

CHAPTER VI

Post Ice Storm Actions and Processes

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A. BACKGROUND

Post storm actions and processes are those items that a utility should undertake following the completion of storm restoration. These actions should be viewed as a continuation of the overall emergency response efforts, not a separate or distinct set of activities. Examples may include:

- Post storm critiques with action items identified
- Invoice verification for external crews and cost allocations for internal charges from affiliates
- Completion of jobs where temporary repairs were made during the storm restoration

Although it may often be neglected, the post storm phase of an event provides an excellent opportunity for utilities to learn from their experiences. During the actual emergency, management of the restoration effort takes precedence over all other activities. However, once work begins to ramp down management should not lose sight of the next step. Unfortunately, it is during the phase immediately following a major restoration effort that many utilities fail. Factors that may contribute to a utility’s lack of effort in completing post storm actions include:

- The desire to return to normal
- The utility’s employees are exhausted from many days of overtime.
- The utility’s employees have returned to their normal work duties, limiting their availability
- The backlog of normal work which was delayed by the storm restoration effort
- The utility’s emergency plan does not require a post storm critique.
- The hesitancy to critique workers who have made sacrifices to work long hours during the restoration

Despite the difficulties, it is imperative that utilities learn from their mistakes and build upon the things they do well.

B. EVALUATIVE CRITERIA

The four New Hampshire electric utilities were evaluated in the areas of planning for post storm operations, and their actions following the completion of the restoration effort. Specific areas of evaluation included:

1. Planning for post storm actions
 2. Gathering and use of damage information following the storm
 3. The use of post storm critiques and self assessments to gather information for continuous improvement
1. **Emergency Response to an outage does not end with the last customer back in service. Numerous activities remain after the actual restoration is complete. These activities need to be planned for and made part of the emergency response effort.**
 - The utility should have a plan for post storm analysis.
 - The utility should verify invoices from the contractors.
 - The utility should rework any temporary repairs done following the storm.
 - The utility should replenish the materials used during restoration.
 2. **Information gathered during and immediately after a storm can be invaluable in future events. It may be used to better predict damage and resource requirements, and its use might also help improve system design to withstand similar future events.**
 - The utility should collect and archive photographic evidence of damage which occurred on their system.
 - The utility should collect, organize, and archive weather information.
 - The utility should do a forensic review of damage they experienced.
 - The utility should use the data collected to develop specific plans for improvement.
 3. **Information gathered from individuals who participated in the storm restoration can be extremely valuable. This information is especially useful if it is gathered immediately following the restoration effort while facts are still clear in the minds of the employees involved.**
 - The utility should perform a post storm assessment and critique.
 - The utility should standardize its assessment to enable trend analysis.
 - The utility should make the post storm assessment procedure part of its emergency plan.
 - The utility should base the size and thoroughness of its assessment relative to the size of the event. More people should be included as the event analyzed becomes larger.
 - The utility should identify and follow up on actions items.

The following tables indicate the extent to which each of the utilities met the criteria. These tables were not prepared to compare one utility with another. The four utilities are very different and face different problems. These tables were prepared to show where each utility may improve its performance in preparation for the next storm or other disaster. A further explanation for the improvements that are recommended to each of the utilities may be found in the findings and conclusions section of this report. The meanings of the symbols used in the tables are:

- Improvement is needed as stated in the report
- ◐ Adequate with minor improvements suggested as stated in the report
- Effective with no improvements noted.

Table VI-1- PSNH post ice storm actions and processes evaluation matrix.

1) PLANNING FOR POST STORM ACTIONS	
The utility has a plan for post storm analysis.	○
The utility verified invoices from the contractors.	●
The utility reworked any temporary repairs done following the storm.	●
The utility replenished the materials used during restoration.	●
2) GATHERING AND USE OF STORM INFORMATION FOLLOWING THE STORM	
The utility collected and archived photographic evidence of damage which occurred on their system.	◐
The utility collected, organized and archived weather information.	◐
The utility performed a forensic review of damage they experienced.	○
The utility used the data collected to develop specific plans for improvement.	○
3) POST STORM CRITIQUES AND SELF ASSESSMENTS	
The utility performed a post storm assessment and critique.	◐
The utility standardized its assessment to enable trend analysis.	◐
The utility made the post storm assessment procedure part of its emergency plan.	○
The utility based the size and thoroughness of its assessment on the size of the event including more people as the event analyzed became larger.	○
The utility identified actions items and followed up on these.	◐

Table VI-2- Utilit post ice storm actions and processes evaluation matrix.

