

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION



**SPECIAL REPORT OF THE
DIVISION OF ENERGY REGULATION**

**PREPARATION FOR AND RESPONSE TO HURRICANE ISABEL BY
VIRGINIA'S ELECTRIC UTILITIES**

September 20, 2004

TABLE OF CONTENTS

EXECUTIVE SUMMARY	ii
INTRODUCTION	1
PREPARATIONS PRIOR TO THE STORM	2
HURRICANE ISABEL IN PERSPECTIVE	4
UTILITY-SPECIFIC IMPACTS FROM THE STORM	8
STANDARD RESTORATION PROCESS	11
UTILITY-SPECIFIC RESTORATION PERFORMANCE	16
COMMUNICATIONS	23
RECENT ENHANCEMENTS AND LESSONS LEARNED	32
SPECIFIC QUESTIONS RAISED REGARDING THE RESTORATION	42
FINDINGS AND CONCLUSIONS	76
GENERAL RECOMMENDATIONS	78
RECOMMENDATIONS SPECIFIC TO DOMINION VIRGINIA POWER	79
APPENDIX	

EXECUTIVE SUMMARY

This report presents the results of an analysis by the Virginia State Corporation Commission Staff (“Staff”) of the preparedness and responsiveness of the state’s investor-owned electric utility companies and member-owned electric cooperatives (collectively, “utilities”) relative to power outages and service restoration following Hurricane Isabel. The report addresses the utilities’ preparations prior to Isabel’s landfall, describes the severity of Isabel’s impacts relative to previous storms as well as her impacts on each utility individually, analyzes the utilities’ restoration results, and identifies the lessons learned as a result of the experience. The report also presents results of the Staff’s investigation into specific questions raised regarding the utilities’ performance. The report concludes with summaries of the Staff’s findings, conclusions and recommendations.

The impacts from Hurricane Isabel on the utilities’ electrical infrastructure and customers were unprecedented;¹ however, the factors involved were for the most part beyond the control of the utilities. These factors primarily included the widespread nature of the storm and the heightened susceptibility to tropical-storm-force winds of trees existing both inside and outside of the utilities’ rights-of-way. Unlike many previous storms in Virginia, Hurricane Isabel can be described largely as a “whole tree” event. That is, most of the damage was caused primarily by uprooted trees falling on the utilities’ lines and poles. Municipally and privately owned trees existing outside of the utilities’ rights-of-way caused much of the damage.

¹ For example, nearly 12,000 utility poles replaced; over 2 million customer outages for up to 16 days.

As a result of its investigation, the Staff has concluded that the utilities' overall preplanning and restoration efforts following Hurricane Isabel generally were reasonable and satisfactory by standard measures of performance. The time required for full restoration of service following Hurricane Isabel was neither unexpected nor unreasonable from the Staff's perspective given the number of customers impacted and the extent of damage. The Staff also concurs with the utilities' prioritization plans for restoration of service following a major outage, which employ a strategy of first restoring service to critical safety and public welfare facilities and then proceeding to those circuits that result in the restoration of service to the greatest number of consumers.

In general, the Staff found no compelling evidence among the utilities that restoration following Hurricane Isabel was hampered on a system-wide scale as a result of inadequate equipment or personnel resources or substandard distribution right-of-way vegetation management programs.² Furthermore, the Staff found no compelling evidence of deterioration in day-to-day service based on the standard measures of performance reported by the utilities. However, with respect to Dominion Virginia Power ("DVP"), as a result of anecdotal feedback from customers and employees regarding a decline in resources and because of the natural incentive to reduce costs in a rate-cap environment, the Staff has determined that it will conduct an in-depth audit of resources and spending on vegetation management beginning in the fourth quarter of 2004.

The Staff also found no major problems with scheduling of work or deployment of linemen in the field. In addition, the Staff found no evidence of deficiencies in the design of the utilities' distribution system infrastructure or the condition of the utilities'

² The Staff notes that the Federal Energy Regulatory Commission placed increased emphasis on vegetation management of the utilities' transmission facilities following the August 2003 Northeast blackout.

wood poles. Finally, although lessons were learned and improvements will be implemented, the Staff found no major problems with the utilities' storm management operations. Going forward, utilities should attempt to maximize the use of self-sufficient mutual assistance crews, with the goal of mobilizing a larger workforce in the event of any similar future catastrophe.

The devastation to the utilities' overhead distribution infrastructure and lengthy outages associated with Hurricane Isabel led many consumers to suggest that the utilities' aerial distribution lines be relocated underground. As a result, the 2004 Virginia General Assembly passed House Joint Resolution No. 153 requiring the State Corporation Commission to study the feasibility of placing distribution utility lines underground, the costs that would be incurred, and the options for funding such underground replacement. The resolution requires the State Corporation Commission to submit to the Division of Automated Systems an executive summary and report of its progress in meeting the directives of the resolution no later than the first day of the 2005 Regular Session of the General Assembly. As such, this report does not address this issue.

The Staff's investigation did determine that there were inconsistencies among the utilities with respect to the issuance of safety-related public information announcements and the imposition of hourly limits on shift work by linemen. With respect to public information announcements, the Staff recommends that utilities provide safety-related announcements to the public before and shortly after major storms. At a minimum, such announcements should address all aspects of preparation, including stocking water and avoiding downed lines. Utilities should also provide periodic announcements to inform the public of the proper, safe and courteous use of generators. With respect to hourly

limits on shift work, utilities should review their storm restoration labor policies to determine whether shift lengths for linemen are consistent with the optimal balance of safety and productivity when conducting multi-day restorations.

The Staff also determined, contrary to the utilities' stated policies, that in some isolated instances low voltage service lines were re-energized before being raised, creating potentially unsafe conditions. The utilities should review their policies regarding the process for locating and managing downed lines, and take the steps necessary to prevent inadvertently energizing downed lines in the future.

The Staff also believes that utilities could take a more active role in protecting their systems against the threat of old, fragile trees outside of their rights-of-way. The Staff recommends that utilities intensify their efforts to work with municipalities and educate homeowners with respect to the potential long-term benefits of removing aging, overgrown trees that exist outside of the utilities' rights-of-way, since these trees present a growing danger to the company's distribution lines.

The Staff also identified some findings, formulated recommendations, and established reporting requirements specific to Dominion Virginia Power. During the course of the investigation, improved communications with customers and local governing bodies were the dominant theme of all comments and suggestions to the Staff. DVP should continue its efforts to improve its ability to provide realistic general restoration targets and specific estimated restoration times as soon as possible following such events. There also needs to be improved communications with local emergency management officials. DVP has already taken a number of steps to address each of these identified issues.

In addition, the Staff recommends that DVP (1) continue to aggressively maintain distribution rights-of-way, (2) apprise the Staff of any changes to its wood pole inspection and replacement programs as a result of its participation in a study to identify improved methods of evaluating wood pole integrity, (3) review its deployment plan for mobilization of mutual aid and contract personnel following a major storm with the goal of deploying additional resources in key areas, (4) evaluate the potential for old, brittle copper wire to impact general reliability or susceptibility to major storms and implement corrective actions as necessary, and (5) review and update its plans for communication with the public, electric cooperatives and emergency management personnel. The Staff has asked DVP to provide by February 1, 2005, a written update of all recommendations in this report.

INTRODUCTION

Hurricane Isabel made landfall on September 18, 2003, and crossed through Virginia as a tropical storm causing massive destruction in the eastern, central and northern regions of the state. The storm resulted in a loss of power to over 2 million consumers in Virginia, an unprecedented level of power outages for the state. As a result of the devastated infrastructure and outages, the Staff of the Virginia State Corporation Commission (“SCC” or “Commission”) received more than 700 inquiries and complaints relative to the adequacy of the electric utility companies’ infrastructure and effectiveness of their restoration processes. Numerous requests were made for the Staff to investigate the utilities’ performance prior to and after the storm.

As standard practice, the Staff performs a post-storm analysis following each major storm. Following Hurricane Isabel, the Staff conducted field visits to observe damaged facilities and service restoration activities.³ The Staff also solicited input from the public and mutual aid utilities, and submitted requests for and analyzed data from Virginia’s impacted investor-owned electric utility companies⁴ and member-owned electric cooperatives.

Because of the importance of consumer input, the Staff conducted a series of seven public meetings during October and November 2003 in seven areas of Virginia affected by the lengthy electric outage. In addition, the Commission encouraged written

³ On September 22 and 24, 2003, the Staff conducted field visits of the devastation in the Richmond area and also witnessed the activities of some linemen in the field. The Staff also visited DVP’s Central Region Headquarters on September 24, 2003, to witness the delivery of new poles for installation in the field. Finally, on October 21, 2003, the Staff visited DVP’s Petersburg office to inspect the inventory of damaged poles.

⁴ Virginia Electric and Power Company d/b/a Dominion Virginia Power (“DVP” or “Virginia Power”); Appalachian Power Company d/b/a American Electric Power – Virginia (“APCo”); Potomac Edison Company d/b/a Allegheny Power Company (“Potomac Edison”); Delmarva Power & Light Company d/b/a Conectiv (“Delmarva Power”).

comments to be submitted by electronic and regular mail. In order to obtain information from the utilities, the Staff issued data requests to all utilities in the state.

The purpose of this report is to provide the results of the investigation by the Staff to analyze and evaluate the utilities' preparation for and response to the storm. The report addresses preparations made in anticipation of the storm, the severity of the storm's impact, restoration performance, customer service, communications, lessons learned, a summary of the Staff's conclusions, and recommended actions to be completed. For those readers who desire to approach the report's sections in a non-sequential manner, some repetition has been included intentionally to facilitate the understanding of individual sections independently.

PREPARATIONS PRIOR TO THE STORM

Reliance on preexisting storm outage restoration plans and thorough planning prior to the arrival of any major storm is a key component of the successful management and execution of a post-storm restoration effort. While all storms provide challenges and uncertainties, hurricanes have the potential to inflict significant widespread destruction, even though impending hurricanes may be easier to predict and provide more advance warning than many other types of storms. Preplanning efforts for such storms typically involve meteorological forecasting, training employees for various storm roles, preparing the public for potential damage, notifying special needs customers, activating storm centers, ensuring the availability of materials, securing line and tree contractor commitments, and discussing with neighboring utilities the availability of materials and mutual aid assistance.

While the various utilities employed different levels of sophistication relative to meteorological forecasting, all of the utilities reported tracking the storm and initiating preparations days before landfall. Dominion Virginia Power, which anticipated widespread outages and substantial damage to its infrastructure, provided the Staff with various details of its preplanning efforts. The state's other utilities also reported that in the days leading up to landfall of the hurricane, plans were formulated for an extensive recovery effort. The utilities' storm centers were activated, inventory levels of necessary supplies were evaluated and suppliers were contacted as necessary, tree contractors and linemen were notified, mutual assistance crews were called as necessary, and pre-storm news releases were issued describing the utilities' pre-storm activities to local media. Dominion Virginia Power, Delmarva Power and Potomac Edison also issued several press releases with the goal of informing the public of the danger of the approaching storm, to focus on safety messages to the public, and to remind customers of the procedures for reporting an outage. Similar announcements were made by A&N Electric Cooperative, Mecklenburg Electric Cooperative, and Rappahannock Electric Cooperative.

As would be expected, the preparations implemented by the utilities prior to the arrival of Hurricane Isabel varied from company to company. Some concern was expressed relative to the adequacy of DVP's preparations, in particular, and this is addressed in detail in the section of the report titled *Specific Questions Raised Regarding the Restoration ("Questions Raised")*. Generally speaking, however, the utilities' preparations appear to have been reasonable. Nevertheless, the utilities reported that

valuable lessons were learned as a result of the storm and that these lessons (including those related to preplanning and preparation) will be implemented for the future.

HURRICANE ISABEL IN PERSPECTIVE

On September 18, 2003, Hurricane Isabel made landfall near Cape Hatteras, North Carolina, as a Category 2 storm with winds near 100 mph. Despite this fairly modest storm classification, over the next 24 hours Isabel caused unprecedented power outages throughout the Mid-Atlantic region. After making landfall and weakening, Isabel cut a path through North Carolina, Virginia, West Virginia, Maryland, Pennsylvania and Ohio. The storm also affected the District of Columbia, Delaware, New Jersey and Rhode Island.⁵

According to a preliminary post-storm report from the National Weather Service in Wakefield, Virginia, the wind field of Isabel expanded well northward as it tracked through North Carolina and Virginia. Sustained tropical storm force winds, with frequent wind gusts approaching and exceeding hurricane force, were observed over an unusually extensive area of North Carolina, Virginia and Maryland. Heavy rain caused flooding over central and southern Virginia causing high water on many roads until late on Friday, September 19, 2003.⁶

Although Hurricane Isabel was not one of the strongest or most costly hurricanes in history, its destruction was widespread. According to the National Weather Service's preliminary post storm report, Isabel will be remembered for the greatest wind and storm surge in this region since Hazel in 1954 and the 1933 Chesapeake-Potomac Hurricane.

⁵ Hurricane Isabel, A Summary of Energy Impacts and OEA's Response, Department of Energy, Office of Energy Assurance ("OEA"), http://www.ea.doe.gov/pdfs/isabelreport_10-7-03.pdf. October, 7, 2003.

⁶ Preliminary Post Storm Report, Hurricane Isabel, National Weather Service ("NWS"), Wakefield, Virginia, http://www.erh.noaa.gov/er/akq/wx_events/hur/isabel_2003.htm, October 9, 2003.

Isabel will also be remembered for the extensive power outages and permanent change to the landscape from all the fallen trees.⁷

According to the Department of Energy's Office of Energy Assurance ("OEA"), the energy impacts from Hurricane Isabel were among the most severe in history. "Power outages affected over 6.5 million customers at the storm's peak. Utility crews were stretched to their limits, even with assistance from mutual aid crews. . . . Even Hurricane Andrew, by far the most costly of all hurricanes with insurance costs of \$19.8 billion (adjusted to 2002 dollars) resulted in only 1.3 million power outages...."⁸

Hurricane Isabel caused the most extensive power outages ever in Virginia.⁹ Isabel interrupted power to approximately 1,829,566 customers of four investor-owned electric utility companies and 262,951 members of 11 member-owned electric cooperatives.¹⁰ Some consumers in Virginia were without power for up to 16 days.¹¹

Dominion Virginia Power, the Commonwealth's largest utility, sustained the greatest impact in absolute numbers. Of DVP's 2.1 million customers in Virginia, approximately 1.71 million (or 81.3 percent) lost power, some for as long as 15 days. By contrast, DVP lost approximately 800,000 customers for up to five days from Hurricane Floyd in 1999, and lost approximately 540,000 customers for up to six days from Hurricane Fran in 1996. Neither have recent system-wide winter storms wreaked as much damage on DVP's system as Hurricane Isabel. Dominion Virginia Power lost approximately 401,000 customers for up to ten days from the 1998 Christmas Eve Ice

⁷ Ibid. NWS.

⁸ Ibid. OEA.

⁹ Ibid. NWS.

¹⁰ Thousands of customers served by municipal electric utilities also lost power.

¹¹ Virginia's State Climatologist predicts that a Category 3 or Category 4 hurricane making landfall in Virginia could result in power outages of up to one month in duration, given the age and condition of the urban and suburban forests that are allowed to exist outside of the utility companies' rights-of-way.

