

# GUIDELINES FOR EMERGENCY RESOURCE PLANNING FOR OVERHEAD TRANSMISSION LINE ASSET OWNERS

A question that each Asset Owner should ask is “Do we have a clear emergency response policy? Is there an organizational structure to respond effectively to emergencies?” However, the question that is most frequently asked by asset managers is “Why do we need all this material in inventory?” Does this sound familiar?

Let’s pose these questions differently. Ask, “What is the responsibility of the asset owner to minimize network outages?” or “How much can the asset owner or the economy afford to lose due to a failure?”

The latter question rings true if one considers that the major impact on the



Tower failure due to mudslide

asset owner (in terms of unavailability or revenue lost) is marginal when compared to losses incurred by society, which is affected most through loss in productivity and affected public and health care ser-

vices. It can be seen that the question on inventory is internally focused on the needs (and more specifically financial considerations) of the asset owner with little regard for other stakeholders. There are no quick answers to this question, but certain guidelines can be provided to ensure that the Asset Owner has the proper resources. It is imperative to recognize that these resources cannot be established without considering the overall emergency preparedness plans that the asset owner has put in place.

Less stock may be required if the asset owner is properly prepared to deal with emergency situations. However, the logistics and constraints imposed during emergencies could render any level of emergency resources useless without a detailed plan as to how to overcome anticipated problems to ensure adequate utilization of the resources when they are required.

Again, the questions which need to be raised are, “Does the asset owner have a clear emergency response policy? Is there an organizational structure to respond effectively to emergencies?”

These are the questions which will be considered in this article.

## 1.0 PURPOSE STATEMENT

The purpose of this article is to help asset owners develop their own emergency response plan for their overhead transmission lines (OHTL). The implementation of the plan should result in adequate material, manpower and equipment resources to address identified emergency situations.



Tower failure due to high winds.

## 2.0 RESPONSE PLAN DEVELOPMENT

The key to the development of an adequate emergency response plan is for the asset owner and senior management to commit to a proactive long term plan for responding to anticipated emergency situations, and the formulation of a corporate policy on how the utility will respond to emergencies.

This policy will involve the commitment of significant resources. The first commitment is the establishment of an Emergency Response Organization.

RTE is the French transmission system operator created after the storms of 1999 (a GIP Priority Action Group).

This rapid reaction force consists of seven teams spread throughout France. It is activated by the crisis management unit for the purpose of analyzing the problem and proposing feasible solutions which can be implemented in less than 5 days to re-establish power supply on network facilities. RTE objective is to have 17 km of 400 kV overhead restoration lines.

BC Hydro, after a major ice storm in 1972, created a stock of material for emergency repair and set up the predecessor of the present transmission emergency response organization. The emergency response organization is managed centrally by a joint BC Transmission Corp and BC Hydro team.

The BC Transmission Corporation planned level of preparedness provides for material and plans for emergency



Emergency Response Structure

erection of up to 10 km of each voltage level of line.

### 2.1 Emergency Response Organization

The Emergency Response Organization is led by a senior manager and includes appropriate internal experts. The Strategic Planning Team of this organization will identify risks, evaluate restoration scenarios and develop the response plan which will be implemented by the Operational Restoration Team.

### 2.1.1 Senior management accountability and support

The responsible individual in the corporation for implementation of this policy should be a senior manager, vice president or higher, because of the requirement for commitment of significant resources. Also, this raises the profile of this program for the people in the organization.

The first job of the responsible senior manager is to assemble a team of in-house experts and appoint a Strategic Planning Team leader, who may also be the Operational Restoration Team manager. Typically this team would consist of skilled individuals in fields such as system operation, engineering, environment, field construction, materials and logistics and communication with the public.

### 2.1.2 Strategic Planning Team

The Strategic Planning Team will produce practical implementation plans for the stated corporate policy as follows:

- Identify potential risks to the asset owner
- Develop various restoration scenarios for identified risks
- Choose scenarios consistent with the corporate policy
- Structure membership of the operational restoration team
- Operational liaison with external emergency response organizations
- Operational liaison with news media (make sure a technical representative is available to explain technical aspects)
- Develop a training program consistent with the policy
- Conduct post event evaluations and implement continuous improvements

### 2.1.3 Operational Restoration Team

The Operational Restoration Team will restore the damaged transmission line following guidelines set by the strategic planning team. The structure and membership will vary with each organization; however the following key functions need to be addressed:

- Team Management
- System Operations
- Engineering
- Field Construction
- Materials coordination
- Safety Coordination
- Logistics, Transport and communications



Tower destroyed by mud slide

Continued on Page 14

# resource planning

continued from Page 13

- Communication Coordination
- Contract Management
- Property Issues
- Financial Coordination

Typical responsibilities for these team members are given in Table 1.