1) PLANNING FOR POST STORM ACTIONS	
The utility has a plan for post storm analysis.	○
The utility verified invoices from the contractors.	◐
The utility reworked any temporary repairs done following the storm.	◐
The utility replenished the materials used during restoration.	◐
2) GATHERING AND USE OF STORM INFORMATION FOLLOWING THE STORM	
The utility collected and archived photographic evidence of damage which occurred on their system.	○
The utility collected, organized and archived weather information.	○
The utility performed a forensic review of damage they experienced.	○
The utility used the data collected to develop specific plans for improvement.	○
3) POST STORM CRITIQUES AND SELF ASSESSMENTS	
The utility performed a post storm assessment and critique.	◐
The utility standardized its assessment to enable trend analysis.	○
The utility made the post storm assessment procedure part of its emergency plan.	○
The utility based the size and thoroughness of its assessment on the size of the event including more people as the event analyzed became larger.	○
The utility identified actions items and followed up on these.	●

Table VI-3- National Grid post ice storm actions and processes evaluation matrix.

1) PLANNING FOR POST STORM ACTIONS	
The utility has a plan for post storm analysis.	◐
The utility verified invoices from the contractors.	●
The utility reworked any temporary repairs done following the storm.	●
The utility replenished the materials used during restoration.	●
2) GATHERING AND USE OF STORM INFORMATION FOLLOWING THE STORM	
The utility collected and archived photographic evidence of damage which occurred on their system.	○
The utility collected, organized and archived weather information.	○
The utility performed a forensic review of damage they experienced.	○
The utility used the data collected to develop specific plans for improvement.	○
3) POST STORM CRITIQUES AND SELF ASSESSMENTS	
The utility performed a post storm assessment and critique.	◐
The utility standardized its assessment to enable trend analysis.	○
The utility made the post storm assessment procedure part of its emergency plan.	○
The utility based the size and thoroughness of its assessment on the size of the event including more people as the event analyzed became larger.	○
The utility identified actions items and followed up on these.	●

Table VI-4- NHEC post ice storm actions and processes evaluation matrix.

1) PLANNING FOR POST STORM ACTIONS	
The utility has a plan for post storm analysis.	○
The utility verified invoices from the contractors.	●
The utility reworked any temporary repairs done following the storm.	●
The utility replenished the materials used during restoration.	◐
2) GATHERING AND USE OF STORM INFORMATION FOLLOWING THE STORM	
The utility collected and archived photographic evidence of damage which occurred on their system.	○
The utility collected, organized and archived weather information.	○
The utility performed a forensic review of damage they experienced.	○
The utility used the data collected to develop specific plans for improvement.	○
3) POST STORM CRITIQUES AND SELF ASSESSMENTS	
The utility performed a post storm assessment and critique.	◐
The utility standardized its assessment to enable trend analysis.	●
The utility made the post storm assessment procedure part of its emergency plan.	○
The utility based the size and thoroughness of its assessment on the size of the event including more people as the event analyzed became larger.	○
The utility identified actions items and followed up on these.	●

C. TASKS

In order to assess the post storm actions of each utility, a variety of information was assembled and reviewed. A number of data requests were submitted to each utility and the data responses were subsequently analyzed. Interviews were conducted with engineers, managers, and executives from each of the utilities. Additionally, directors of town emergency operations and the New Hampshire Division of Homeland Security and Emergency Management were interviewed. Customer comments that were collected by the NHPUC regarding the storm were also examined and analyzed. Lastly, public statements collected after the storm during hearings held by the NHPUC and the New Hampshire Division of Homeland Security and Emergency Management were also extensively used in the analysis for this report.

D. FINDINGS AND CONCLUSIONS

Conclusion: None of the New Hampshire Electric utilities are adequately recording weather data or developing damage prediction models.

