as “Officer –in- charge – Power Supply (Managing Director in distribution companies). UP have five distribution companies, as mentioned above.
- ✓ In the absence of Managing Director, Chief Engineer attached to the Managing Director will perform the function.
- ✓ Appoint one officer as “Officer –in- charge – Power Supply (Chief Engineer at, zonal Level)” (UP have 17 zones).
- ✓ In the absence of Chief Engineer, Superintendent Engineer will perform the function.
- ✓ Review and update precautionary measures and procedures and review with staff, the precautions that have been taken to protect equipment and the post disaster procedures to be followed.
- ✓ Regular technical inspection of the all equipments and instruments of the plant or sub station should be done to avoid any mishap in present day and their proper functioning at the time of any disaster. The following should be inspected regularly.
  - High tension power lines,
  - Transformers,
  - Insulators,
  - Poles,
  - Other equipments should be checked regularly.
- ✓ Disaster management Tool kit should be established at each sub station comprising:

1. Cable cutters,
2. pulley blocks,
3. jungle knives,
4. axes,
5. crowbars,
6. ropes,
7. hacksaws and
8. spanners,
9. Tents
10. Ladders for crews should also be in store.

- ✓ Information system will include following:
  - An advanced information system should be maintained at each level of hierarchy or at each substation level.
  - The information should immediately reach the Emergency Management Group who in turn through chain of command be made known to all the key personnel in the organization.
- ✓ Exhaustive training of personnel's at each level of the hierarchy for dealing with the disaster situation. Starting with the search and rescue, finding and fixing faults, working long hours under stress conditions.
- ✓ An illustrative check list of who has to do what, to whom report and how to do, is required to be prepared by each sub- station, in case of emergency.
- ✓ An illustrative check list of the material being used during and after the disaster condition should be made.
- ✓ At the time of disaster the mutually cohesive actions and response of the local authorities is needed.

- ✓ Public Awareness Programme should be conducted regularly to make the general public aware about potential hazards likely to occur in their area. Emphasis may be given to the following aspects.
  - Display of information at all the suitable places in the area related to assisting agencies, their telephone numbers, etc.
  - Participation of local youth organizations, voluntary organizations, educational institutions be sought to conduct educational session to make people aware about the safely measures and rescue operations in the event of a disaster.
- ✓ There are few public services which need emergency power supply therefore power back for them is essential
  - Key Government Offices,
  - Hospitals,
  - Water supply and drainage board,
  - Police stations,
  - Telecommunication and
  - Meteorological stations.
- ✓ 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:
  - Well-documented emergency plans.
  - Data on availability of resources and buffer stocks of restoration materials.
  - Identification of key personnel: with their skills and experience on the disaster management.
  - Allocation of budget for emergencies.



- “Delegation of Power” at various levels for disaster conditions.
  - Mutual assistance agreements signed by all power utilities for sharing men and material resources on demand.
- ✓ The facilities considered necessary for preventing and minimizing the impact of disasters are given below:-
- **Recovery Equipment and Spares Inventory:** In case of any disaster, it is necessary to have an inventory of recovery equipment and spares available with various power utilities and their location so that these could be pressed into service within the shortest possible time.
  - **Communication Facilities:** For dealing with any crisis situation, communication plays a very vital role. Use of satellite communication system can be effectively made to coordinate the activities of various agencies involved in the relief and restoration work and expedite restoration of normalcy in the shortest possible time.
  - **Transport and Other Arrangements:** Arrangements for adequate number of vehicles for movement of people and materials must be ensured. Medical facilities around the clock shall be made available to the staff engaged in the restoration activities. Arrangements for drinking water supply must also be ensured.
  - **Financial Resources:** Arrangements for cash flow of adequate financial resources must be made so that the restoration activities do not get hampered because of shortage of funds. The authorized signatory may be designated for each strategic location that can take on the spot decision.

- **Black Start Facilities:** Arrangements for start up power source for each major installation must be identified. Regional Load Dispatch Centers have to make necessary plans.
- **De-watering Pumps:** During floods the immediate concern is to minimize the impact of flood water on generators and other equipment. Availability of de-watering pumps is, therefore, considered necessary for stations located in flood prone areas.
- **Mobile DG Sets:** Sufficient number of mobile DG sets should be available at all distribution circles and should be moved immediately to provide emergency relief & to meet the need of dewatering pumps.
- **Solar Energy Systems and Photovoltaic System:** Solar energy systems and photovoltaic systems are particularly viable and suitable during the initial periods of disaster. The non-conventional sources of energy such as solar cells, photovoltaic power systems and also diesel generating set are of great value especially when factored against the high cost and rampant looting that often accompanies blackouts. The renewable energy sources can play an important role in reducing the exposure to risks of natural disasters and in speedy recovery because distributed renewable energy power systems are much less prone to being knocked out of service from a single catastrophic natural disaster than are centralized power systems.
- **List of Contractors:** The local Project Authorities of disaster prone areas should keep a list of competent contractors/agencies who can be assigned the various components of restoration activities in the event of a disaster.
- **Emergency Restoration Systems (ERS):** In the case of damage to transmission lines, temporary arrangements for restoration of power