TABLE 1: Operational Restoration Team Member Responsibilities

<b>Team Manager</b> <ul style="list-style-type: none"> <li>• Overall project manager</li> <li>• Reports directly to senior management</li> <li>• Mutual aid agreements</li> <li>• Governmental authorizations</li> <li>• Coordination with Distribution utilities</li> </ul>	<b>System Operator</b> <ul style="list-style-type: none"> <li>• Determines circuit restoration priorities</li> <li>• Provides input for circuit restoration plan</li> <li>• Coordinates protection</li> <li>• Returns circuit to service</li> </ul>
<b>Engineering</b> <ul style="list-style-type: none"> <li>• Damage assessment</li> <li>• Provides design specifications</li> <li>• Approve field modifications</li> <li>• Construction inspection</li> <li>• Revise design criteria</li> <li>• Recommends restoration priorities following damage assessment</li> <li>• Approves material substitution</li> <li>• As built drawings</li> </ul>	<b>Field Construction Manager</b> <ul style="list-style-type: none"> <li>• Damage assessment</li> <li>• Planning &amp; scheduling</li> <li>• Coordination and supervision of restoration</li> <li>• Site safety, protection and isolation procedures</li> <li>• Site environmental compliance</li> <li>• Communication with Operational Restoration Team</li> <li>• Returns line to system operator for service.</li> <li>• Coordination of all external work crews</li> </ul>
<b>Materials coordinator</b> <ul style="list-style-type: none"> <li>• Material expediting</li> <li>• Procurement</li> <li>• Quality control</li> <li>• Issuing &amp; packaging</li> <li>• Recycling &amp; disposal</li> </ul>	<b>Safety Coordinator</b> <ul style="list-style-type: none"> <li>• On site safety</li> <li>• Site first aid</li> <li>• Compliance with safety regulations for all personnel</li> <li>• Worker qualifications</li> </ul>
<b>Logistics</b> <ul style="list-style-type: none"> <li>• Shipping &amp; receiving</li> <li>• Travel, accommodation &amp; meals</li> <li>• Equipment &amp; tools</li> <li>• Permits</li> <li>• Customs &amp; immigration</li> <li>• Transport</li> <li>• Telecommunication equipment</li> <li>• Site security</li> </ul>	<b>Communication Coordinator</b> <ul style="list-style-type: none"> <li>• Internal &amp; external communication</li> <li>• Coordination of site visits</li> <li>• Provide feedback from outside stakeholders</li> </ul>
<b>Contract Management</b> <ul style="list-style-type: none"> <li>• Verifying contractor activities</li> <li>• Negotiating contracts</li> </ul>	<b>Property Issues Coordinator</b> <ul style="list-style-type: none"> <li>• Owner contact &amp; access permission</li> <li>• Right of way issues</li> <li>• Property damage &amp; restoration</li> </ul>
	<b>Financial Coordinator</b> <ul style="list-style-type: none"> <li>• Funding approval</li> <li>• Purchase orders</li> <li>• Cost control</li> </ul>

## 2.2 Identify Risks

The first and most important activity of the Strategic Planning Team is to identify potential failure events. The following should be considered:

- Identify historical failure events experienced by the asset owner.
- Current condition of the lines being considered
- Potential natural events (storms, floods, landslides, fires, etc.)
- Man made failures (vandalism, aircraft, automobiles, etc.)

The predicted frequency, extent and

severity of the event is estimated as well as the potential for multiple simultaneous events. Also, with the identified events will come a set of conditions (e.g. poor site access, ground conditions and hostile environment), to be considered.

The basic design withstand criteria of the lines (cascading towers, ability to withstand identified event loads) should

cases, these costs of consequences can be connected either to the company as a whole, or to the system operations division (i.e. electricity commerce division), or to the transmission line division. (Reference technical bulletin No. 175 for the calculation of risk)

The combination of probability of failure and consequences will quantify the risk, and the appropriate level of resources to be committed, consistent with the company policy.

## 2.3 Estimate the Aggregate of all risk events

Evaluate the probability of the occurrence of multiple simultaneous events or very large scale single events, in order to estimate the amount of resources required. For example, is material required for a single event, or is material required for simultaneous events (very large area storms, multiple sabotage events are examples of simultaneous events)? Note key suppliers located in the affected area

## 2.4 Restoration Scenarios

The Strategic Planning Team determined the risk of identified events. Probable events can be prioritized from this assessment. It may be possible to reduce some of these risks by taking proactive measures, for example: agreements with major customers to curtail demand in emergency situations and reinforcement of specific structures.