None of the electric utilities make use of forensic weather data. Forensic weather data is defined as actual documented weather measurements. If it had been collected, this data could have been evaluated to determine why the events caused the damage that occurred. This analysis would include determining the stresses on structures and trees that resulted from the actual ice and wind loads that were experienced. Understanding both the species of tree involved in the damage as well as the types of loads and stresses that caused limbs and trees to break and fall onto power lines would also be included in the evaluation. Estimating the forces that caused the failures on the system will help to determine if the structures were performing as predicted or if modifications to design specifications are required. To perform this type of analysis, accurate weather data needs to be recorded and archived.

There is a great deal of anecdotal evidence concerning ice loadings on trees and utility structures that occurred due to the ice storm.^{1 2 3 4} Yet none of the utilities endeavored to record actual ice levels or where those levels occurred, and then correlate this data with loading assumptions made during the design of their power line structures.^{5 6 7 8} There is also anecdotal evidence that much of the damage to the system was caused by falling trees and limbs, yet none of the utilities

¹ Hybsch, R. Director of Customer Operations, PSNH. Interviewed by Fowler, M. June 4, 2009.

² Lynch, H. Disaster Recovery Executive, NHEC. Interviewed by Fowler, M. June 17, 2009.

³ Letourneau, R. Director Electric and Gas Operations, Unutil. Interviewed by Fowler, M. May 1, 2009.

⁴ Kearns, R. Director Emergency Planning, National Grid. Interviewed by Fowler, M. June 9, 2009.

⁵ Unutil. (March 27, 2009). Data Response STAFF 2-24. NHPUC.

⁶ PSNH. (March 23, 2009). Data Response STAFF 2-24. NHPUC.

⁷ NHEC. (March 24, 2009). Data Response STAFF 2-24. NHPUC.

⁸ National Grid. (March 27, 2009). Data Response STAFF 2-24. NHPUC.

attempted to quantify this damage or separate failures caused by trees from other types of failures. This lack of recorded data makes future analysis difficult.

Three of the four New Hampshire electric utilities have not attempted to use past storm data to try to model the damage that may be caused by a future storm event. PSNH has worked with Plymouth State University to develop a model to forecast damage to electrical systems based on past storm data. Damage projection models do exist for the utility industry but they are in their infancy in terms of sophistication and accuracy. They were developed for hurricane events and therefore tend to focus on the type of damage seen during hurricanes. This limits their value for predicting damage due to less predictable events such as ice storms, tornados, thunderstorms, or lightning. However, no prediction model can be used or developed until the utilities begin to collect and correlate weather data with associated damage.

Recommendation No. 1: Each electric utility should gather and analyze weather and damage information during and immediately following weather events and develop models to predict damage.

- Each electric utility should collect weather and damage information both during and immediately following storms.
- Each electric utility should attempt to collect local weather data from towns, airports, and other local sources, when possible.
- Each electric utility should record more specific data concerning the location of damage and its cause.
- Each electric utility should provide damage assessors, wire watchers, and crews with inexpensive digital cameras and a method to link the photographed damage with the damage location.
- Each electric utility should assign responsibility to an employee for recording and correlating damage, as well as producing a chronology of the damage to the system.
- Each electric utility may decide to use a contractor or retiree to produce the chronology and correlate the recorded photographs and other information gathered.
- Each electric utility should contract with aerial photography firms to record widespread damage from the air.
- Each electric utility should work more closely with municipalities who can collect damage data.
- Each electric utility should analyze the data collected to develop models for predicting future damage.
- Each electric utility should analyze the data collected to improve their existing practices.

Conclusion: All of the New Hampshire Electric utilities reviewed can improve upon their post storm evaluation methods and procedures.

The New Hampshire electric utilities all performed a storm critique of some type following the December 2008 ice storm. However, the extent of these critiques and the documentation that resulted from them vary considerably. PSNH performed a post storm critique which solicited comments from Division and Area Work Center management; however, these comments were not compiled into a report.⁹ Until performed an extensive post storm critique which was documented and published. The Unutil review contains 28 specific recommendations covering all aspects of the Unutil storm restoration organization and processes.¹⁰ National Grid did not perform a critique specific to its New Hampshire restoration effort, and NHEC performed an informal critique.