supply can be made with the help of ERS, which consists of special type of light weight modular structures, with light polymer insulators and number of stays. This facility is currently available with Power Grid Corporation of India. It is, however, suggested that based' upon the past experience of disaster prone areas, one set of ERS for each such area should be procured and kept in store at strategic locations.

✓ Communication & information management is the key to any crisis response & recovery plan. Use of modern day information technology has to play a greater role. Software system incorporating risk assessment, creating procedures, establishing command & control structure, monitoring crisis response activities and integration with various agencies/groups would need to be incorporated as a part of emergency management.

✓ **Other Essential Requisites to Handle any Disaster**

- Fire alarm and extinguishing system to be checked regularly for its healthiness and regular drill should be carried out for its operation by involving the officers and staff of that Unit so that they also know how to operate the system.
- Safety audit must be carried out at each generating station and substation on yearly basis.
- State level support groups shall identify category-wise all the generating, sub-station grid centers and load dispatch centers based on their importance.
- The electricity grid must be updated on continuous basis in consultations with the Electricity Board.
- State level Support Group shall meet at least once in six months. Power

Management Group (PMG) at National level has to meet once in 12 months for exchange of views and also for updating the Disaster Management Plans.

- Power utilities shall constantly review the equipment / system design standards and practices based on the new developments and the state of the art technologies and design practices available at that time. The equipment, which frequently creates problems need to be replaced.
- Each power station shall create a fund for meeting the requirement of disaster management plan.
- Carry out comprehensive statewide drills periodically (at least once in every six months) to test capabilities. Emergency scenarios shall be developed to test the emergency plans and operational response at all levels through mock exercises. At the end of each exercise an evaluation of the response call shall be carried out to take care of any deficiency noticed.
- Underground Power House should be provided with exit routes at different locations and these exit routes need to be displayed for the staff working in the power house to come out in case of any emergency like fire/flooding etc.
- Smoke evacuation system should be provided in case of fire in underground stations.
- Sample formats for formulation of Crisis/Disaster management Plan are given in the enclosed for reference.

## **DURING DISASTER**

Actions taken by UPPCL WITH ITS SUBSIDIARY COMPANIES during the disaster are as follows

- ✓ Within the affected district electoral ward, all available personnel will be made available to the district disaster manager. If more personnel are required, and then out of station officers or those on leave may be recalled.
- ✓ All personnel required for disaster management should work under the overall supervision and guidance of District Disaster Manager.
- ✓ Establish radio communications with emergency operations centre, divisional secretary/ district secretary, district control room and your departmental offices within the division.
- ✓ Restore the power supply and ensure uninterrupted power to all vital installations and facilities.
- ✓ Arrange personnel on an emergency basis for clearing of damaged poles and salvage of conductors and insulators.
- ✓ Monitors energy system damage and repair work.
- ✓ Begin repair/reconstruction after any disaster.
- ✓ Assist hospitals in establishing an emergency supply by assembling generators and other emergency equipments, if necessary.
- ✓ Establish temporary electricity supplies for other key public facilities, public water systems, etc.
- ✓ Establish temporary electricity supplies for transit camps, feeding centres , relief camps.
- ✓ District control room and on access roads to the same.

- ✓ Establish temporary electricity supplies for relief material warehouses.
- ✓ Compile an itemized assessment of damage, from reports made by various electrical receiving centres and sub-centres.
- ✓ Report all activities to the head office.
- ✓ Plan for emergency accommodations for staff from outside the area.
- ✓ On the recommendations of the EOC (Nodal Officer-Power Supply)/District Collector/district control room at the district level, CEB will send cables, poles, transformers and other needed equipment, send vehicles and any additional tools needed and Provide additional support as required.
- ✓ All district level officials of the departments would be asked to report to the work stations.
- ✓ Review and update precautionary measures and procedures and review with staff, the precautions that have been taken to protect equipment and the post disaster procedures to be followed.
- ✓ Take steps to protect equipment according to guidelines mentioned above...
- ✓ Serves as the supporting agency for response and restoration efforts.
- ✓ Collects, assesses, and provides information on energy supply and demand.
- ✓ Contributes to situation and after-action reports.
- ✓ Identifies supporting resources needed to restore energy systems.
- ✓ Reviews and sponsors the energy requirements of various sectors in disaster
- ✓ To ensure supply of electricity to important government offices and public services (water, supply, hospitals and road lighting) .
- ✓ In drought conditions construction of 11 kv lines should be done to provide the power for domestic and irrigation purposes to the government and private tubewells of the affected areas.