The Strategic Planning Team will determine what resources are required to restore the line within a specified time frame. This typically requires consideration of possible system reconfigurations to address the problem as well as an estimation of Material, Manpower & Equipment requirements, Logistics, Support Services, Communication for each identified event and restoration scenario. Material and resources to be considered in preparing the estimated requirements for each scenario are summarized in Table 2. These estimates will be the basis for the response plan.

## 3.0 RESPONSE PLAN

The risk assessment and scenario review can be used as the basis for establishing the level of event or events for which the asset owner will be prepared. When that level is established relative to the emergency response policy the response plans can be prepared. This

Continued on Page 16

continued from Page 14

planning will be the basis for emergency spare material stocks and sourcing, manpower and equipment plans, emergency organization structure and responsibilities and the training necessary to implement the plan. Most of the key elements of the plan are addressed here.

When these plans are implemented, it is critical that they be reviewed by the Response Planning Team on a frequent basis to insure the validity of the plans and external agreements.

It is essential that documentation and inventory of material and resources be kept up-to-date at all times.

### 3.1 Level of Emergency Response

The plan will vary with the asset owner and its circumstances, but it should be structured to deal with three levels of emergency:

- First level is of a size and impact that it can be managed by a local manager
- The second is of a size and impact that it will be managed by a senior manager
- The third is a size and impact that restoration will be managed by a senior manager, as part of an inter-agency emergency recovery program

While the size and scope of the problem is different, the basic organization structure and plan elements are the same.

### 3.2 Rapid Response

Implementation of emergency response plans can be expedited by Early Warning Systems and rapid identification of the damage location and scale. The Operational Restoration Team and resources can be put on standby when risk factors increase due to weather forecasting information, political or special events or terrorist events. When a failure does occur, equipment and means of quickly locating the failure need to be available.

### 3.3 Emergency Material

Whether the Utility chooses to retain emergency stock or not, it is essential that there be a plan to address material needs. The better the risk identification and the response plan, the more likely it is that essential material will be available. This may not require very large investments in material, but rather investment in the right material. Some of the

TABLE 2: Material and Resources to be Considered in Planning Restoration Scenarios

<p><b>Material</b> (for permanent and/or temporary construction)</p> <ul style="list-style-type: none"> <li>• Suspension &amp; tension structures (including foundation materials and anchors)</li> <li>• Conductor</li> <li>• Splices, terminations &amp; hardware</li> <li>• Insulators</li> <li>• One of a kind structures &amp; conductors (crossings)</li> <li>• Emergency response agreements with key suppliers.</li> <li>• Stock emergency restoration structures</li> <li>• Basic material ready for fabrication</li> <li>• Suitable long-term storage to avoid deterioration.</li> <li>• Standardized replacement insulator &amp; hardware kits</li> </ul> <p><b>Logistics and Transport</b></p> <ul style="list-style-type: none"> <li>• Transportation requirements (special loads &amp; permitting, helicopter loads)</li> <li>• Clear understanding of security and location of emergency material.</li> <li>• Location of Mutual aid material (other utilities, suppliers)</li> <li>• Housing, food, transport to job site</li> <li>• Site first aid facilities</li> <li>• Communications equipment</li> </ul>	<p><b>Manpower</b></p> <ul style="list-style-type: none"> <li>• Skill level required</li> <li>• Numbers required</li> <li>• In-house and external availability and agreements</li> <li>• Training (Workers &amp; management)</li> <li>• Special construction techniques &amp; work methods</li> <li>• Engineering Expertise</li> </ul>
<p><b>Support Services</b></p> <ul style="list-style-type: none"> <li>• Human Resource services</li> <li>• Payroll &amp; banking</li> <li>• Clerical support</li> <li>• ROW &amp; property</li> <li>• Environmental</li> <li>• Safety Officer</li> </ul>	<p><b>Equipment &amp; Tool Requirements</b></p> <ul style="list-style-type: none"> <li>• Heavy equipment (cranes, specialized stringing equipment) requirements, availability &amp; maintenance.</li> <li>• Helicopters</li> <li>• All-Terrain Vehicles and other special man transport needs</li> <li>• Specialized small tools (compressors, splicing dies, night-lights, etc.)</li> <li>• Appropriate rigging tools</li> <li>• Conductor tie-off equipment</li> </ul> <p><b>External Communications</b></p> <ul style="list-style-type: none"> <li>• Media relations</li> <li>• Public information</li> <li>• Information to local governments</li> <li>• Impacted stakeholders</li> </ul>
	<p><b>Alternative Responses</b></p> <ul style="list-style-type: none"> <li>• Temporary Generators</li> <li>• Temporary re-configuring of circuits</li> <li>• New temporary feed</li> <li>• Re-examine the need for the line</li> </ul>

more commonly used approaches for emergency response material are:

#### 3.3.1 Segregated emergency stock

This material may be intended for temporary repair, like-for-like replacement, or both. It should attempt to standardize as much as practical. The stock should have very tight control with decisions to release this material for non-emergencies, to be made by the senior manager responsible for emergency response.

#### 3.3.2 Non-segregated emergency stock

Minimum stock levels are set with the intent that this material always be available somewhere in the system. This allows the stock to turn over. This approach might be used for less critical, readily available material or material which deteriorates with age.

#### 3.3.3 Mutual Aid Agreements

These agreements establish understanding between neighboring asset owners or pools of owners, under emergency situations. The group may pool interchangeable emergency stock as well as provide access to individual emergency out-source agreements. It is very impor-

tant that all parties understand the intent and rules of such an agreement. However, during large storms or multiple failure events, mutual assistance between neighboring asset owners may have its limitations.

After the storms of 1999, RTE signed mutual aid agreements with several European utilities to facilitate the interventions of other transmission system operator teams with their own equipment.

#### 3.3.4 Out-Source Agreements

Agreements can be established with vendors ranging from priority access to material, to commercial agreements to retain emergency stock for the Utility.

### 3.4 Manpower

Manpower plans follow a very similar structure to the material plans. Whether internal workforce and equipment are used or external resources, or both, it is essential that there be a viable plan. Questions such as how many staff are required for standby, short term availability or long term availability must be answered by the plan.

With RTE emergency reaction organization, 300 RTE operators and 600 spe-

cialists from outside companies can be called up in half a day.

As soon as an intervention action is triggered, a major chain of different specialists such as electrician and mechanical engineers, topographers, linesmen, logistic managers, helicopter pilots and telecommunication experts is activated.

### 3.4.1 Internal Work Force

What level of work force is required, what skills, how many are on standby? All these questions need to be answered and plans in place to address them in the event of an emergency.

### 3.4.2 External work forces

If the decision is made to use external contractors either exclusively or as supplements to internal forces, commercial agreements or understandings are essential. The criticality of these agreements increases with the level of dependence on the contractors. Regular review of these agreements is essential.

### 3.4.3 Mutual Aid Agreements

This is an agreement between asset owners or among a pool of owners to share resources in the case of emergency. Again it is important that the intent and rules of the agreement are clearly understood. Regular review of these agreements is critical.

### 3.5 Logistics

It is essential that the material requested by the field is clearly communicated to the emergency stores. Pre-assembling kits and pre-packaging of material and tools are useful ways of expediting this process. Also, the mode or modes of transportation and transport availability need to be closely managed. The person responsible for logistics must be able to expedite the material, communicate needs clearly to the stores and have transport arrangements suitable to the location and urgency of the field need. One practice followed by some asset owners is to have special trailers and containers pre-packaged with key material and tools. Other preparations which can be made are special transport needs (load limits, wide loads, etc.) and permitting. If it is anticipated that helicopter transport will be used then packaging should take into account the load limits of the helicopters likely to be available.

One of the most critical aspects of emergency restoration is effective communication between all of the parties involved. One of the most important pieces of equipment is communications equipment such as satellite phones and portable radios and battery charging facilities.

### 3.6 Equipment

Either the asset owner's equipment such as: puller pilot winder, all wheel drive bundle bull wheel tensioners and fiber optic bull wheel tensioners (for pulling overhead ground wire and fiber optic cable) should be maintained, or agreements with owners of such equipment established. This equipment must be maintained in good working order for effective emergency response. In addition, other specialized equipment suitable for various terrains found along the OHTL right-of-ways (such as: all terrain rubber track vehicles for working in snow conditions, and all wheel drive trucks with front winches) should also be maintained by the asset owner, or be readily available under special agreements.

A major piece of equipment for emergency response is helicopters for: transportation of men and materials to remote

job sites, staging materials in rough terrain, and as safety standbys for construction personnel at job sites. During transmission line emergency restoration, they are used to locate the damaged site and find the actual trouble location.