The requirement of conducting a post storm critique is not a part of the overall Emergency Operations Plans and procedures of any of the electric utilities. While post storm critiques were performed, they were not part of a normal systematic process. None of the utilities has a defined set of data that will be collected, performance measures that will be reviewed, or a process for storing the data produced by the review.

Conclusion: PSNH does not have a process in place for responding to the incident management system review and does not include the necessary participants in its post storm reviews.

PSNH performed a formal review of its storm restoration performance during the December 2008 ice storm. The review was conducted in February 2009. Although the review is titled “Incident Management System (IMS) Review,” it covers a number of topics beyond the structure of incident management. PSNH has requested confidential treatment of this document. Therefore, this appraisal is limited to the conduct of the assessment and its value in future restoration efforts.

The PSNH post storm critique included comments about their adherence to the new IMS processes and opportunities for improvement. The critique could have benefited from broadening the number of participants to include line workers, electricians, and tree crews. The PSNH IMS review included input from the following IMS positions:

- Area Commander
- Southern Division Incident Commander
- Western Central Division Incident Commander
- Seacoast Northern Division Incident Commander
- Planning Chief EOC

⁹ Utilities performing post storm critiques usually do not collect these into a special report.

¹⁰ Unutil. (March 25, 2009). Unutil’s Response to the 2008 Ice Storm, Self-Assessment Report.

- Logistics Chief
- Safety and Environmental Chief
- Communications Chief

Each participant provided formal comments. These were organized into the following categories:

- Summary (Incident, Position, who the position reports to)
- Organizational Strengths (of the IMS approach)
- Organizational Opportunities
- Overall Comments

The comments and suggestions were candid, and focused on specific items that could be improved or things that were done well. The eight individual comment forms in the IMS review produced over one hundred suggestions. Some of these overlapped and, not surprisingly, many addressed the same opportunities. Examples include:

- Creation of specific positions and to whom they would report within the IMS structure
- Improved functionality of the trouble analysis system and reporting
- Better means of documenting crew resources
- Use of air patrols
- Methods of turning electric system information into information useful to towns

While the PSNH review is a very good template for an after action review, it would be beneficial to expand it to participants beyond the IMS manager and staff level. It would also benefit from expanding beyond a critique of the IMS to an overall critique, which encourages input on issues other than IMS. Issues such as the unproductive use of time while waiting for safety clearances and difficulties with order closeouts are seen by crews and first level supervisors but do not always work their way up to managers. These issues should be included in the review and may come from field employees who are not involved with the IMS.

Recommendation No. 2: PSNH should develop a process for responding to the IMS review and future post action reports and should expand the number of participants in its post storm reviews.

- PSNH should make after action reviews part of their emergency plan.
- PSNH should prioritize the topics resulting from its reviews.
- PSNH should develop a process to accept, reject, or study further suggestions resulting from the review.
- PSNH should assign responsibility for implementing or studying those suggestions accepted or marked for further study.
- PSNH should develop white papers which would describe in detail the costs, benefits, and the steps needed to implement any needed improvements that are identified.

- PSNH should have a second review step using the more detailed information provided in the white papers before deciding to implement or reject an improvement.
- PSNH should assign responsibility along with a schedule, milestones, and budget to implement the improvement.
- PSNH should develop a method to track the progress of the implementation of all suggestions resulting from the review.
- PSNH should expand upon the number of individuals contributing review forms on future critiques to include all those individuals who may have constructive suggestions concerning storm restoration.

Conclusion: Unitil does not include post storm critiques in its Emergency Operations Plan.¹¹

Unitil published an extensive self-assessment of its restoration performance during the December 2008 ice storm entitled: “Unitil’s Response to the 2008 Ice Storm, Self Assessment Report.” This report was released on March 25, 2009, and was written by an outside consultant. The self-assessment identified 28 recommendations in the areas of:

- Preparations and Crew Mobilization
- Damage Assessments
- Power Restoration
- Outage Tracking
- Logistics Support
- Public Communications
- Customer Communications
- Storm Readiness

Unitil has implemented several of the 28 recommendations and is in the process of implementing the remainder.¹² In fact, Unitil had already implemented several of the recommendations before a subsequent ice storm on January 9, 2009, only weeks after clean up from the December storm. During the January ice storm, improvements were noted including more rapid deployment of field forces and additional communications through conference calls with municipal officials.