Storm, and lost approximately 285,000 customers for up to nearly four days from the 2000 Super Bowl freezing rain storm.

A comparison of the damage caused by Hurricane Isabel to DVP's system with that of Hurricane Fran to Carolina Power & Light ("CP&L," now Progress Energy) in North Carolina is also instructive. Hurricane Isabel made landfall near Virginia's southern coast as a Category 2 storm and cut through the interior of the state. Similarly, in 1996, Hurricane Fran slammed into North Carolina's southern coast and cut through the interior of that state.

While Hurricane Fran was a more powerful Category 3 storm at landfall, Hurricane Isabel may have been more destructive in some ways. In the wake of Hurricane Fran, CP&L lost approximately 791,000 customers for up to ten days and had to repair or reinstall more than 5,000 poles and 2,800 transformers,¹² costing approximately \$115 million¹³. As a result of Hurricane Isabel, DVP lost approximately 1.8 million customers for up to 15 days and had to replace about 8,000 poles and 7,900 transformers at a cost of approximately \$ 217 million (\$134.6 million after tax write-offs).

In summary, while Hurricane Isabel was not one of the strongest hurricanes to hit Virginia, it did result in record levels of electric utility customer outages and destruction to the state's energy infrastructure. The Staff has previously determined that while the number of consumers impacted from major storms has been increasing due to increasing customer density and tree growth, there has been no apparent parallel increasing trend in the length of time to complete the restoration of service following major storms over the

¹² CP&L Infobulletin, "Service Restored to Virtually All CP&L Customers," September 16, 1996.

¹³ (2002 \$). Response of Electric Utilities to the December 2002 Ice Storm, NC PUC, September 2003.

past 30 years.¹⁴ This could be, in part, because utilities have been able to adapt to the increases in the number of customers experiencing outages and destruction to their infrastructure through improved planning, advances in information technology, and the ability to manage increasing numbers of contract and mutual aid personnel for wide-scale restoration efforts. Nevertheless, Hurricane Isabel resulted in outages of unprecedented number and duration, at least in Virginia.¹⁵ The Staff believes that the record-level energy impacts caused by Hurricane Isabel were a result of a combination of factors generally beyond the control of the utility companies, primarily the widespread nature of the storm and the heightened susceptibility to tropical-storm-force winds of those trees existing outside of the utilities' rights-of-way. Expert judgment, anecdotal evidence, and expenditures on tree cleanup support this conclusion.

Based on forest inventory data published by the U.S. Forest Service¹⁶ and hurricane damage estimates provided by the Virginia Department of Forestry,¹⁷ Dominion Virginia Power has inferred that Hurricane Isabel damaged nearly 100 million trees¹⁸ on Virginia forestland, including 2 million select red and white oak trees. Locally, the City of Richmond estimated that Richmond lost as many as 10,000 trees as a result of Hurricane Isabel, many of them more than 100 years old¹⁹. The Virginia State Climatology Office has concluded that the destruction of the trees was inevitable due to

¹⁴ Investigation of Dominion Virginia Power's Performance Relative to the January 30, 2000, Freezing Rain Storm and System Reliability, VA SCC Staff Report, December 2000.

¹⁵ Duke lost 696,000 customers in North Carolina for up to 18 days from Hurricane Hugo in 1989 and Niagara Mohawk lost 120,000 customers for up to 23 days from the New York Ice Storm of 1998.

¹⁶ USDA Forest Service, Forest Inventory and Analysis Mapmaker, <http://ncrs2.fs.fed.us/4801/FIADB>

¹⁷ Virginia Department of Forestry, Hurricane Damage Estimate, Mr. John Scrivani, Research Director.

¹⁸ "All live trees" consists of growing stock, rough, and rotten trees one inch in diameter and larger.

¹⁹ "Parks Foundation Announces the Hurricane Isabel Tree Replacement Fund," RichmondGov.com, <http://www.ci.richmond.va.us/article11182003.asp>

the presence of an aging and overgrown forest of urban and suburban trees.²⁰ Contributing factors included tree damaged root systems due to past prolonged drought, saturated ground from excessive rainfall, and sustained storm force winds. On September 22 and 24, 2003, the SCC Staff photographed examples of the damage to the energy infrastructure in the Richmond area, and some of those photographs are displayed in the Appendix.

UTILITY-SPECIFIC IMPACTS FROM THE STORM

As mentioned previously, Hurricane Isabel caused unprecedented outages and destruction to the electric utilities' energy infrastructure. Primarily as a result of the path of the storm and the relative size of the various electric systems in the state, DVP's system sustained the most damage (on an absolute basis) among all utilities in the state. Dominion Virginia Power declared Hurricane Isabel to be the most destructive storm in the company's history. The hurricane resulted in nearly 52,000 work orders, and the company estimates it replaced 8,000 poles, 9,000 crossarms, and 7,900 transformers. The total cost (pre-tax) of restoration was estimated at \$217 million, including \$28.4 million for tree cleanup by regular and special storm tree contractor services.

A comparison of the damage to DVP's system caused by Hurricane Isabel with some other recent major storms is provided in Table 1. Note for example that the number of poles replaced after Hurricane Isabel was at least ten times greater than any previous storm. In addition to unprecedented damage to the company's infrastructure, a greater percentage of DVP's customers experienced outages (82%), and DVP's customers were without power longer (up to 15 days) than ever before.

²⁰ "Isabel and Virginia's Current Problem," Advisory 03/05, VSCO, September 29, 2003.

APCo, Potomac Edison and Delmarva Power were also impacted by Hurricane Isabel. Hurricane Isabel had no impact on the Old Dominion Power Company. Summaries of customer impacts, infrastructure damage, and costs of restoration among the state’s electric utilities are provided in Tables 2, 3, and 4, respectively. Most of the electric cooperatives also sustained significant impacts from the storm. However, BARC suffered only minor impacts, and Craig-Botetourt and Powell Valley sustained no impacts. A summary of the impacts to the electric cooperatives is provided in Table 5.

Table 1. Catastrophic Storms Damage Comparison

Dominion Virginia Power	Work Orders	Poles Replaced	Crossarms Replaced	Customers Affected	Duration of Outage
Hurricane Isabel – 2003	52,000	8,000	9,000	1,708,137	15 days
Super Bowl Storm – 2000	5,000	22	190	285,000	4 days
Hurricane Floyd – 1999	10,100	469	1,329	730,000	5 days
Christmas Eve Ice Storm – 1998	12,300	815	3,144	401,000	10 days
Hurricane Fran – 1996	8,000	620	793	540,000	6 days

Table 2. Hurricane Isabel Customer Impacts

Electric Utility	Total Customers Affected	Percent of Customers Affected	Total Duration of Outage
Virginia Power	1,708,137	81.3 %	15 days
Potomac Edison	45,808	52%	6 days
Delmarva Power	12,407	58 %	5 days
APCo	63,214	12.9 %	5 days

Table 3. Hurricane Isabel Infrastructure Damage

Electric Utility	Poles Replaced	Crossarms Replaced	Transformers Replaced	Feet of Cable Replaced
Virginia Power	8,000	9,000	7,900	1,000,000
Potomac Edison	345	700	56	Mainly spliced
Delmarva Power	4	30	7	5,130
APCo	88	79	17	20,413

Table 4. Estimated Costs of Restoration (Millions of Dollars)

Electric Utility	Total Cost	Company Labor	Tree Contractor	Line Contractor	Mutual Aid	Materials/Supplies	Vehicles/Misc.
Virginia Power	134.6	15.7	17.6	37.0	37.4	10.4	16.5
Potomac Edison	3.90	1.36	0.81	0.83	0.45	0.22	0.22
Delmarva	0.76	0.21	0.09	0.24	0.16	0.04	0.03
APCo	2.17	0.54	0.30	0.37	0.52*	0.08	0.36

* non-Virginia AEP crews

Table 5. Hurricane Isabel Impacts on Electric Cooperatives

Electric Cooperative	Customers Affected	% Customers Affected	Total Duration of Outage	Poles Replaced	Total Cost (\$ millions)
Rappahannock	80,500	93.8 %	11 days	450	4.58
Southside	34,680	70.0 %	11 days	395	2.4
Prince George	10,144	100 %	11 days	305	2.06
Community	9,787	100 %	16 days	270	1.90
Northern Virginia	52,057	46.1 %	7 days	83	1.72
Mecklenburg	16,771	56.0 %	7 days	87	1.41
Northern Neck	13,852	85.6 %	11 days	207	1.24
Central Virginia	22,323	75.8 %	6 days	100	0.55
A&N	5,536	51.1%	3.5 days	25	0.42
Shenandoah Valley	15,000	42.9 %	4 days	16	0.18
BARC	2301	19.9 %	2 days	6	0.05
Craig-Botetourt	0	0	0	0	0
Powell Valley	0	0	0 days	0	0

STANDARD RESTORATION PROCESS

The utilities generally follow similar strategies for the restoration of service following a major weather-related outage. As weather conditions permit following a storm, utilities afford the highest restoration priority to essential public health and safety facilities such as hospitals, 911 emergency call centers, and critical water pumping facilities. The utilities also intend to respond with the highest priority to remedy situations where damaged equipment poses a significant threat to public safety, such as a live high voltage wire down on a road. The prioritization of other restoration projects is

driven by an attempt to restore service to the greatest number of customers in the shortest period of time, thus utilities might concentrate initially on transmission lines and delivery points to the electric cooperatives, for example. The utilities have both economic and public service incentives to execute their publicized restoration schedules.

Since it takes a few days to patrol (both by air and on foot) and reasonably assess thousands of miles of damaged circuits following a major storm event, utility management must initially make decisions regarding the marshalling and deployment of resources without the benefit of full information. The difficulty of this task is compounded by the demands of managing and coordinating the logistics of an unusually large workforce, including many non-company workers, who must perform dangerous work, frequently under inclement weather conditions.

It is electrically necessary to begin restoration work on each circuit at its source transmission line or substation and proceed sequentially to the end of the circuit. Therefore, in general, main-line three-phase portions of circuits are repaired first, as all three-phase and single-phase taps feed from the mains. Next, repair sites on the taps are prioritized in a declining order, beginning with the ones that will restore service to the most customers with each repair; however, there are several complicating factors that determine when any individual service is restored.

Protective devices (fuses, reclosers, sectionalizers, and the substation breaker) are situated at various locations on a circuit and operate automatically to de-energize a faulted (short-circuited) section of the circuit. This protects circuit components from sustained damaging fault currents and limits the interruption in service to the customers down-line (i.e., away from the substation) from the fault.

Each distribution line is protected by a circuit breaker at the substation. Typically, one or more sectionalizers and/or reclosers will be installed down line from the substation along the main-line circuit and along three-phase branches of the main-line circuit. Single-phase tap lines, usually protected by fuses, branch off of the main-line sections of the circuit and continue to the farthest points of the circuit. Customers are served directly from fuse-protected transformers, which step down the primary voltage of the circuit to voltages compatible with customer equipment. The important point to note is that there may be several protective devices between the substation and a customer.

The operation of any one protective device between the substation and a particular customer results in an interruption of service to the customer. Consequently, all of the faults down line from each of these protective devices must be cleared and facilities repaired before service can be restored to the down-line customers. During restoration efforts, each repair location or project corresponds to a protective device on a company's distribution lines. Therefore, restoring service to any individual customer may require several repair projects between the substation where the distribution line originates and the customer's meter.

Shortly after a major storm, utilities know which customers have lost power, as well as the protective device furthest upstream from each customer that has operated and locked-out to clear a fault. However, there is limited information about the status of any other down-line protective devices. Further, the cause and severity of damage to the circuit is unknown until a visual inspection is made. The work required for each repair project may vary substantially, ranging from a relatively simple replacement of a fuse

(perhaps a five minute job) to a rebuild of sections of the circuit (sometimes requiring days).

Obviously, these two contrasting scenarios require vastly different repair resources in terms of manpower, materials, and restoration equipment. Since the objective is to restore service to the maximum number of customers in the shortest period of time, several factors in addition to the number of outages down line from each device must be considered in establishing restoration priority. Area field personnel have the most detailed information regarding damaged facilities and required restoration resources within a certain area and are in the best position to evaluate such considerations and deploy available resources accordingly within that specific area.

The restoration work that results from widespread, devastating weather events will always exceed the resources of the local utility. Hence, utilities call upon neighboring utilities (mutual aid) and contractors to accelerate the restoration work. Utility personnel familiar with the local system are assigned to visiting crews. Guides may also serve as a resource to handle field support activities, such as obtaining materials and meals, thereby enabling the line crews to focus their efforts on restoration work.

Contract tree crews are also necessary for restoration after a major storm. Some tree crews are teamed with line crews and accompany them to each job site. Other tree crews work independently with a guide and clear trees ahead of line crews when energized conductors or other safety issues are not a concern.

In any restoration effort, safety is a limiting factor in how many field personnel can work at one time. Adding more line crews increases the risk to safety as it is hazardous to overpopulate a circuit with workers. Safe operating practices demand

knowledge of the status of all line personnel possibly impacted by a re-energized line during service restoration. Having different types of workers, from line crews to tree crews to patrollers, simultaneously working in the same area can complicate this endeavor. As more crews are added in the field, more time must be spent verifying their status. An excessive concentration of resources within a particular area could potentially lengthen the restoration effort.

Dominion Virginia Power reported that management practices are evolving to better utilize mutual aid crews. According to DVP, most utilities have migrated away from full command and control of every single visiting crew. Instead, many mutual assistance crews are very nearly self-sufficient, autonomous workforces. Today's mutual assistance teams may consist of not only the traditional linemen and first-line supervisors but also patrol/assessment teams, safety personnel, second-line supervisors, logistics experts, and even materials coordinators, refueling teams, and caterers. DVP notes that this permits them to manage more visiting resources without increasing DVP's management personnel. For example, the former concerns of verifying that power lines have been cleared to be energized, which was very management- and time-intensive, can now be distributed to qualified off-system supervisory personnel placed in charge of specific DVP circuits. The disadvantages of the new approach include diminished knowledge of specific job-by-job work progress (for the different jobs assigned within a larger work package) on the circuits/substations assigned to a particular off-system group, diminished capability to provide customer feedback on restoration progress associated with a specific job, and less ability to assure a most-customers-first restoration except at a "whole-circuit" level.

UTILITY-SPECIFIC RESTORATION PERFORMANCE

In the course of executing their responsibilities to restore service after Hurricane Isabel, all utilities embraced a similar philosophy regarding priority of restoration. The companies sought to first respond to emergency situations and critical infrastructure. Thereafter they attempted to employ a strategy which would ensure that circuits impacting large groups of customers would be restored first. As the effort moved beyond main circuits and into neighborhoods, geographic-based (i.e., neighborhood) restoration became more efficient. The Staff was advised of some concerns regarding DVP's priority of restoration after the storm, and these are addressed in detail in the *Questions Raised* section of the report. A discussion and summaries of the resources used by the utilities and the results of the restoration effort, with an emphasis on DVP's performance, are provided below.

The utilities strived to restore electric service to as many customers as quickly and as safely as possible. They made advance provisions for equipment and labor force in numbers they anticipated would be sufficient, and crews began restoration work as soon as possible. However, the widespread damage caused by fallen trees impeded transportation and the overall restoration effort.