### 3.7 Communications

#### 3.7.1 Internal Communications

One aspect of planning, crucial to the successful handling of an emergency, is communication between the various units of the emergency response team. A "single point contact" concept can be used during emergency situations to insure that all communication between each unit is direct and that the responsibilities are clearly defined.

Using this concept, a single individual within each unit is assigned to handle all intra-company contact in any major functional area. In addition, once a task is assigned to an individual, it becomes the obligation of that individual through completion - thus establishing a clearly defined path of responsibility. This approach can improve the efficiency of the intra-company communications in the hectic emergency environment. An emergency centre where the Operational Restoration Team members can gather is important. At this centre there will be network diagrams, communication equipment, telephone directories with contact details of contractors, suppliers, customers etc. and pre-planned emergency documentation.

#### 3.7.2 External Communications

The responsible person has an important role to communicate the plan and schedule of restoration to the news media,

**Continued on Page 36**

**the HUBBELL<sup>®</sup> SHOTGUN STICK**

**CHANCE<sup>®</sup>**

**Reliable, Versatile and Trusted.**

*The most valuable tool  
in your lineman's hands.*

**HUBBELL**  
POWER SYSTEMS, INC.

**HUBBELL CANADA LP**  
870 Brock Road South • Pickering, ON L1W 1Z8  
Phone: (905) 839-1138 • Fax: (905) 839-6353  
[www.HubbellPowerSystems.ca](http://www.HubbellPowerSystems.ca)

**HUBBELL POWER SYSTEMS, INC.**  
210 N. Allen • Centralia, Mo 65240  
Phone: (573) 682-5521 • Fax: (573) 682-8714

**HUBBELL DE MEXICO, S.A. DE. CV**  
Av. Coyoacan No. 1051 • Col. Del Valle • 03100 Mexico, D.F.  
Phone: (525) 575-2022 • Fax: (525) 559-8626

continued from Page 17

the public, other service organizations, and both Government and non-government agencies. It is essential that this person be part of the Operational Restoration Team in order that current information can be provided to the external parties and also that the team be made aware of outside issues and the message being sent.

This person should be the only channel for dissemination of information externally.

### 4.0 Training

An organization can only build confidence and competence in its emergency preparedness through regular training. This includes training of the organization to know its emergency response plans. Training of all members of the Emergency Response Team, including senior management, through regular sim-

ulated (mock) training exercises is recommended. This should be conducted on a regular basis, and based on the emergency response plan set out by the organization.

Line crews should receive regular classroom and field training to better prepare for emergency response. Crew training can also be on-the-job training, if in-house crews perform jobs, such as build towers and string conductor, transmission line modifications, fiber optic installations as well as normal maintenance including live line maintenance. If in-house line crews do some, or all, of these jobs, they will stay familiar with the equipment and tools that are available to them because they use them on a normal, daily basis.

Without this normal use of the construction tools and equipment, some material might not be operable when required in emergencies. A free flow of ideas should be encouraged from the line crews on new tools and equipment, to improve response time.

If there is significant reliance on contractors, they must be included in the training exercises.

### 5.0 Continuous Improvement

After every incident, the Strategic Planning Team needs to re-evaluate restoration plans through a post-event evaluation, in order to make the required adjustments and/or improvements. Also, the data to be collected following a failure should be gathered as outlined in TB No. 175 Chapter 2.

Another important source for internal improvements is the evaluation of emergency restoration response of other OHTL asset owners.

### 6.0 Conclusion

An effective emergency response plan requires a clearly-stated corporate policy. This policy is the basis for detailed risk assessment and planning of an appropriate response. The asset owner can then evaluate whether this plan falls within the policy and financial constraints. This may lead to iterations of the policy and restoration plan.

Implementation of the plan will result in adequate material, manpower and equipment resources to address identified emergency situations consistent with the corporate policy. Due to the changing utility environment, it is essential that the restoration policy and plan be reviewed regularly.



**The complete source for all your Transformer needs**

We are one of the industry's most technically capable manufacturers producing the broadest and most competitive range of standard and custom dry-type transformers and related magnetic products in North America.

- Low & Medium Voltage Control
- Buck-Boost
- Line Reactors and DV/DT Filters
- Energy Efficient Distribution and K-Factor
- Power Quality including Harmonic Mitigating
- Encapsulated Transformers for Hazardous Locations
- Drive Isolation and Autotransformers
- Dry-Type Power

**HPS** Hammond Power Solutions Inc.  
*Your First Source For Transformers*

www.hammondpowersolutions.com 1-888-798-8882