Unitil has also increased telephone line capacity by 40 percent and later added additional telephone lines. In May, Unitil hired an Emergency Management Director who will be responsible for implementing the recommendations, along with other emergency duties assigned.

Although Unitil did do a post storm review and productively implemented suggestions coming from that review, it does not include the requirement for conducting a post storm review in its Emergency Operations Plan. This plan should include the requirement that a post storm review

¹¹ Unitil. (Feb 19, 2009). Data Response STAFF 1-1. NHPUC.

¹² Francozio, R. Director of Emergency Planning, Unitil. Interviewed by Fowler, M. May 20, 2009.

should be done and it should describe the methodology to be used for all post storm critiques. It should also assign responsibility for performing these reviews to specific employees.

Recommendation No. 3: Unitil should include post storm reviews in its Emergency Operations Plans.

- Unitil should make post storm reviews a formal part of its Emergency Operations Plan.
- Unitil should design these reviews so the level of detail increases with the severity of the event.
- Unitil should include in its Emergency Operations Plan who will be included in these reviews, when they will occur, and how suggestions resulting from the reviews will be documented.
- Unitil should perform these reviews whenever its Emergency Operations Center is activated or whenever any event requires more than one day for restoring power to all customers.

Conclusion: National Grid has a post storm review process in place.

National Grid routinely performs post storm reviews. It conducted three storm critiques that included New Hampshire and addressed the December 2008 ice storm.¹³ Its review of this storm resulted in several actions involving its system in New Hampshire. The National Grid employees who participated in the ice storm critiques include representatives of:

- New England – North
- Energy Solution Services (New England)
- Transmission Control (New England)
- Construction Delivery
- Corporate Affairs (Media Relations and Internal Communications)
- Customer Contact Center (New England)
- Dispatch & Control
- Emergency Planning
- Supply Chain Management (Logistics Group)
- Protection & Telecom Operations Group
- Process & Systems
- Customer Meter Services
- Gas Dispatch

In early January 2009, and following the completion of the restoration effort, Inspections - New

¹³ National Grid. (March 27, 2009). Data Response STAFF 2-48. NHPUC.

England, the group responsible for conducting periodic reviews of the system's distribution infrastructure, began an examination of all distribution feeders in New Hampshire affected by the December 2008 ice storm. This group uses a software application to track items that need to be reviewed for possible repair, replacement, or improvement. New England – North Division is responsible for providing oversight to this effort. The Construction Delivery department used the list of items needing replacement to create work packages and assigned an internal project lead to coordinate the work via weekly conference calls with Division personnel.

Approximately three contractor line crews have been working from the Salem Service Center since January 2009, using the report results generated by efforts of the Inspections – New England department. Once items are closed, the completion is noted in the company's graphic information system. As of February 2009, Inspections – New England had completed reviews and repairs of 21 feeders that were affected by the December 2008 ice storm in New Hampshire.

Conclusion: NHEC performs post storm reviews but the reviews are not part of its Emergency Operations Plan.

NHEC performs storm critiques as standard practice and did so after the December 2008 ice storm.¹⁴ NHEC identified 19 specific recommendations requiring OMS enhancements and improvements in AMI, communications, logistics, and resource procurement. No specified implementation plans were developed as a result of these recommendations.

Recommendation No. 4: NHEC should make post storm critiques a part of its Emergency Operations Plan.

- NHEC should make post storm reviews a formal part of its Emergency Operations Plan.
- NHEC should design these reviews so the level of detail increases with the severity of the event.
- NHEC should include in its Emergency Operations Plan a list of employees who will be included in these reviews, when these reviews will occur, and how suggestions resulting from the reviews will be documented.
- NHEC should perform these reviews whenever its Emergency Operations Center is activated or whenever any event requires more than one day for restoring power to all customers.

¹⁴ NHEC. (March 24, 2009). Data Response STAFF 2-48. NHPUC.