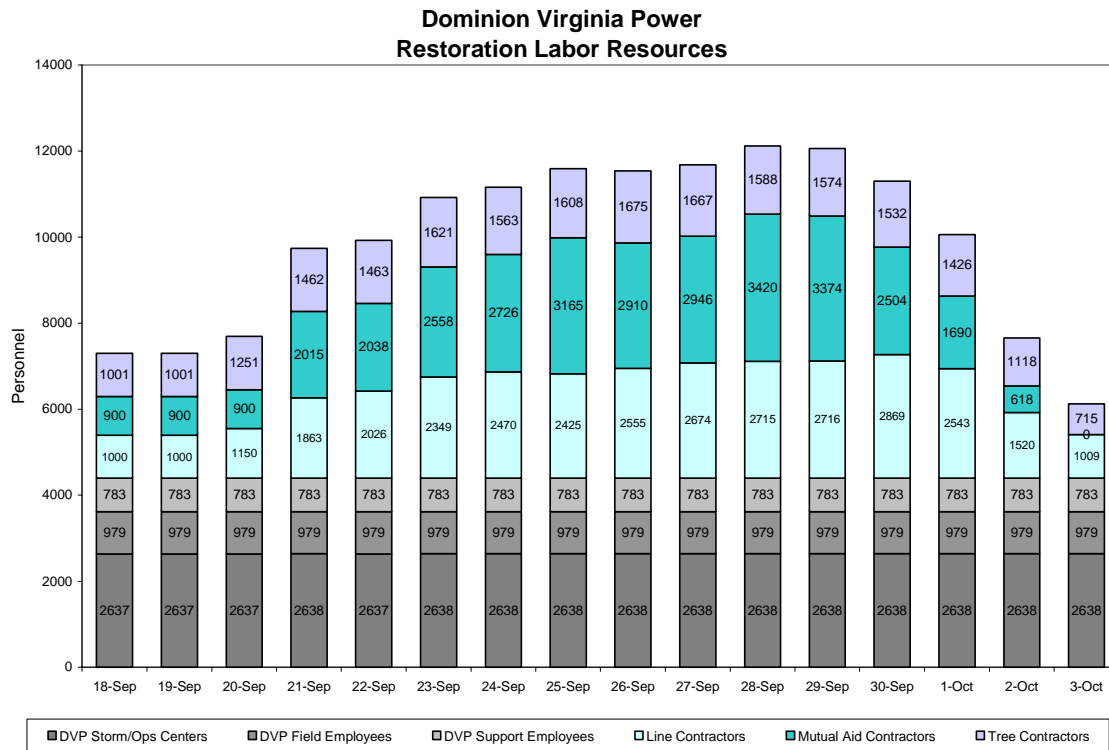
The management of personnel during the restoration effort varied only slightly among the state's utilities. Although the restoration process was a 24-hour-a-day effort, APCo, Delmarva Power, Potomac Edison, and DVP all reported scheduling the large majority of their personnel to perform work during the daylight hours. The same policy was typical among the state's electric cooperatives as well. The utilities believe that workers are more productive during the day, and that the nature of restoration activities

such as tree removal is disruptive to customers at night. One utility suggested that the best time for the employees to rest is at night when the general population is asleep.

The utilities reported that it is common industry practice to limit shift work during an extended restoration event to 16 hours on shift followed by 8 hours off, which allows employees a reasonable rest period and reduces the safety risk to employees. APCo, Delmarva Power, and Potomac Edison scheduled 16-hour shifts. Dominion Virginia Power was criticized for scheduling work for less than 16-hour shifts during the restoration process and this issue is discussed in detail in the *Questions Raised* section of the report. Among the electric cooperatives, all but two also implemented 16-hour shifts: Northern Virginia Electric Cooperative and Prince George Electric Cooperative scheduled 14-hour shifts.

Dominion Virginia Power's total labor resources for Hurricane Isabel varied from day to day during the restoration effort but peaked at 12,123 on September 28, 2003. Included among the aforementioned labor force on that day were 3,420 mutual aid contractors,²¹ 2,715 line contractors, 1,588 tree contractors, 979 DVP field employees, 783 DVP support personnel, and 2,638 DVP personnel in the company's various storm and operations centers. The following chart shows the number of personnel working to restore power on DVP's system on each day from September 18 through October 3, 2003. As mentioned previously, this was by far the largest deployment of resources for a post-storm restoration effort in the company's history.

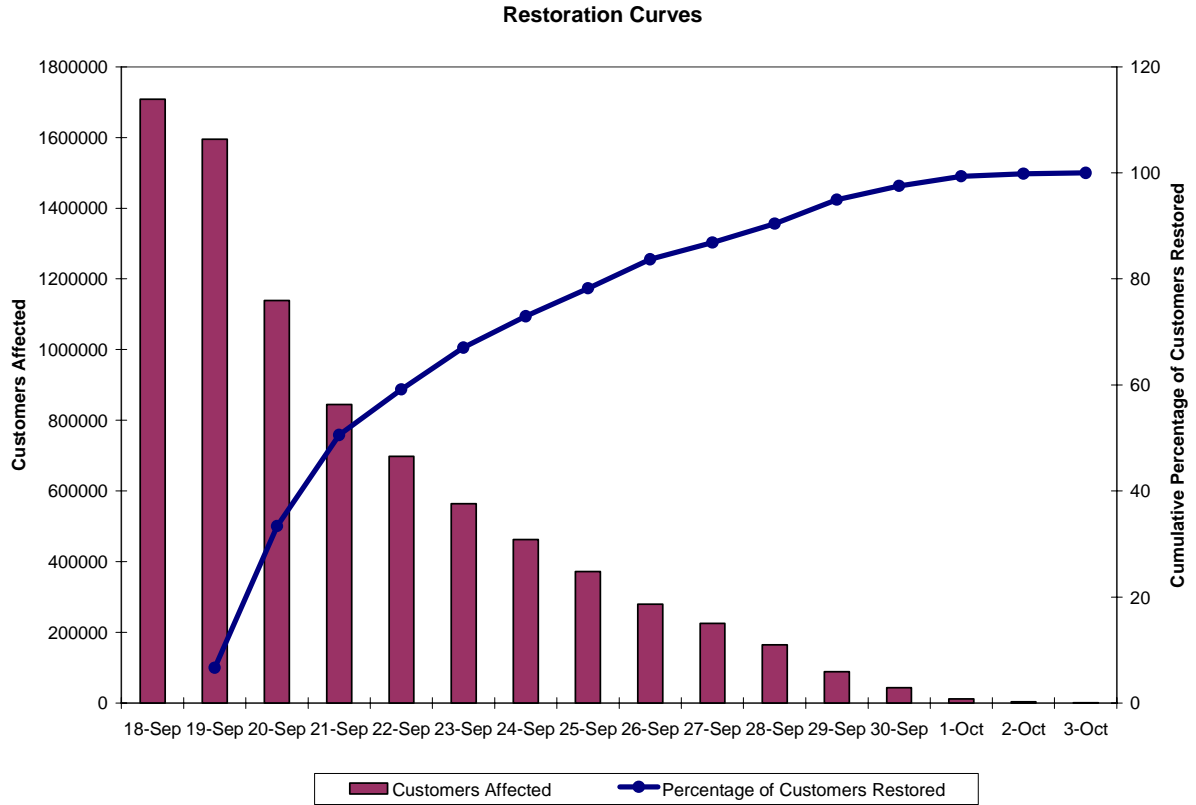
²¹ The peak number of mutual aid persons under contract at one time. 3902 different personnel (2971 line and 931 support) from 21 different companies were employed over the restoration period.



While acknowledging that their performance was not perfect and that improvements are needed in some areas, DVP claimed three major successes with respect to safety, resource management, and planning. The company deserves recognition for successfully managing 12,000 employees during the 15 day outage without any major injuries. In addition DVP noted that it had accomplished the largest acquisition and deployment of salaried and craft personnel in the company’s history. Finally, the company concluded that previous improvements to the restoration plan and focused storm training led to an effective allocation and use of resources.

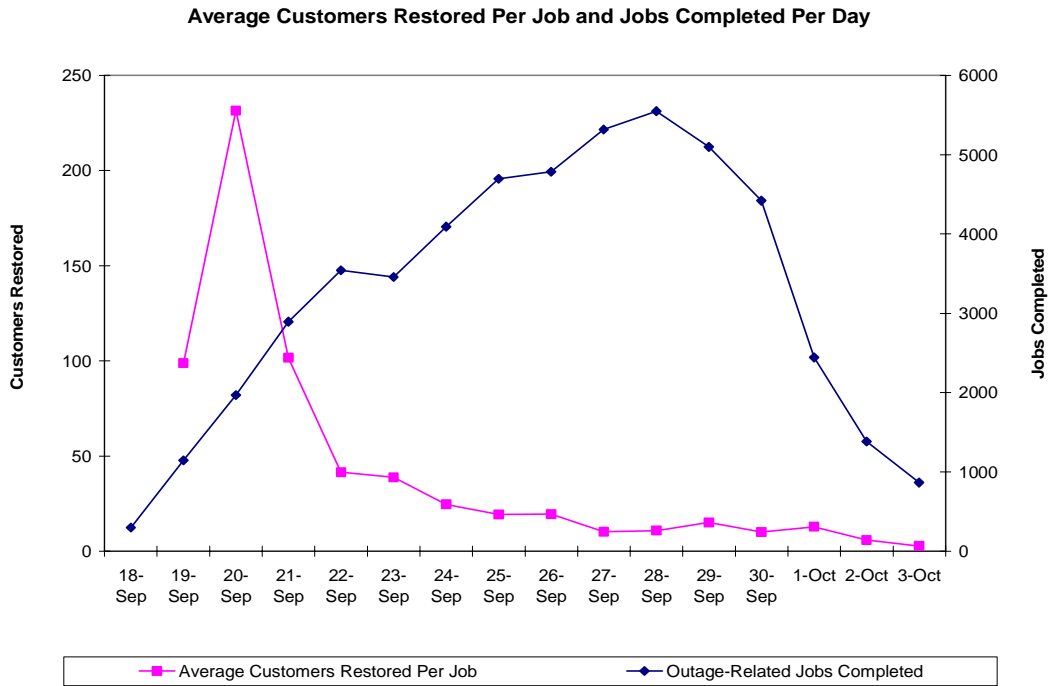
The following chart shows the restoration curves for DVP’s customers. The company established goals of restoring 75% of the outaged customers by September 25th, 90% of the customers by September 28th, and 100% of the customers by October 3, 2003.

Actually, by September 25th – the seventh day of the outage – the company had restored power to 1,335,713 (or 78.3%) of its customers.



As indicated previously, DVP’s policy with respect to restoration priority is to complete the jobs that will restore the greatest number of customers first. The following chart, which shows the number of jobs completed on each day and the number of customers restored per job completed, is an indication that the company’s performance was consistent with this policy. For example, after the first three full days of the restoration, DVP had completed only slightly over 6,000 work orders, but had restored service to almost 1 million customers, restoring an average of approximately 140 customers per work order completed during that period. During the next three full days of restoration, the company would complete approximately 11,000 work orders, but

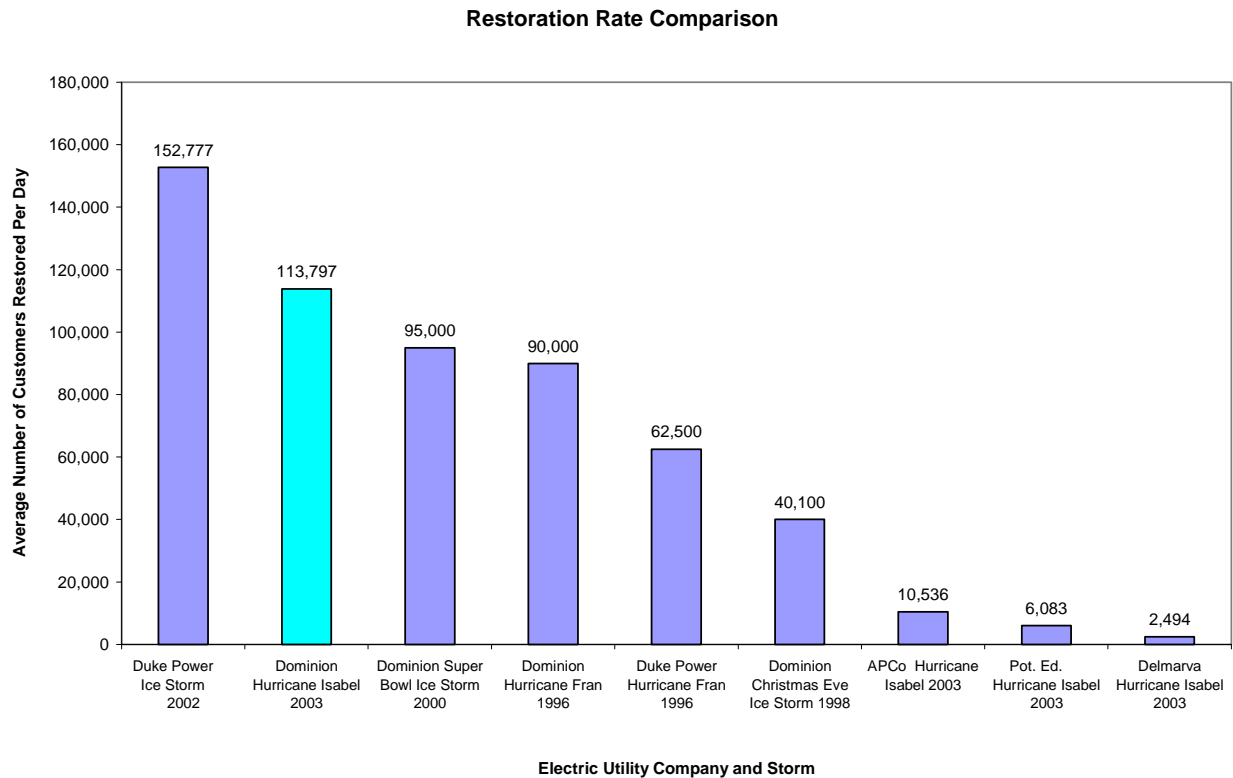
restore service to less than one-half million customers, averaging 34 customers per work order completed during that period. On the final day of the restoration, the completion of each work order restored on average less than three customers.