- ✓ At some places trolley transformers should be used to provide the power on temporary basis.
- ✓ In severe flood conditions the power supply should be cut to avoid any mishap. Later with the help of temporary poles\trolley transformers supply should be restarted.
- ✓ In heavy flooded areas where power supply through transmission lines is not possible generator sets should be used. The arrangement of the generator sets for public utilities is managed by District Administration.
- ✓ In case of fire accident the supply should be immediately cut off to avoid any mishap.
- ✓ Once the fault is recognized, it should be responded within 24 hours in urban areas and within 36 hours in rural areas.
- ✓ Store at each district should have ample material to handle any local fault.
- ✓ In case more material is required, managing director stores will direct the superintendent stores to grant the demand.
- ✓ **Setting up of Control Rooms:** It is necessary to have an integrated approach at state level to monitor and meet the various situations arising out of the crisis in the power sector. It is, therefore, proposed to have a three tier controlling system as per details given below:
  - a. Central Control room with headquarters at Lucknow
  - b. Regional control room to be located at convenient place in the affected region.
  - c. Power Station / Grid sub-stations level control room.

These Control Rooms will work in a very well coordinated manner. The main objectives of these control rooms will be to pool up all the possible resources to ensure continuity of power supply in the STATE.

These control rooms should have fast communication facilities for exchanging the up-to-date information. In this regard, direct hot line communication and equipment have to be provided. These Control Rooms shall have list of minimum man power required for continuous operation and maintenance of a particular utility on 24 hours basis with 2 or 3 shifts operation. A complete list of the personnel/experts at state/regional level for the operation and maintenance of the utilities shall be maintained so that in case of emergency, the experts may be sent for quick fault finding and restoration of power supply. Regular mock exercises for different types of crisis will be monitored by these control rooms to achieve the best possible response and efficiency of services under disturbed condition.

## **POST DISASTER RESPONSE AND RECOVERY STAGE**

Actions taken by UPPCL AND ITS SUBSIDIARY COMPANIES in post disaster situation are as follows:

- ✓ Hold meetings with staff and discuss the departments' performance.
- ✓ Assess the condition of structures under department's jurisdiction and carryout repairs as needed.
- ✓ Assess the condition of departmental vehicles and equipment and organize their repair and maintenance.
- ✓ Draw lessons from the performance and identify actions to be taken for future



improvement.

- ✓ Review and documentation.
- ✓ Implement action plan for improving future performance.
- ✓ Training of staff.
- ✓ Development of checklist and contingency plans.
- ✓ **Damage Assessments:** Immediately following a disaster, an initial damage assessment must be performed by the plant level emergency management group (EMG) to assess the impact of disaster on the electrical infrastructure. The assessment should provide a rough estimate of the type and the extent of damages, including probable cost and the need for financial assistance. When the information has been collected it should be transmitted to the State Government.. The joint damage assessment team comprising of State,Zonal and local officials shall conduct the assessment to determine the area of impact, the severity and magnitude of damage and the resulting unmet needs of the sub-stations/transmission system etc.
- ✓ **Measures for Quick Restoration of Power Supply:** Following measures are essentially required for quick restoration of power after a black out:

- The start-up procedure for the generating units should be known to everyone and working level personnel should start the machines without referring to or waiting for management's consent during the crisis.
- Shift duty personnel should be detained till the restoration process is completed before handing over charge to next shift.
- Survival / Auxiliary / Start-up power should be provided to the collapsed system till requirement on priority basis and power should be utilized for other purposes only after meeting these power requirements.
- Priority should be accorded in restoration as under:
  - Survival/start-up power to nuclear units.
  - Restoration of power supply to generating stations & Load Despatch Centre(s).
  - Start-up power to hydro and gas units.
  - Formation of self-sustaining islands around the generating stations as per laid down procedure.
- ✓ Area Load Dispatch concept should be adopted during start-up to avoid jamming of communication system as well as for ease in decision making.
- ✓ A list of DOT telephone numbers of all the sub-stations with STD codes should be available in the plant as well as SDMC/RMDC as communication

is the essential requirement and time is the essence during the restoration process.