Overall, DVP was able to restore service to an average of 113,797 customers per day following Hurricane Isabel, the highest restoration rate Dominion has ever achieved.²² Although DVP’s restoration rate for Hurricane Isabel was not as high as Duke Power’s restoration rate after the December 2002 Ice Storm, it was nearly double Duke Power’s restoration rate after Hurricane Fran in 1996. DVP’s restoration rate after Hurricane Isabel was also better than DVP’s restoration rates after Hurricane Fran and the 2000 Super Bowl freezing rain storm, even though the damage to the infrastructure

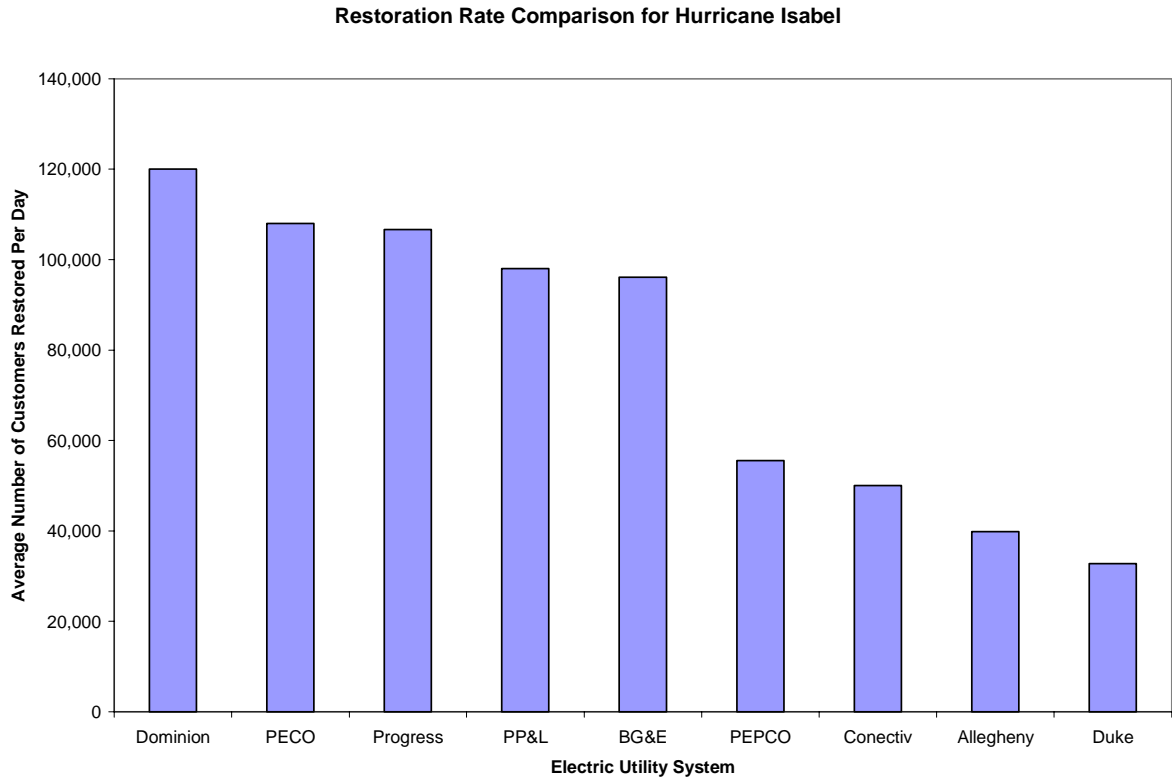
²² Evaluations of a utility’s performance from one storm to the next, or comparisons among different utilities for the same storm, based on restoration rates are imprecise at best given that restoration rates are, in part, a function of variations in the amount of structural damage from the storm and variations among different utility systems with respect to customer density and topography.

caused by Isabel was much worse than the damage caused by either Fran or the Super Bowl storm. The average restoration rates following Hurricane Isabel for the state’s investor-owned electric utilities (Virginia jurisdiction), as well as a sampling of restoration rates for other catastrophic storms, are provided in the following chart.²³



²³ Information regarding Hurricane Charley (August 2004) was obtained following the development of the referenced chart. However, because Charley was the most recent Hurricane to make landfall in the U.S. at the time of completion of this section of the report, the Staff thought it important to include some relevant statistics in this footnote. Hurricane Charley caused few problems in Virginia but devastated portions of Florida. More than 2 million Florida electricity customers, including 502,000 served by Progress Energy and 874,000 served by Florida Power & Light, were without power beginning Friday night, August 13. As of Sunday night, August 22, nearly all of Progress Energy’s customers had been restored, amounting to a restoration rate of approximately 56,000 customers per day. Progress Energy replaced 2,285 distribution poles and 5,779 transformers as a result of the destruction caused by Charley. Florida Power & Light reported restoring an average of 100,000 customers per day.

A comparison of the restoration rates exclusively for Hurricane Isabel for DVP and several out-of-state investor-owned utility systems is provided in the following chart.



Among the electric cooperatives, both Northern Virginia Electric Cooperative and Rappahannock Electric Cooperative restored in excess of 7,000 customers per day on average. Southside Electric Cooperative, Central Virginia Electric Cooperative, and Shenandoah Electric Cooperative restored in excess of 3,000 customers per day on average, and Mecklenburg Electric Cooperative averaged just under 2,400 customers per day. The restoration rates for the remaining five reporting electric cooperatives ranged from 611 to 1,581 customers per day on average.

COMMUNICATIONS

Effective communication is a key component to the successful recovery from a major incident such as Hurricane Isabel. During such events the public relies on its government officials and owners and operators of critical infrastructure, especially utilities, to provide a sense of comfort that progress is being made and that life will return to normal as quickly as possible. In order to communicate effectively with the public, it is critical that utilities and emergency management organizations involved in restoration efforts communicate with each other as efficiently and effectively as possible. Failure to do so will result in slowed restoration and loss of public trust.

During the Isabel restoration effort the Commission Staff was inundated with concerns relative to the adequacy of DVP's communication plan. Consumers, localities, electric cooperatives, and nursing home representatives, to name a few, commented that DVP failed to provide sufficient information relative to service restoration.

As mentioned earlier in this report, as a result of the overwhelming number of concerns expressed during the storm, the Commission Staff conducted seven public meetings in the areas most impacted by Hurricane Isabel. Additionally, the Staff established an email address for written correspondence. The purpose of these forums was to provide the public an opportunity to further discuss the electric and telephone utilities' responses to Hurricane Isabel.

While the meetings were lightly attended in general, the Staff received comments from approximately 40 people in attendance with approximately another 100 providing us written comments. The vast majority of those that commented reiterated the

concerns expressed by those that contacted us during the storm -- DVP did not communicate effectively with the public during the restoration effort.

Effective communication following an event such as Isabel is extraordinarily complicated because of the initial lack of information, the limited effectiveness of electronic communication media, and the volume of customers and organizations seeking individualized, case specific information. Adequate communication for one individual or group may be unacceptable to another. However, given the critical public interest of electric service, the Commission Staff believes that DVP, as well as all other utilities, must continually work to improve its ability to communicate during major outage events. The purpose of these next sections is to highlight specific concerns relative to DVP expressed to the Commission during and after the storm. Later sections of the report will identify improvements being implemented by DVP since the storm.

Communications with Consumers

As a result of the outages caused by Hurricane Isabel, the Commission Staff received approximately 700 consumer complaints. Of these calls all but approximately 20 were from DVP consumers. This volume of calls greatly exceeded the volume during any other storm. For example, following the Super Bowl freezing rain storm the Staff received approximately 200 calls. Two issues dominated the concerns expressed by consumers: estimated restoration time and restoration priority. Most callers were simply looking for information relative to when their service would be restored. Consumers expressed frustration that they could not get an estimated restoration time from DVP and as a result could not adequately make plans for their families. Additionally, consumers and organizations with special needs, especially representatives from nursing homes,

indicated that they believed restoration of their service should be given priority over other consumers.

Following Isabel, DVP was not able to provide all customers with a specific restoration time until September 27, nine days after the Hurricane hit. Even then a large percentage of consumers received an estimated restoration time that was the last day of the estimated system restoration. Of equal concern was the company's inability to provide system restoration goals. The company informed the public on September 21 (three days after the storm) of its goal to restore service to 75 percent of the affected customers by September 25. However, it took until September 25 (seven days after the storm) to provide its 90 percent and 100 percent system restoration goals.

Understandably, the company cannot immediately provide specific information after major storms that result in significant infrastructure damage and customer outages. Damage assessments must be conducted to develop reasonable restoration estimates. However, the company should continue its efforts to improve its ability to provide realistic general restoration targets and customer specific estimated restoration times as soon as possible following such events.

In an attempt to provide customers with information about its restoration progress, DVP used its website to list the areas it would be working each day. While this plan seemed reasonable, it may have added to consumer frustration. All too frequently consumers visited the website and saw that their area was listed as a work location, but were unable to find DVP crews or contractors. While this is understandable since the company provides its crews more work orders than can be handled in a day (to prevent crews from finishing and then having to await further instruction) and since work

locations may be far removed from the affected customers, it may have added to the frustration of an already stressed consumer base. Consumers that expected to find crews working near their homes were not only angry, but became skeptical about the company's ability to manage the restoration and the information disseminated by the company. This skepticism likely led to an increase in the number of complaints.

During and after the storm, the Staff heard from consumers with special needs that they should be given priority over other consumers because they needed electricity to operate life saving equipment. The most vocal of these concerns came from representatives in the nursing home and assisted living industry. Specifically, these representatives indicated that many nursing home residents are just as sick as people in hospitals; therefore, they should be placed in a priority status during future storms. The Staff also heard from consumers who continue to reside in their own home, but require the use of life supporting equipment. Likewise these consumers expressed the belief that they should be better identified in the restoration process and be granted priority over other consumers.

DVP and other utilities reasonably argue that it is not logistically possible to provide all special need individual consumers or nursing homes and assisted living facilities priority status. DVP has approximately 10,000 individual customer accounts coded as medical emergency customers. Likewise there are a large number of nursing home and assisted living facilities. These customers and facilities are spread throughout its system on virtually every circuit and at differing electrical locations on each circuit. As a result it is simply not possible during a major outage, with damage across the

system, to establish a policy providing each of these consumers priority over other customers. Such a policy would essentially result in affording no priority restoration.

For this reason the Staff does not recommend a basic change in DVP's service restoration priority. However, the Staff does believe that DVP can improve upon its ability to communicate effectively with these customers. First and foremost, the company must identify the special needs and critical facilities customers within its system and then it should develop a plan for communicating with these customers. With respect to nursing homes, DVP has recognized, and the Staff agrees, that while certainly not all nursing homes are equivalent to hospitals some do provide care similar to hospitals and as such should be afforded some level of priority service. Regardless of priority status, however, the company recognizes the need to provide better information to all.

DVP indicated that it did not have a completely up-to-date list of critical facilities during the Isabel restoration effort and has been working with the localities and private industries since Isabel to update those lists. It should be understood that while the Staff believes that DVP must improve, it is incumbent upon the localities to do a better job establishing and maintaining communication links with all utilities prior to emergencies as well. Additionally, no utility can guarantee uninterrupted service, even to priority service customers. Therefore, it is important that such customers have developed a plan and are prepared to deal with extended interruptions of electric service.

It should be noted that the general nature of the calls from consumers following Hurricane Isabel differed from that of either the Super Bowl freezing rain storm or the Christmas Eve Ice Storm. In those storms a large percentage of the consumers that contacted the Commission expressed frustration with the instant outage, but expressed

greater frustration over the frequency with which they lost their service. Following the Super Bowl freezing rain storm, in part because of the complaints, the Staff recommended that the company begin trimming its rights-of-way more aggressively. The Staff believes that the company's effort in this regard, as well as new approaches in defining reliability improvement projects, helped to reduce the number of complaints following Isabel relative to outage frequency.

Communication with Emergency Management Officials

In addition to the consumer complaints, numerous localities expressed concern with the adequacy of communications with DVP. The Staff attended multiple meetings to hear these concerns first hand. Specifically, we attended a Northumberland Board of Supervisors meeting on October 9, 2003, a Hampton Roads Planning District Commission meeting on November 12, 2003 (included representatives from Counties of Gloucester, Isle of Wight, James City, Southhampton, Surry, and York and the cities of Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg), a Henrico County public forum hosted by Supervisor Patricia O'Bannon on November 19, 2003, and a Fairfax County Power Summit on February 17, 2004. In each of these meetings, the localities indicated that they need two things and that generally DVP failed to provide them in an adequate manner: locality specific information relative to the number of their citizens that are without power and restoration information relative to their critical infrastructure, such as pumping stations.

Prior to and during Hurricane Isabel, DVP's plan for communicating with the localities included: (i) a telecommunications hotline for local emergency managers to

notify the company of emergency situations at any time during the year; (ii) a second hotline into the Regional Operation Centers that was activated during major outage events; and (iii) a regional company representative who is responsible for communicating with multiple counties and cities throughout the year and during major outage events.

The localities stated that this plan was not sufficient during a major event such as Isabel. In short they could not get adequate information relative to the restoration of their critical facilities and worse they found it difficult at times to reach anyone within the company. The localities indicated that DVP's failure to provide timely information at times hindered the planning of emergency management storm response activities. Additionally, without adequate information they could not communicate as effectively as possible with their citizens.

Several localities recommended that DVP place a representative inside local emergency operation centers. DVP claims that it does not have sufficient resources to meet such a request without impacting the restoration effort. The Staff does not recommend this approach at this time as there needs to be an appropriate balance between exchanging information as effectively as possible and restoring service as efficiently as possible. However, the Staff does believe that DVP must improve its communications with local emergency management officials.

Communication between DVP and Electric Cooperatives

The cooperatives rely on DVP for the delivery of electricity at either the transmission or sub-transmission level to delivery points for the cooperatives' distribution circuits. As such a cooperative must rely on DVP to restore service to the delivery points before the cooperative can fully restore service to its customers. During and immediately

following Hurricane Isabel the Commission Staff received complaints from some of the electric cooperatives relative to the adequacy of information they received from DVP. In short the cooperatives argued that the lack of timely information hindered their ability to restore service as quickly as possible and furthermore impacted their ability to provide adequate information to their own customers.

In response to these concerns the Staff hosted a meeting on November 6, 2003, in which representatives from DVP and nine electric cooperatives met to discuss the concerns and begin to discuss potential remedies for those concerns. During the meeting several issues of contention were discussed. First, the initial conversation between DVP and the cooperatives relative to preparation for Hurricane Isabel was not held until the evening of September 17, the day before the storm hit. All parties agreed that conversations should have begun sooner and will happen sooner prior to future catastrophic storms.

Second, the cooperatives indicated that they had difficulty getting information from DVP during the restoration process. They claimed that the phone number DVP provided to them was the call center number. Whether this was the only point of contact with DVP early in the storm or not, clearly several of the cooperatives lacked a sufficient point of entry into DVP to get information. In general the participants indicated that due to employee turnover it was unclear who the cooperatives should be contacting to get vital restoration information. Responsibility for developing and maintaining communication protocols rests with both parties. Consensus was reached to establish a better method of communicating during a major outage event. It was agreed that such a method should include a phone number for the cooperatives to call directly into DVP's

storm center. Additionally, it was agreed that a mechanism for obtaining and maintaining contact information and communication protocols would be developed.

Third, several of the cooperatives expressed concern that the delivery points were not adequately prioritized by DVP. In short, the cooperatives are concerned that the delivery points, that serve hundreds of customers, were only considered by DVP to be one customer. DVP stated that this concern was unwarranted as they accounted for the number of customers and critical facilities located beyond the delivery points when prioritizing work orders. However, the company further stated that it relied upon the cooperatives to provide necessary information relative to each delivery point. DVP further stated that it did not know how many customers were served by some delivery points. As a result, it was agreed that the cooperatives would provide a list of the total number of customers and a list of critical customers served off each delivery point.

The Staff notes that it is frustrated that a meeting such as the one held on November 6 was necessary. Hurricane Isabel was not the first natural disaster to cause significant power outages and communication plans should have been developed and updated routinely through the years. Clearly, DVP and the electric cooperatives failed to maintain and update adequate communication protocols and contact lists. It is expected that DVP and the electric cooperatives will routinely update their communication plans so that during future catastrophic storms the exchange of valuable information will be seamless.

In conclusion, the importance of effective communication during the restoration of electric service following a major storm cannot be underestimated. The Commission Staff expects the utilities to continually review and improve upon their plans for

communicating with the public, emergency management coordinators, and restoration partners.

RECENT ENHANCEMENTS AND LESSONS LEARNED

The purpose of this section is twofold. First, it identifies recent improvements in restoration management that were a result of lessons learned from previous storms and that were implemented prior to Hurricane Isabel. Second, it summarizes the lessons learned from the restoration effort after Hurricane Isabel and lists the initiatives implemented or being evaluated to improve future performance. In the discussion that follows, each utility is considered separately.

Dominion Virginia Power

As a matter of company policy, DVP performs system storm critiques following each major storm. For example, critiques following several storms in the late 1990s, including the 1998 Christmas Eve Ice Storm and Hurricane Floyd in 1999, identified several opportunities for improvements. As a result of these critiques, DVP modified its storm management plan in an attempt to improve the effectiveness of restoration efforts. The modifications to the plan provided a structure for assigning employee duties during major storm restoration, as well as guidelines to improve the efficiency of field crews, but did not involve an increase in the number of linemen in the field. Included in the plan were staffing models for the local office level, the regional storm center, and the system storm center. Also included were guidelines for creating response teams to accompany line crews during major restoration efforts. These teams include support personnel such as a point person, team leaders, logistics coordinators, guides, patrollers, and mechanics. Employees are assigned specific storm duties based on the knowledge and skills gained

through their normal job duties. Employees from areas and business units not affected by the storm are used in an effort to maximize resources during the restoration effort.

Other improvements included the use of additional cell phones for faster communications between field crews and operating centers, information technology support personnel to ensure the proper functioning of all systems, and regular communications between the storm centers and the customer service centers to provide customers with the most up-to-date information. Computer system enhancements were made to improve estimated restoration times given to customers during major storm events; however, DVP suspended the communication of restoration estimates during the initial stages of the Hurricane Isabel restoration effort due to the extensive nature of the outages and difficulty assessing the damage to the company's infrastructure.

As a result of a system storm critique of the 2000 Super Bowl freezing rain storm, the company identified concerns with respect to a contractor fatality, customer communications, newspaper coverage, and tree trimming. As a result of the identification of these concerns, the company took actions designed to increase the safety focus on contractors during major storm restoration, improve the accuracy of customer outage information, and complete previously unscheduled tree removal work in storm ravaged areas.

Following Hurricane Isabel, DVP conducted a "system-level process critique" on October 17, 2003, and seven "area-level critiques" on October 22, 23, and 24, 2003. In these critiques, the company identified some issues and concerns where potential improvements should be evaluated in the areas of pre-planning, assessment, restoration

and post-restoration. The major concerns identified for improvement are listed as follows:

1. Predicting storm impacts.
2. Expanding and training the pool of employees available for storm roles.
3. Transferring damage assessments into the trouble reporting system.
4. Disseminating information to local emergency operations centers.
5. Communicating customer specific information (e.g., restoration times).
6. Handling priority and emergency calls in the customer service center.
7. Accelerating delivery of material.

Dominion Virginia Power also gained some insight from external participants. Upon their departure, the off-system contractors and mutual aid utility personnel were surveyed for feedback. The number of participants that responded varied from question to question but averaged approximately 750. The survey asked the participants to rate DVP in the areas of safety, communications, organization and coordination, and accommodations and meals. Approximately 80 percent of the respondents rated DVP “good,” “better than expected,” or “outstanding,” while approximately 15 percent of the respondents rated the company as “needs improvement.” Only about 5 percent rated the company’s performance as “poor” in each category.

The external participants were also given the opportunity to provide input by means of an on-line survey. A total of 175 respondents answered questions in five broad categories: assignment, effectiveness, communications, resources, and overall impression. The respondents were also asked to describe what went well and areas of

concern. Concerns were expressed relative to advanced planning and training, clarity of roles, utilization of personnel skills, time management, maps, and communications.

The Staff also surveyed the 21 mutual aid utilities that provided assistance to DVP by means of a letter dated January 21, 2004. The Staff extended an invitation to each utility to provide any information relative to the restoration effort following Hurricane Isabel, including comments regarding safety, communications, organization, work assignments, map directions, accommodations, meals, training, efficiency, resources, and attitudes. The Staff received a response from seven utilities: Allegheny Power in Pennsylvania, American Electric Power in Ohio, Georgia Power Company, Hydro-Quebec in Canada, OGE Energy Corporation in Oklahoma, Progress Energy in North Carolina, and SCE&G in South Carolina.

The responses from these seven mutual aid utilities regarding DVP's overall restoration effort and the condition of DVP's distribution infrastructure and rights-of-way were very positive, generally. None of the mutual aid utilities that responded to the Staff's inquiry identified any systemic problems with the restoration effort. The utilities also noted that in most cases where minor problems occurred, DVP reacted promptly to make corrections. In some cases, different crews from the same utility provided conflicting statements relative to a particular issue, reflecting either the subjective values of the individuals or the localized nature of the problem. A list of the concerns, most of which were identified as occurring early in the restoration process, is presented on the following page. As would be expected, many of the concerns reflect the same concerns identified by the mutual aid utilities in response to DVP's surveys. (The positive statements expressed were too numerous to list here.)

- insufficient grounding conductors for tree trimming crews
- insufficient 35kV materials supplies
- insufficient fuel for trucks
- insufficient ice and water supplies due to local boil advisories
- lack of diversity in the food supply
- insufficient laundry services
- existence of some old/brittle copper conductor on the system
- shortage of guides for mutual assistance crews
- lack of work for some crews
- shortage of maps and electrical network plans
- excessive safety meetings
- failure of trying to feed everyone at a central location
- remoteness of some staging areas
- shortage of restrooms and dumpsters at staging areas
- inefficiency in distribution of security badges

In July 2004, DVP reported to the Staff that it is continuing to explore options to resolve these matters as appropriate. Logistics are being reviewed and/or enhanced to both improve productivity and comfort of restoration personnel during catastrophic events.

Finally, DVP has taken considerable action since Hurricane Isabel to improve upon its ability to communicate with the public and emergency management personnel. With respect to communications with consumers, DVP reported that it began a process of segmenting its accounts into customer layers. These layers will be used to help with prioritizing restoration activities, but equally as important they will assist with communicating effectively with different types of consumers.

DVP informed the Staff that 4,000 accounts have been identified and placed in one of three categories: critical, high profile, and public interest. Within the critical accounts category there are approximately 700 accounts that represent customers such as major hospitals, critical pumping stations, military and Homeland Security installations, major telecommunication switching stations, and Emergency Operation Centers. These critical accounts will be given the highest priority during restoration of service. During a

major outage event DVP will now have the capability to query its outage management system to determine which critical facilities are without power and focus on those. In the past, DVP had such information within its system, but could not easily query its system.

Within the high profile accounts category are approximately 1,000 accounts that represent such customers as large government buildings, electric cooperative delivery points, and certain nursing homes. These customers likewise will be given heightened (although not the highest) priority during restoration activities. In addition DVP will develop a communication plan specific to these types of customers.

Last, within the public interest account category are approximately 2,300 accounts that represent such customers as most nursing homes and assisted living facilities, fire stations, and major traffic signals. These accounts will likely not be given heightened priority during restoration activities because of the operational impossibility of providing such priority to accounts that are spread throughout the system at varying locations along a circuit. However, DVP will develop a communications plan targeted to these customers that will provide more detailed information relative to restoration progress and estimated restoration times.

All customers within these three categories will have their accounts flagged within DVP's customer management system. Thus, if a customer calls into the call center, the representative that answers the phone will know that he is a segmented customer. In addition, DVP has trained 25 employees to make proactive calls during a major event to umbrella organizations, such as the Nursing Home Association. The purpose of these calls will be to provide information relative to the general restoration

effort and to the extent possible account specific information that the umbrella organization can in turn communicate to its members.

Additionally, since Hurricane Isabel, DVP has worked with localities in an attempt to develop a communications plan that accommodates the needs of the localities without interfering with the restoration of utility service. DVP will now provide all localities that are GIS capable access to a database that will provide locality specific outage density information. This information will also list the critical infrastructure within the locality that is without power and provide an estimated restoration time for that critical infrastructure. For those localities that are not GIS capable the company will provide the same information in a PDF file. This information will be updated twice daily during a major outage event.

With respect to the electric cooperatives, DVP indicated that it has taken steps to improve its protocols for communicating with the individual cooperatives during catastrophic outages. Specifically, DVP will: (i) contact each cooperative prior to a major storm to inform them of a conference call to discuss the impending threat; (ii) designate an employee to serve as the transmission contact who will coordinate all transmission related inquiries for wholesale customers including the electric cooperatives; (iii) provide an office for an ODEC representative near the company's Transmission Lines Center; (iv) provide the cooperatives access to the company's online electric transmission system map that provides continuous updates of transmission line outages and restorations; and (v) maintain a collaborative process with the cooperatives to update contacts and information exchange protocols.

Delmarva Power

Delmarva Power routinely performs system storm critiques after major storms in order to identify opportunities for improvement. In the wake of Hurricane Floyd in 1999, the company developed several improvements to its restoration plan. In 1999 the company began briefing mutual aid crews about the company's work practices and safety practices requirements. In 2000, the company and eight other utilities in Delaware, Maryland, New Jersey, New York, and Pennsylvania formed the Mid-Atlantic Mutual Assistance Group to exchange information and assist with the movement of mutual assistance crews between utilities. In 2001 the company contracted with Impact Weather to provide a weather forecasting and tracking service that focuses on hurricanes and tropical storms. The company implemented an outage management system in 2002 and added a staging area management plan to its restoration plan in 2003. In 2003 a media restoration plan was amended to include a major communications plan for customer outages of 100,000 or more. During Hurricane Isabel, this plan was used to prepare customers for the storm and assist in keeping customers informed throughout the storm and the restoration process.

Following Hurricane Isabel, the company initiated an internal review of the procedures and restoration results. In addition, the company hired James Lee Witt, former Director of the Federal Emergency Management Agency ("FEMA"), to conduct an independent assessment of the company's emergency preparedness for and response to Hurricane Isabel. The Witt assessment was issued January 13, 2004, and the company has initiated a plan to address the findings. Of the areas identified for improvement, the following six are viewed by the company as the highest priority:

1. Expand the capacity of the outage management system.
2. Improve the process for providing timely status and restoration estimates to customers.
3. Implement a comprehensive plan to train personnel for restoration responsibilities.
4. Revise the public and media communications process and content.
5. Revise the company power delivery corporate restoration plan.
6. Address the requirements of special needs customers.

APCo

APCo reported that it recently increased the use of Global Positioning System units and computer mapping to improve assessment and work management during service restoration efforts. This, coupled with implementation of an enhanced dispatching system, should provide additional information on outages to both storm management and field personnel. Additionally, engineering technicians have been trained to assist with minor service restoration switching, thus supplementing line personnel efforts.

APCo held debriefings and storm critiques in the weeks following the Isabel recovery effort. As a result, the company was able to report what went well and lessons learned that identified possible areas of improvement. In part, APCo reported that in the future it would provide a list of consistent office contact numbers to field personnel and ensure that all work packets provided to circuit coordinators are prioritized. The company indicated also that it was considering utilizing more meter readers and meter electricians as crew guides, and that it was focusing on improving the ability to respond to changes in storm path and speed.

On August 4, 2004, APCo provided an update with respect to (1) the use of meter readers and electricians as storm damage assessors and as crew guides and (2) its ability to respond to storm changes. The company reported that it has begun using meter readers and electricians on a regular basis to ride with assessors and then reassigning them as

crew guides as the restoration effort continues into the repair stage. In addition, APCo has begun using a weather forecast system called Energycast Alert that provides radar coverage for each service territory and provides a Power Disruption Index that forecasts weather related outages. With respect to APCo's ability to respond to changes in storms, the company is now staging assessment personnel just outside the projected damage areas and moving as appropriate. During Isabel, APCo put all assessors on standby but did not move them from their home areas until the storm passed thus creating a four to five hour delay in assessment. By that time, the restoration effort was underway and valuable assessment opportunities had been forgone.

Potomac Edison

Potomac Edison has recently implemented an incident management system and upgraded its outage management system. The company also noted the creation of the Mid-Atlantic Mutual Assistance Group. The company has begun using helicopters for distribution patrols and developed training for scouts and guides. In addition, Potomac Edison also states that it has improved its communications with regulatory agencies, local officials and county emergency management agencies, and is providing more consistent information to its customers and the media. During Hurricane Isabel the company implemented reporting of outages by county. Further development and improvement of Potomac Edison's incident management system is continuing.

Electric Cooperatives

All of the electric cooperatives that were affected by Hurricane Isabel conducted post storm critiques to evaluate new procedures that had been implemented prior to the hurricane and to discuss lessons learned as a result of the restoration effort. In most cases

no major policy or procedural changes were deemed necessary, while most suggestions for improvement involved minor details. Two common concerns reported by some of the cooperatives involved the need for reliable back-up communications and the need to educate the public on the safe use of electric generators.

Prince George Electric Cooperative (PGEC”) and Northern Neck Electric Cooperative (“NNEC”) implemented some new restoration management changes prior to the storm that reportedly worked well. PGEC ensured repair crews were available at all substations in the beginning of storm restorations and limited repair crews to 14 hours of shift work. NNEC assigned crews primarily to 16-hour shifts during daylight hours as opposed to dispatching crews 24-hours per day. NNEC believes more work is accomplished on the day shift and believes day shift work is less risky.

SPECIFIC QUESTIONS RAISED REGARDING THE RESTORATION

The purpose of this section is to respond to specific questions raised regarding the utilities’ preplanning and restoration policies and efforts relative to Hurricane Isabel. Although most of the following discussion reflects the numerous questions specifically raised relative to DVP’s policies and performance, some of the discussion is relevant to all of Virginia’s electric utilities.

1. Adequacy of preplanning by DVP.

Dominion Virginia Power began making internal preparations, contacts with material suppliers, and contacts with off-system line and tree contractors during the week prior to landfall. On Monday, September 15, 2003, the company opened its System Storm Center and began activating its off-system line and tree contractor resources. The company also initiated the Southeastern Electric

Exchange (“SEE”) Mutual Assistance Joint Mobilization process²⁴ on the 15th, and over 7,000 mutual aid personnel and contractors were ready to begin work by the 17th. In order to prepare the public for potential damage and extended outages, press releases and radio ads also began on September 15th. In addition a conference call was held with electric cooperatives and briefings were held with state government and the local EOCs.²⁵ On September 16th, DVP for the first time used its voice response system to make ten thousand calls to customers, whose accounts indicated special needs, reminding them of the need to make arrangements in advance for shelter in a location other than their homes should power outages result from the storm.

The frame of reference for hurricane planning in DVP’s electric service territory was established by the conditions experienced as a result of Hurricanes Fran and Floyd. However, DVP reported that it recognized very early that Isabel had the potential to inflict significantly more damage to North Carolina and Virginia than either Fran or Floyd. Pre-storm estimates of customer outages ranged from 800,000 to 1,000,000 based on early predictions for the projected path of the storm across eastern Virginia. The company confirmed that there was a clear understanding, as later forecasts were revised, that Isabel had potential to create even more damage than initially anticipated, but additional predictions were not made as to the number of customer outages or outage length.