- ✓ Loading of generator supplying the start-up power should not exceed 80% of its capacity. Efforts should be made to keep the generator operating on lagging side; if not possible, at least to near unity power factor.
- ✓ **Restoration of Transmission Lines:** Transmission lines are the arteries of the Electricity grid and these are most prone to damage due to earthquake, cyclone, terrorist attack, flood, etc. Following points should be essentially considered for handling disasters:
  - Disaster Management Groups should be constituted at each level.
  - Intimation regarding movement of such identified personnel to disaster site should suffice and no sanction / approval from their standing hierarchy should be required.
  - In every utility, looking after Operation & Maintenance of transmission lines, section-wise responsibility should be clearly defined and they should have contingency plan for various emergencies. The process of restoration guidelines under different conditions should be laid down and all the documents should to be made available to all the Disaster Management Committee/Task Force members.

- The substation and other control centers should have details of the key front line personnel/task force members who are identified for handling the restoration process in the event of disaster so that deployment of these personnel to the affected areas can be made without any delay.
- Availability of all the resources meant for tackling the disaster/restoration process should be listed and the same should be available to the concerned members.
- Each “Key front line personnel Team” shall be provided with mobile satellite telephone for ensuring instantaneous response/mobilization to the front on occurrence of a disaster.
- For the restoration of transmission lines, Emergency Restoration System (ERS) should be provided & made use of. The ERS, communication and other equipments should be maintained properly so that it can be use without any delay.
- Spare towers and conductors should be available with the agency having the responsibility of O&M of transmission line.
- Strategic locations should be decided for spares on centralized/regional/zone wise.

- In case of advance warning, the restoration team should reach at convenient place nearest to the expected affected area in order to reach the spot at the earliest. The team would assess the extent of damage and inform the higher coordinating authorities.
- Alternate feed point should be identified for traction, defense locations and other important areas.

### **Restoration of Sub-stations**

Substations are the nerve centers of the Electricity Grid. In case of any disaster the preparedness of the substations for restoration is a must. Following points need to be considered for handling various eventualities:

- Every utility owning and operating the substations should carry out an in-depth analysis of all the possible contingencies and should prepare plans for such contingencies.
- Standing instructions should be available in written form at each substation to take care of various contingencies.
- Alternate communications system should be available with every key substation,

- The power backup facilities like D.G. Set and inverter should be maintained properly and checked periodically for readiness of operation in case of any emergency.
- Each substation should follow the instructions given by concerned SLDC, RLDC and other coordination agencies.
- The fire fighting equipment and the bore wells should be maintained and checked periodically. Mock fire fighting exercises should be done on regular basis.
- The transportation arrangements in case of any emergency should be decided in advance.

### **Uttar Pradesh Power Transmission Corporation (UPPTC)**

- ✓ To establish disaster control room to handle the situation at plant level.
- ✓ To ensure working of all units and to provide necessary equipments and technicians to damaged plants
- ✓ To ensure regular uninterrupted power supply during disaster condition.
- ✓ To establish temporary electricity supplies for Maintenance of their power plants (thermal and hydel).
- ✓ Monitors energy system damage and repair work
- ✓ To increase the production in order to meet the increased demand during the disaster.
- ✓ To Serves as the supporting agency for response and restoration efforts.
- Hold meetings with staff and discuss the departments' performance

- Assess the condition of departmental equipment and organise their repair and maintenance
- Assess the condition of power installations and organise their repair and maintenance
- Draw lessons from the performance and identify actions to be taken for future improvement
- Implement action plan for improving future performance
- ✓ Assess the condition of structures under department's jurisdiction and carryout repairs as needed.
- ✓ Review and documentation. .
- ✓ Training of staff.
- ✓ Development of checklist and contingency plans.

### **Disaster Management Plan for failure of Electricity Grid**

Integrated operation of vast and complex electricity grid like the one existing in the country demands utmost vigil and care from disaster point of view. Attacks at key grid sub-stations, power stations transmission lines or computer-based load dispatch centers could black out the entire region for considerable period of time.

In the event of a grid failure, coordinated actions are required to be taken at the generating stations, substations and transmission lines under the directions of RDMC(s) and SDMC(s) for speedy restoration of power supply. Black Start /

Restoration Procedures are already available in each Region for use in the event of partial / complete failure of the grid identifying inter-alia the start up power availability and restoration procedures.