Dominion Virginia Power also reported that the initial wave of off-system resources – mutual aid and contractors – was the largest pre-deployment of

²⁴ As members of the SEE, utilities participate in a mutual aid agreement to assist other members with service restoration when there is severe system damage due to adverse weather or other natural disasters.

resources ever assembled by the company. According to the company, the logistics of lodging, feeding, and providing an effective work plan for an influx of outside workers of this magnitude created challenges never before experienced. While preplanning for this influx of resources was not perfect, mutual aid and contract personnel that participated in post-storm critiques indicated that accommodations were for the most part satisfactory, and the Staff is confident that the lessons learned from the experience should enhance the company's ability to plan for future events.

As damage assessments were completed, DVP realized that subsequent additions to the workforce would be needed. However, DVP has expressed to the Staff that it would not have been prudent to pre-stage additional mutual aid or contractor resources, even in hindsight. In fact, because of the unpredictability of the storm path, and based on feedback from mutual aid utilities that were pre-deployed, DVP now believes that placing fewer resources close to the predicted storm path might be more sensible for future events. The company believes that placing large volumes of outside resources in the potential path of a hurricane introduces hardships and risks while providing only slight gains in restoration time, and the Staff believes that logic is reasonable.

The Staff believes the company's preplanning was acceptable but that improvements can be implemented as a result of lessons learned from its experience with the Hurricane Isabel restoration. DVP has reported that predicting storm impacts and expanding the pool of employees available for storm roles are among the major concerns identified for improvement. Dominion

²⁵See *Communications* section of the report for details.

started a project in May 2003 to develop the first iteration of a tool to predict storm damage impacts. The development of a prototype tool was in its final stages and DVP planned to implement it for storm damage assessments in urban areas starting in August 2004. In addition, DVP is participating in a study with Cornell University to develop a storm damage prediction tool, initially focused on hurricanes and ice storms, which is projected to be complete in two to three years.

2. Adequacy of the mutual assistance workforce requested by DVP.

DVP has reported that in preparation for major storms the company makes rough estimates of the expected level of infrastructure damage and time to repair the damage and then combines field experience with actual results from previous storms to determine a reasonable baseline of support to request from mutual assistance utilities.²⁶ The process of obtaining the needed mutual assistance begins with the initiation of the Southeastern Electric Exchange Joint Mobilization process, which involves conference calls among SEE utilities. Assessments, needs and available resources are discussed and commitments are made during these conference calls. Resources beyond what SEE utilities can provide are typically sought through direct contact with non-SEE utilities that subscribe to the Edison Electric Institute Mutual Assistance Agreement. According to DVP, assistance from SEE and EEI utilities is provided on a “make-whole” as opposed to a “for profit” basis.

According to DVP, the company sought firm resource commitments in preparation for Hurricane Isabel; however, those utilities closest to DVP, and

²⁶ In addition to mutual aid from other utilities, the restoration effort also requires tree contractors, line contractors, and DVP support and field employees; however, the subject of this section is mutual aid.

therefore closest to potential storm damage, were reluctant to commit resources prior to landfall and impact assessment. Consequently, the company initially received commitments from mutual aid resources that were further away than the adjacent utilities. As damage assessments and restoration activities allowed, contractors and crews from the adjacent utilities also were released to assist DVP. According to DVP, all of its requested resource needs were met.

DVP also maintains, and the Staff agrees, that there is a practical limit to pre-deployment of workers and materials and that placing them in the path of a hurricane creates great risk for little gain in restoration time. In addition, the closest mutual aid utilities are not willing to commit to a pre-deployment given the threat of storm damage to their own systems. To the extent possible, mutual aid crews were pre-deployed along the Interstate 85, Interstate 95 and Interstate 81 corridors. They were then re-deployed to areas of highest damage as the event passed. DVP has concluded that pre-deployment of fewer resources might be more prudent in the future.

DVP reported a mutual aid work force of 900 personnel on the day of the storm and the first two full days of the restoration effort. By the third day of the restoration effort the mutual aid work force had swelled to over 2,000 personnel, and by the fifth day of the restoration the number of mutual aid personnel was over 2,500. For days six through twelve of the restoration effort, the number of mutual aid personnel fluctuated between 2,500 and 3,400 before declining during the final three days. Although the maximum workforce occurred on day ten of the restoration effort, DVP insists that the deployment should not be characterized

as a 10-day ramp up. According to DVP, off-system responders arriving during the five- to ten-day work period were primarily replacements for departing crews, not additional workers.

As mentioned elsewhere in this report, DVP managed the largest restoration workforce in the company's history in response to Hurricane Isabel. According to DVP, the company now has the ability to manage more resources with the same level of DVP management. The reason is that mutual assistance deployment is evolving from command and control of every single crew to the assignment of very nearly self-sufficient, autonomous workforces. The company has suggested, given unlimited resources and self-sufficient, autonomous mutual assistance teams, that a practical upper limit to the number of field crews might be determined by the number of circuits on the system.

There can be no question that DVP has improved its capacity in recent years to manage a larger workforce in response to a catastrophic storm. After the Christmas Eve Ice Storm of 1998, DVP mobilized a workforce of nearly 2,200 to replace 815 poles and restore service to 401,000 customers in 10 days for an average of 40,100 customers restored per day. After Hurricane Isabel, DVP mobilized a workforce of nearly 12,000 to replace 8,000 poles and restore service to 1.7 million customers in 15 days for an average of almost 114,000 customers per day. However, storm restoration is an evolving process and the company and the Staff believe that improvements can be achieved in the future.

Although the Staff does not expect DVP to meet a standard of perfection in its restoration efforts, in hindsight the Staff believes that DVP probably

underestimated the anticipated number of outaged customers and extent of damage to the infrastructure from uprooted trees. As a result, the company initially might have underestimated the workforce necessary to saturate the restoration effort. However, the Staff cannot find fault with the company's reliance on its experience with hurricanes over the past 10 years to extrapolate the potential impact from Hurricane Isabel. In addition, the Staff acknowledges DVP's success at managing the largest restoration effort in its history while implementing a heretofore largely untested policy of increased reliance on autonomous mutual aid crews to self-manage an enormous restoration effort. In the future if nothing is done by private citizens and localities to mitigate the risks from an ever aging urban forest that exists outside of the utilities' rights-of-way, the Staff agrees that a larger, more powerful hurricane arriving under similar conditions²⁷ could produce even greater damage to the utilities' infrastructure, potentially resulting in a longer outage.

Staff recommends that DVP use the experience gained in Hurricane Isabel to improve its predictive capabilities and take the necessary steps to prepare for the arrival of a similar or larger hurricane. The company should continue to support the evolving process leading to a responsible and increasing reliance on self-sufficient mutual assistance crews, with an expectation of mobilizing a larger workforce in the event of a similar catastrophe. The company also should continue to evaluate past performances and foster the relationships needed to acquire a highly capable mutual assistance workforce.

²⁷ "Similar conditions" refers to the presence of weakened trees in saturated soil as a result of three years of drought followed by a year of record rainfall.

3. Susceptibility of DVP's infrastructure to tree-related damage due to insufficient tree trimming.

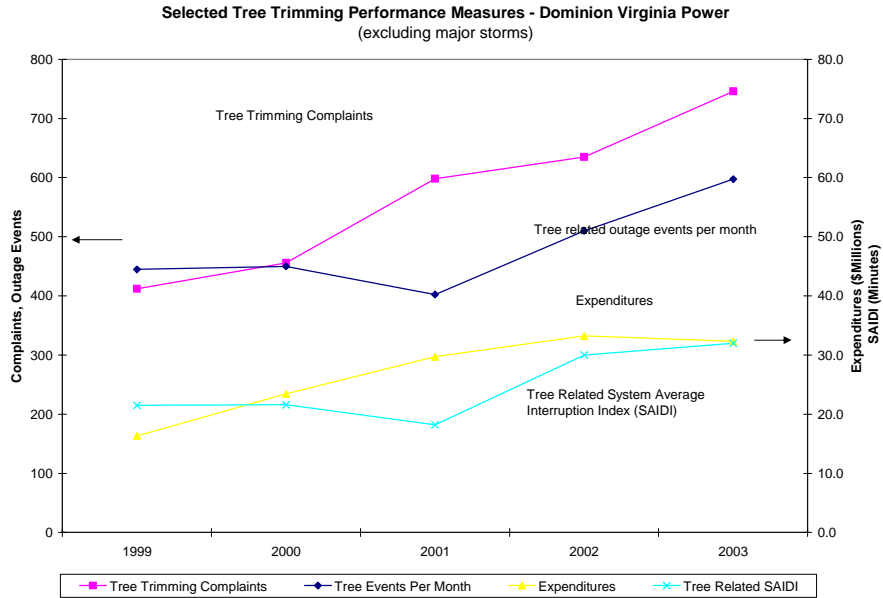
DVP routinely trims trees along the right-of-way corridors that carry a system-wide network of nearly 36,000 miles of overhead lines to its customers. Employing a three-year trimming cycle, the company attempts to trim annually one-third, or approximately 12,000 miles, of the 36,000 miles with a contracted workforce of approximately 600 tree trimmers. In addition to routine tree trimming, DVP also conducts hot spot trimming and administers a tree removal program.

In a December 2000 report to the Commission, the Staff concluded that DVP's tree-trimming programs had failed to keep pace with tree growth into distribution rights-of-way. The Staff was concerned that a disproportionate emphasis may have been afforded aesthetics and concerns of property owners to the detriment of reliability. As a result, the Staff recommended that DVP intensify its tree trimming operations in order to meet its requirement to provide reliable service to all customers.

As a result of the Staff's recommendation in 2000 for DVP to intensify its tree-trimming operations, the company expanded its tree removal program. This program historically had focused on dead tree and live danger tree removal, as well as the removal of large overhangs on circuits or segments of circuits showing poor reliability. From the 3rd quarter 2000 through the 2nd quarter 2003, the tree removal program was enhanced to incorporate a company-initiated, right-of-way clearance expansion plan. The purpose of the right-of-way clearance expansion

plan was to clear the rights-of-way for approximately 1000 miles of primary voltage distribution lines to their full width of 30 feet because of operating and reliability concerns. The company's prior practice had been to clear only a 20-foot path in order to accommodate customer preferences. The company now clears new rights-of-way to the full extent permitted by the easement agreements and will continue to use contractors to trim trees and remove brush to the full width.

DVP also reported significant increases in spending on its tree trimming programs from 1999 to 2002. As the following graph indicates, total spending on tree trimming programs reportedly increased from \$16.3 million in 1999 to \$33.2 million in 2002, representing an annual average compound growth rate of approximately 27 percent. Part of the increase was attributed to routine tree trimming which increased from \$13.5 million in 1999 to \$18.3 million in 2002. In addition, the combined expenditures of the tree removal and hot spot trimming programs increased from \$2.9 million in 1999 to \$14.9 million in 2002. Total spending continued at a similar level in 2003; however, on a specific program basis, spending on routine and hot spot trimming increased, while spending on tree removal decreased (as a result of the completion of the right-of-way expansion program and a return to the pre-2000 tree removal program). The current funding plan for 2004 is \$25 million total for tree trimming and tree removal.



In spite of DVP’s reported implementation of the Staff’s recommendations by means of the aforementioned increases in tree trimming expenditures and expansion of the tree removal program, it is clear from the previous graph that the number of tree-related outage events increased in 2002 and 2003 after a significant decrease in 2001. The company attributed the increase in tree-related outage events in 2002 and 2003 to drought stress that accumulated during the most recent extended drought that began in 2000. The increase in weakened and dead trees resulted in an increase in limbs and trees falling into the rights-of-way, damaging the company’s distribution infrastructure. The Staff believes the explanation to be reasonable. (The company reported that tree failures were significantly lower in January and February 2004 when compared to the same time during 2002 and 2003. As of May 2004, tree related outages were about 4.6% ahead of 2003 May YTD tree related outages, but about 12.3% less than 2002 May YTD tree related outages.)

Experts generally agree that drought causes primary and secondary physical damage in trees, including root damage and root death, branch dieback, and in extreme cases tree death. Furthermore, with respect to the apparent anomalous decrease in tree-related outage events in 2001 during the midst of the drought, it is generally agreed that symptoms might not be evident until sometime after drought conditions have been encountered. For example, branch dieback and tree death could lag drought conditions by as much as two years.²⁸ The Staff also notes that 2001 was an extremely mild weather year with respect to the type of storms that typically cause power outages.

The Staff believes DVP made good faith efforts to increase annual spending on tree trimming and to employ more aggressive trimming in response to the Staff's recommendations following its earlier investigation of DVP's performance relative to the January 30, 2000, Super Bowl freezing rain storm. Unfortunately, the Staff acknowledges that the increased emphasis on tree trimming prevented neither the extensive destruction to DVP's system from Isabel nor the annual increase in tree-related outage events during 2002 and 2003. However, the Staff believes that the Isabel event was of limited value for assessing the effectiveness of the company's tree trimming program because much of the damage to the company's infrastructure was due to whole trees being uprooted. In addition, the Staff believes that the general increase in tree-related outage events in 2002 and 2003 was due, in part, to the most recent extended drought that began in 2000.

²⁸ Sharon M. Douglas, *Drought Stress, Tree Health, and Management Strategies*, Department of Plant Pathology and Ecology, The Connecticut Agricultural Experiment Station.

The Staff recommends that DVP continue to aggressively maintain 30-foot rights-of-way and increase expenditures for tree trimming as necessary to reduce and stabilize tree-related outages. The Staff also recommends that DVP attempt to educate municipalities and homeowners of the potential long-term benefits of removing aging, overgrown trees that exist outside of the utilities' rights-of-way but nevertheless present a growing danger to the company's distribution infrastructure.

4. Efficiency of utilities' work scheduling policies.

The utilities reported that the restoration process was a 24-hour-a-day effort; however, they typically scheduled a large majority of their personnel to perform work during the daylight hours. The utilities explained that day shift work poses fewer risks, that day shift workers are more productive, and that the nature of restoration activities such as tree removal is disruptive to customers at night. The Staff agrees with these assessments.

Night shift work typically consisted of a much smaller work force used primarily to conduct planning and emergency operations. For example, Dominion Virginia Power utilized night shift teams to assemble work packages for day shift crews and provide updated information to customers, as well as manage the continuing restoration effort in the field. The continuing night shift restoration efforts in the field included material delivery, vehicle refueling, and prioritizing and dispatching emergency and restoration work to night shift field crews. Night shift field crews were used to continue critical work left from the daytime effort and to establish safe conditions for returning day shift crews.

The utilities also reported that it is common industry practice to limit shift work during an extended restoration event to 16 hours on shift followed by 8 hours off, which allows employees a reasonable rest period and reduces the safety risk to employees. APCo, Delmarva Power, Potomac Edison, and all but two of the electric cooperatives scheduled 16-hour shifts. Northern Virginia Electric Cooperative and Prince George Electric Cooperative scheduled 14-hour shifts.

Critics questioned Dominion Virginia Power's judgment for scheduling shifts of less than 16-hours. Dominion Virginia Power reported that in most cases, 14-15 hour work shifts were the norm, although in some instances crews may have worked longer than 16 hours to complete a particular job. According to the company, post-event critiques indicated that the average work shift was on the order of 14 hours. Dominion Virginia Power explained that its "hours-of-work" policy is geared toward providing adequate rest for the engaged workforce, and work days are scheduled with the intent of providing workers 8-8.5 hours of rest prior to returning for another shift.

Theoretically, a one-hour extension of the work shift could reduce a 15-day outage to a 14-day outage, assuming a one-to-one correlation between shift length and duration of the restoration effort, and assuming no loss of efficiency in work performed at the end of a shift in the dark. However, working the maximum allowed shifts day-in and day-out over a two-week period under stressful conditions could conceivably decrease efficiency and increase the risk of injury. It is difficult to argue with Dominion Virginia Power's success in managing its largest restoration effort in history without a major injury. The Staff believes that

Dominion Virginia Power's hours-of-work policy is not unreasonable; however, the Staff recommends that all of the state's electric utilities revisit their hours-of-work policies to determine the optimal shift length when conducting a lengthy restoration effort under stressful conditions.

5. Adequacy of utilities' wood pole inspection programs and condition of DVP's wood utility poles.

All wood poles purchased by electric utilities meet National Electric Safety Code ("NESC") standards and conform to the requirements of the *American National Standard Specifications and Dimensions for Wood Poles*, ANSI 05.1. Thereafter utilities employ various inspection and replacement programs in an attempt to ensure the integrity of the wood poles on their systems. As a result of the high number of wood pole failures sustained by some utilities during Hurricane Isabel, questions were raised regarding the adequacy of these inspection programs and the integrity of the utilities' infrastructure. Discussions relative to the utilities' inspection programs and the wood pole failure mechanisms during Hurricane Isabel are provided in the following paragraphs.

According to Osmose Utilities Services, Inc. ("Osmose"),²⁹ the typical electric utility system has an average pole age of about 32 years. Osmose maintains that without a comprehensive inspection and remedial treatment program, about eight percent of poles do not meet the NESC strength requirements, and an additional 25 percent or more are decaying and weakened.³⁰

Such inspection programs typically include visual inspections, sounding and

²⁹ Osmose provides services and products designed to extend the useful life of critical utility infrastructure.

³⁰ Osmose, "Overview: Asset Management and Pole Maintenance," www.osmose.com, January 22, 2004.

boring tests, and ground-line treatments with insecticide/fungicide. With the exception of DVP, investor-owned electric utilities in Virginia contract with Osmose or Utility Pole Technologies (“UPT”) Inc., a division of Asplundh, to conduct a comprehensive inspection and remedial treatment program for their wood poles.

DVP determines when poles need to be replaced through visual inspections that are conducted on three-year intervals as part of its main feeder and tap line patrols. DVP discontinued the contractor ground-line inspection program in 1990 because the company believed it produced minimal results. The company keeps no records of the age or conditions of its utility poles.

By comparison, APCo inspects and maintains poles on a ten-year cycle for poles in service 16 years or longer, and reinforces or removes weak poles as necessary. Potomac Edison inspects and maintains poles on a 12-year cycle for poles in service over 15 years. Delmarva Power inspects and treats wood distribution poles on an 8-12 year cycle. The electric cooperatives typically employ Osmose, Southside Utility Maintenance, Inc., or other contractors to perform visual, sounding and ground-line inspections on a 7-10 year cycle; however, Powell Valley Electric Cooperative in the mid-1990s reverted to random inspections of its wood poles by field linemen and engineers.

The utilities generally attributed wood pole failures during Hurricane Isabel directly or indirectly to tree contact; however, only A&N Electric Cooperative and Delmarva Power³¹ investigated the age and condition of the

³¹ According to Delmarva, the 4 replaced poles consisted of one in deteriorated condition which had been set in 1958, and three poles in good condition which had been set in 1972, 1985, and 1994, respectively.

poles damaged during the storm. DVP reportedly experienced failures in less than two percent of its poles during Hurricane Isabel, although the absolute number of poles that failed was much higher than in any previous storm. According to the company, field observations confirmed that the majority of these failures were the direct result of trees making contact with the poles or the indirect result of trees pulling on overhead conductors. The Staff found no evidence that poles broke primarily at the ground line and therefore cannot conclude that a ground-line inspection program would have had any impact on the integrity of DVP's infrastructure. Two photographs of broken DVP utility poles taken by the Staff during a field inspection after Hurricane Isabel are displayed below.



On October 21st the Staff visited DVP's Petersburg office to inspect the inventory of damaged poles. The broken poles consisted of what appeared to be both "newer" and "older" poles. While the poles appeared to exhibit various levels of hardness, dryness and weathering, the Staff found no evidence of rotten wood in any of the poles observed. Not unexpectedly, the Staff observed that many of the poles had broken at weak points such as where bolt holes had been drilled through the pole to attach hardware. Photographs of some of the broken poles are displayed below.



The Staff is aware that some concerns have been expressed relative to the possibility that DVP’s infrastructure might be old and, therefore, in poor condition. However, according to Daniel O’Neill, Director of Navigant Consulting,³² age alone is not always a determinant of equipment condition. In fact, O’Neill states that replacing infrastructure components based on age is one of the least cost-effective ways of improving service. With respect to wood poles, specifically, O’Neill notes that native pole species dating to the 1950s or earlier can have less decay than poles recently purchased from tree plantations.

In order to better understand the efficacy of classic methods for evaluating wood pole strength, the Staff contacted the National Electric Energy Testing

³² “Reliability Tradeoffs,” *Electric Perspectives*, January/February 2004.

Research and Applications Center (“NEETRAC”)³³. According to the NEETRAC’s program manager for mechanical systems,³⁴ lab tests have demonstrated that the age of a pole, the visual condition of a pole, and classic sounding tests are not reliable indicators of pole strength. Furthermore, ground-line inspections and boring procedures test for wood rot at the ground line, but do not focus on defects elsewhere on a pole or on the overall weakness of a pole.

DVP reports that it has been participating in a NEETRAC study to identify improved methods of evaluating wood pole integrity. The study is expected to be completed by the end of 2004. The Staff hopes that DVP, as well as other utilities, might be able to enhance the integrity of their infrastructure through future improvements in pole inspection and replacement programs.

6. Soundness of DVP’s policy regarding restoration priorities.

Dominion Virginia Power’s philosophy regarding priority of restoration, which the Staff finds reasonable, has not changed since the Staff completed its investigation of the 2000 Super Bowl freezing rain storm. Dominion Virginia Power still seeks to first respond to life-threatening situations, emergency facilities, and critical infrastructure. For example, the company assigns high priority in restoring service to 911 emergency call centers, Homeland Security and military installations, major hospitals, and critical water pumping stations.

After responding to high priority accounts, the company employs a “most-customers-first” strategy which ensures that circuits impacting large groups of

³³ The National Electric Energy Testing, Research and Applications Center (NEETRAC) is a nonprofit, member-supported electric energy research, development and testing center, housed in the Georgia Institute of Technology’s School of Electrical and Computer Engineering.

³⁴ Paul L. Springer III, PE, landline communication, January 21, 2004.

customers are restored. As the effort moves beyond main circuits and into neighborhoods, a geographic restoration becomes more efficient and crews are instructed to stay in a given area until restoration is complete.

Indicative metrics used by the Staff to measure whether a utility is generally consistent with the most-customers-first policy are the “number of work orders completed per day” and the “average number of customers restored per work order completed.” The statistics provided by DVP relative to the Hurricane Isabel restoration effort indicate that the company was successful in the implementation of its stated policy. During the first, second, and third full days of the restoration, each work order completed resulted on average in the restoration of 99 customers, 231 customers, and 100 customers, respectively. During the fourth full day of the restoration effort, each work order completed resulted in the restoration of only 41 customers on average. Thereafter, the average number of customers restored per work order completed dropped fairly gradually during the remainder of the restoration effort. On the final day of the restoration, an average of less than three customers was restored for each work order completed.

Dominion Virginia Power did give some special consideration prior to the storm to individual customers with special needs through the use of the company’s voice response units. As mentioned previously, DVP reported that approximately ten thousand special needs customers were notified of the possibility of lengthy outages and the need to obtain alternative accommodations. However, because individual special needs customers likely exist at varying locations along all of the company’s circuits, the Staff believes it is not feasible to

place the restoration of special needs customers above that of customers in general.

DVP has reported to the Staff that transferring damage assessments into the trouble reporting system and handling priority and emergency calls in the customer service center are major concerns identified for improvement. As a result according to DVP, several new enhancements were developed and implemented on October 28, 2003. According to the company, these new enhancements involve new capability of systematically tracking the different types of damage associated with each work request. In addition, this information now rolls up into active summary screens where the amount of damage currently existing can be tracked by local office, region, and system levels.

7. Adequacy of DVP's customer-specific restoration estimates.

As mentioned earlier in this report, DVP suspended the communication of restoration estimates during the initial stages of the Hurricane Isabel restoration effort due to the extensive nature of the outages and difficulty assessing the damage to the company's infrastructure. When the company once again on September 27th began to provide such estimates, critics charged that most customers were not assigned a restoration date, and those that were assigned a restoration date were simply assigned an estimated restoration date that matched the projected final day of the outage (October 3, 2004).

In response to a data request, DVP reported that it had assigned repair time estimates to approximately 93 percent of the customers that remained without power as of September 27th, and approximately half of those were assigned a

restoration date of October 3rd. Of the customers that were assigned a restoration date, 72 percent had service restored earlier than 24 hours prior to the estimated repair time, 23 percent had service restored within 24 hours of the estimated repair time, and 5 percent had service restored later than 24 hours after the estimated repair time. DVP has reported to the Staff that communicating customer specific information such as restoration times is a major concern identified for improvement.

Dominion Virginia Power indicated that improving the efficiency and effectiveness of its damage assessments should allow it to provide customer specific estimated restoration times sooner in an event. As such the company stated that it will train approximately 150 natural gas employees from within Dominion Resources to perform damage assessments following catastrophic storms. In addition, the company indicated that during future restoration efforts mutual aid crews will provide more assistance with damage assessment.

8. Soundness of DVP's restoration process.

As mentioned previously in this report, Dominion Virginia Power's philosophy regarding the restoration process is to first respond to life-threatening situations, emergency facilities, and critical infrastructure. Thereafter the company employs a "most-customers-first" strategy which ensures that circuits impacting large groups of customers are restored. As the effort moves beyond main circuits and into neighborhoods, a geographic restoration becomes more efficient and crews are instructed to stay in a given area until restoration is complete. Since the Christmas Eve Ice Storm of 1998, DVP has collaborated

with other utilities with respect to identifying and implementing successful practices and lessons learned.

Dominion Virginia Power reported that the utilization of mutual aid crews in a typical restoration process is a major area where practices have begun to evolve. According to DVP, most utilities have migrated away from full command and control of every single crew on their systems. Instead, mutual assistance deployment has evolved into mobilizing very nearly self-sufficient, autonomous workforces. DVP notes that the benefit of this steadily evolving approach is the ability to manage more resources with the same level of company management. The potential downsides of the new approach include diminished knowledge of day-to-day/job-by-job work progress on the circuits/substations assigned to a particular off-system group (and consequently a diminished capability to provide customer feedback), as well as less control to effect a most-customers-first-oriented restoration except at the macro (circuit/substation) level.

Another significant change in DVP's restoration process since the Christmas Eve Ice Storm was the deployment of DVP linemen and other field personnel in leadership roles for off-system teams. These "field generals," as DVP describes them, are responsible for leading whole teams rather than simply completing the work of a single person in their normal duties. This practice has the effect of enlarging DVP's management capabilities.

Dominion Virginia Power's restoration management process has undergone some changes since the 2000 Super Bowl freezing rain storm, after which the Staff conducted an analysis and determined the company's restoration

management process to be reasonable. The changes included the creation of two new storm job classifications – the Patrol Manager³⁵ and the Night Packaging Manager³⁶ – and further defined the role of the existing Restoration Manager job classification. Technological advancements included implementation of a system-wide facilities mapping program and programming changes to improve the efficiency of the company’s trouble reporting system.

The Staff believes that DVP’s basic storm restoration process, in general, is sound and that the management of the Hurricane Isabel restoration effort, in particular, though not perfect, was satisfactory. The Staff agrees that the restoration process should be viewed as dynamic and will evolve as experience is gained and lessons are learned. The Staff believes that past changes made by DVP benefited the restoration process after Hurricane Isabel and that lessons learned from Isabel should result in improved performance in subsequent storms. DVP has reported to the Staff that expanding and training the pool of employees available for storm roles is a major concern identified for improvement.

9. Sufficiency of DVP’s personnel resources for day-to-day operations and restoration following catastrophic storms.

As a result of the lengthy restoration effort following Hurricane Isabel, two related questions were raised regarding the total number of linemen employed by DVP: (1) whether the total number of DVP-employed linemen is sufficient to

³⁵ The Patrol Manager position was created to improve initial damage assessments and facilitate a more comprehensive damage patrol effort.

³⁶ The Night Packaging Manager position was created to prioritize outstanding work each night, to create efficient job packages for bulk assignment to day shift field forces, and to update customer information and estimated restoration times for the work packages assigned. The Night Packaging Manager also provides oversight for night shift crews and works with Regional Storm Center management in assessing and prioritizing their assignments.

ensure adequate service on a day-to-day basis and (2) whether a lack of company employed linemen requires DVP to rely too heavily on contractor and mutual aid linemen for restoration following major storms. In order to answer these questions, the Staff attempted to analyze annual trends in data for the following criteria:

- number of linemen
- number of customers
- miles of overhead distribution lines
- overtime worked per lineman
- number of new service connections completed
- average length of time to complete a new service connection
- average time to restore service following an outage (excluding major storms)

The Staff also looked at the annual cost to employ linemen on a full time basis and the cost of mutual aid mobilized for the Isabel restoration effort.

As a result of its initial evaluation, the Staff has not been able to detect deterioration in day-to-day service, but the Staff did observe some unanticipated short-term trends in reliability and noted some apparent inconsistencies in data submitted by the company in response to previous data requests. However, as a result of anecdotal feedback from customers and employees regarding a decline in resources and because operating in a rate-cap environment provides a natural incentive to reduce costs, the Staff has determined there is a need to obtain more detailed data regarding the sufficiency of the company's workforce, including overhead linemen, for day-to-day operations. The Division of Accounting will be conducting an audit during the fourth quarter of 2004 in an attempt to resolve these issues.

Ostensibly, one might anticipate that the company would have hired more linemen to accommodate annual increases in the number of customers and miles of overhead distribution lines. However, it appears that the number of linemen has been decreasing since 1998, and from 2001 to 2003 the number of company linemen decreased by approximately 10 percent, by one accounting. Such a decrease might be justified given that the annual number of new service connects decreased by approximately eight percent during that same time period, and the annual average amount of overtime logged per lineman has increased.³⁷ Furthermore, the reported decrease in the number of employed linemen apparently did not adversely affect the length of time to complete new service connects. On the contrary in fact, DVP reported that the average length of time to complete a new service connect in 2002 (11 days) and 2003 (14 days) improved significantly compared to the time to complete a new service connect in 2001 (24 days).

However, since 2001 the Staff has observed an increase in the average length of time required to restore service following outages not related to major storms, which could be related to a decrease in the number of linemen employed by the company. In addition, the Staff has been apprised of employee concerns regarding the size of the workforce and the amount of overtime being logged. As a result of these findings, the Staff will audit additional data regarding the sufficiency of the workforce for day-to-day operations.

³⁷ Overtime work by linemen decreased in 2000 and 2001, but was at a three-year high as of September 2003 after increasing steadily since 2001.

On the other hand, the Staff found no evidence that the current level of linemen had a significant negative impact on the restoration effort following Hurricane Isabel. It appears that the company's heavy reliance on contract and mutual aid personnel for catastrophic storm restoration is appropriate. The reliance on mutual aid during a major restoration effort eliminates the inefficient practice of hiring a workforce of linemen that would be idle during day-to-day operations but available "on-the-shelf" in the event of a catastrophic storm. During the restoration effort following Hurricane Isabel, the mutual aid workforce averaged approximately 2,000 persons per day and cost DVP a total of nearly \$40 million. A workforce that large would cost DVP nearly \$200 million on an annual basis, including overhead expenses and the additional vehicles necessary to support such a workforce. The Staff believes that the optimal level of DVP's workforce should be determined not by whether additional company employed linemen could displace mutual aid linemen during a major storm, but by whether the workforce is sufficient to provide adequate service on a day-to-day basis.

The Staff agrees with DVP's policy of relying primarily on mutual aid for restoration activities following catastrophic storms, which are unlikely to occur on a regular and consistent basis. The company's baseline workforce should be maintained at the level necessary to preclude excessive overtime work, deterioration in new service connection completion times, and erosion of restoration times following day-to-day non-storm related outages. Again, the Staff will audit additional data relative to whether the current level of linemen (and other distribution personnel) is sufficient for day-to-day operations.

10. Availability and sufficiency of materials and equipment for DVP's restoration effort.

In preparation for Hurricane Isabel, DVP notified equipment suppliers on September 15, 2003, to build up their inventory for poles, crossarms, insulators, fuses, and pole hardware. Suppliers were also instructed to begin shipping the equipment immediately after the storm had passed. Dominion Virginia Power also reported that 24-hour production shifts were established in production plants that produce transformers and cable. In addition, DVP's alliance partners were notified on September 17th to be prepared to share materials. Mutual aid companies were notified to bring materials with them.

Dominion Virginia Power reported the following quantities of equipment in stock prior to the arrival of Hurricane Isabel:

- Poles – 2,524
- Transformers – 2,395
- Cable – 693,731 feet
- Crossarms – 3,529
- Insulators – 7,926
- Fuses – 7,859
- Pole Hardware – 19,953 pins, bolts, connectors, and splices

Although the quantities of equipment necessary for the restoration effort exceeded the above listed stockpile, DVP noted that it had sufficient material inventory to respond and remain productive until the first shipments of material from the vendors started to arrive. According to DVP, material availability had no significant impact on the speed and efficiency of restoration. The following quantities of equipment (with costs in parentheses) were ordered to replenish supplies and support the restoration effort following the Hurricane:

Poles – 8,275 (\$1, 612,581)
Transformers – 7,153 (\$4,520,351)
Cable – 1,335,475 feet (\$763,552)
Crossarms – 17,755 (\$384,152)
Insulators – 38,644 (\$470,206)
Fuses – 26,612 (\$272,998)
Pole Hardware – 137,711 pieces (\$343,889)

Although the availability of material was not a major issue in the overall restoration effort, some mutual aid personnel expressed concerns relative to material shortages in some instances. DVP reported that the following corrective actions have been implemented to accelerate material delivery after major storms:

- (a) Refined and improved process flows for each step of material sourcing and delivery during a storm.
- (b) Developed a model that supports prediction of material needs based on a damage assessment of broken poles, broken crossarms, and damaged spans of wire.
- (c) Designed a process to stage materials at a central site for major storms. The company believes that housing emergency materials at a central site might improve its capability to distribute such materials to impacted areas, as opposed to moving materials from multiple locations across the system.
- (d) Developed an expanded contact listing for utilities that utilize 34.5 kV systems in order to facilitate the acquisition of additional materials during major storms.

DVP also worked with suppliers and vendors to have them create, by September 2004, a storm plan that recognizes and complements the utility's refined and improved process flows referred to in item (a) above.

11. Equity in pre-positioning and deployment of linemen in DVP's territory.

Because Hurricane Isabel threatened every local office in DVP's service territory, DVP's crews initially reported to their home locations. According to DVP, mutual aid crews were pre-deployed along the I-85, I-95 and I-81 corridors, and then re-deployed to areas of highest damage as the event passed, with some attention given to minimize extreme geographic separation of crews that

originated from the same utility company. As the restoration effort neared completion in the lesser damaged northern and western portions of DVP's territory, crews and contractors working in these areas were redeployed south and east, according to the company.

DVP was able to restore service in the Northern Virginia, Shenandoah Valley, and Southside regions on the order of five days ahead of the Richmond Metro/Tri Cities ("Richmond"), Tidewater, and Gloucester/Northern Neck regions. The overall restoration time in each region was primarily a function of the relative damage incurred in each region. Richmond, Tidewater, and Gloucester/Northern Neck incurred the most damage and a substantial portion of the infrastructure in those regions had to be rebuilt. The repair work in Northern Virginia, Southside, and Shenandoah Valley was less extensive and was completed faster. However, there were a number of additional reasons that contributed to an early restoration in Northern Virginia, Southside, and Shenandoah Valley and these are listed as follows:

- These regions were closest to incoming mutual aid crews.
- Not as many critical facilities were damaged in these regions.
- Circuits were more accessible because of fewer uprooted trees.
- Surrounding infrastructure (e.g. hotels) could support more personnel.

In spite of the reasons that facilitated restoration in Northern Virginia, Southside and Shenandoah Valley, some concern was expressed that the early restoration in those regions may have been, in part, a result of the inequitable deployment of restoration personnel to those areas. In order to investigate

regional equity relative to the mobilization of linemen in DVP's five regions, the Staff initially analyzed the absolute number of linemen deployed in each region and the number of linemen deployed per outaged customer in each region. However, any evaluation of crew deployment must consider not only the number of outaged customers but also the extent of damage in each region.

The actual number of field personnel deployed regionally on the first full day of the restoration was greatest in the Richmond and Tidewater areas. During the ensuing days, Richmond and Tidewater also saw the greatest influx of reinforcements. In Northern Virginia, the number of field personnel mobilized initially was of the same order of magnitude as Richmond and Tidewater; however, the total number of field personnel remained fairly static in Northern Virginia because damage to the infrastructure was comparatively less and the restoration effort proceeded relatively quickly. In summary, the number of field personnel initially deployed to Richmond, Tidewater and Northern Virginia during the first full day of the restoration was four to seven times higher than the number deployed to Southside, Shenandoah Valley and Gloucester/Northern Neck.

This deployment strategy seems logical given the high numbers of outaged customers and the extent of damage in these regions. For example, the number of outaged customers in Tidewater (612,818) or Northern Virginia (484,861) or Richmond (418,444) was on the order of five to twelve times higher than the number of outaged customers in Southside (52,086), Gloucester/Northern Neck (56,333), or Shenandoah Valley (83,595). Although Southside,

Gloucester/Northern Neck, and Shenandoah Valley had fewer absolute numbers of field personnel, the number of linemen deployed per outaged customer was initially higher in these areas than in Richmond, Tidewater, or Northern Virginia.

DVP also provided additional information to explain the difficult restoration and lengthy outage specifically in the Gloucester/Northern Neck region that might counter the criticism that the linemen in that region were too few or incompetent. Gloucester probably endured the highest intensity of the storm and damage to the infrastructure was most severe in Gloucester. Gloucester's geography, consisting of hundreds of fingers of land jutting into the Chesapeake Bay, lends itself to a high number of radial lines with few customers per mile, many of which support groupings of customers at their waterfront ends. DVP reported that crews in Gloucester could work hours or even days rebuilding line without restoring a single customer – on their way to re-energizing a locus of customers at the very end of that line. Transmission line damage was also high in the Gloucester area. DVP concluded that more facilities per customer and more damage per facility because of the high intensity of the storm in this area required longer restoration times.

The system-wide deployment of mutual aid and contract personnel for the restoration of service following a catastrophic outage is at best an inexact science. The Staff believes DVP's implementation plan was reasonable given (1) the widespread nature of the outages, (2) the variation among regions in the degree of devastation to the company's infrastructure, (3) the early inaccessibility of some circuits due to uprooted trees, and (4) the limitations in some communities to

support a large influx of field personnel. In addition, the Staff believes a fundamental tenet of restoration policy should be to saturate each region with the field personnel necessary to restore service independently in each region as soon as possible. Utility companies should not intentionally neglect the restoration activities in one region in order to artificially extend an outage in that region for the purpose of matching a longer duration outage in another region. Nevertheless, although a standard of perfection is not expected, the Staff requests that DVP review its deployment plan for possible improvements in the mobilization of mutual aid and contract personnel following a multi-region event. In particular, DVP should attempt to develop innovative ways to deploy and support additional resources in the Gloucester/Northern Neck region in the event of a similar event given the special conditions that exist in that region. Other regions with similar special conditions should be considered as well.

12. Clarity and reasonableness of policy for restoration beyond point of attachment.

During Hurricane Isabel the Staff received several complaints relative to the reattachment of downed service drops. The company's policy states that the customer is responsible for making necessary repairs at the point of attachment; however, many consumers were not aware of this responsibility. The complaints came from consumers who had waited days for service to be restored only to be informed that the final restoration action necessary, the reattachment of the service drop, was their responsibility. In these cases had the consumers known it

was their responsibility they could have hired an electrician sooner and had their service restored.

The company temporarily amended its policy during the latter part of the restoration effort to allow its employees to make necessary repairs as long as it did not require that company employees enter the home. The company has indicated that it does not want to permanently change its policy because of the liability associated with making such repairs.

The Staff informed DVP that we recommend that the company review their policy and determine whether it can be amended or whether the company can develop a plan to communicate more effectively that the service drops are the customers' responsibility.

13. Accuracy of DVP's Spending on Right-of-Way Maintenance.

After Hurricane Isabel, certain media outlets reported that DVP had reduced or held down spending on right-of-way maintenance. DVP countered that the apparent decline in its distribution line spending reflected standard accounting practices for a new right-of-way clearing program. In response to a data request by the Staff, DVP responded that the company embarked on an expanded right-of-way clearing program in 2000, which was completed in 2003. Unlike the company's routine trimming plan, the costs associated with the "first-clearing" of existing rights-of-way were capitalized consistent with FERC requirements.

On April 30, 2004, Dominion Virginia Power filed with the Commission its Annual Informational Filing ("AIF") for calendar year 2003 that includes the

financial impacts of Hurricane Isabel in its determination of earnings. As part of the review of DVP's 2003 AIF, the Division of Public Utility Accounting will conduct an audit of the costs incurred as a result of Hurricane Isabel. The scope of the audit will include a review of: (1) total costs incurred; (2) the policy for capitalizing vs. expensing storm costs; (3) retirements of property destroyed by the storm, (4) reported expenditures on vegetation management; and (5) the policy for capitalizing vs. expensing routine tree trimming costs and the costs associated with "first-clearing" of existing rights-of way. The Staff anticipates that the audit will occur during the last quarter of 2004.

14. Underground Utility Damage Prevention.

Another concern that was raised as a result of the restoration effort was excavation damage to gas pipelines by crews of the mutual aid utilities. Several gas pipelines were damaged during excavation work to install new poles apparently due to not following the requirements of the Underground Utility Damage Prevention Act ("Act") or the Commission's Damage Prevention Rules. According to the company, every mutual aid/contractor crew was led by a DVP employee that was fully cognizant of the Act. Going forward, DVP has included additional Miss Utility information in a distribution booklet given to the outside work forces to educate and remind them about safe digging practices in Virginia when they are assisting DVP in restoration efforts.

FINDINGS AND CONCLUSIONS

- The record-level impacts caused by Hurricane Isabel were a result of a combination of factors, some of which were generally beyond the control of the utilities, including primarily the widespread nature of the storm and the heightened susceptibility to tropical-storm-force winds of those trees existing both inside and outside of the utilities' rights-of-way.
- Unlike many previous tropical (or ice) storms in Virginia, Hurricane Isabel can be characterized as a "whole tree event" with respect to the root cause of the devastation to the electric utility infrastructure. That is, most of the damage was caused primarily by uprooted trees falling on the utilities' lines and poles – as opposed to being caused merely by broken tree limbs. Municipally and privately owned trees existing outside of the utilities' rights-of-way caused much of the damage. Virginia's State Climatologist noted that many of these trees are old, fragile, and untended, and have been allowed to remain standing far longer than they should have been.
- Hurricane Isabel caused extensive damage to DVP's transmission system from downed trees, flooding and wind. The damage to the transmission system not only affected the company's retail customers but also impacted 22 transmission delivery points serving six different electric cooperatives. DVP reported that it aerially patrolled the rights-of-way affected by Isabel and by year-end 2003 had removed potential problem trees.

In addition on April 19, 2004, in the wake of the August 2003 electric power blackout in the Northeast and Midwest United States, the Federal Energy Regulatory Commission ("FERC") issued an order requiring utilities to report on vegetation management practices related to designated transmission facilities by June 17, 2004. The FERC, in cooperation with the National Association of Regulatory Utility Commissioners Ad-Hoc Committee on Critical Infrastructure, analyzed these reports in order to identify appropriate ways to assure effective vegetation management for electric transmission facilities. The FERC submitted a report of its findings and recommendations to Congress on September 7, 2004. In particular, the report recommends the adoption of legislation on establishing an Electric Reliability Organization and making its standards mandatory and enforceable, under federal oversight.

- The time required for full restoration of service following Hurricane Isabel was for some consumers greater than two weeks; however, given the number of consumers impacted and the extent of damage, the lengthy outages were (from the Staff's perspective) neither unexpected nor unreasonable.
- The Staff concurs with the utilities' prioritization plans for restoration of service following a major outage, which employ a strategy of first restoring service to critical safety and public welfare facilities and then proceeding to those circuits that result in the restoration of service to the greatest number of consumers.

- Contrary to the utilities' stated policies, the Staff observed some isolated instances of downed low voltage service lines that were re-energized before being raised, creating potentially unsafe conditions.
- Pre-storm safety-related announcements, in the form of press releases and calls to special needs customers, were inconsistent and not uniformly issued by the utilities. DVP not only issued press releases but also used its voice response system to contact 10,000 special needs customers prior to the storm, apprising them of the potential for extended outages and recommending that they seek alternative accommodations. Once issued, utilities have no responsibility to ensure that customers heed advance warnings to make other accommodations in the event they lose power.
- The loss of power to water and sewer pumping and treatment stations created a variety of problems in certain localities. For example, according to an assessment conducted by the Governor's Hurricane Isabel Assessment Team,³⁸ the Richmond area and Fairfax County seemed to have the most problems with sewage and water contamination after water-treatment plants lost power. In addition, DVP reported that the loss of water and sanitation services complicated the deployment of mutual aid linemen in limited cases. The Assessment Team noted that local plans should cover how essential facilities such as sewer and water facilities will continue operating during power outages.³⁹
- DVP did not communicate with the public as effectively as possible during the restoration process, especially as it relates to system restoration goals and customer specific restoration times.
- DVP failed to communicate as effectively as possible with several of the electric cooperatives and local emergency management personnel during the restoration effort. The failure was the result of poor maintenance of communication contacts and protocols. In addition, DVP did not have a completely up-to-date list of critical facilities, including critical water pumping stations, which hampered communications.
- It appears that DVP has decreased the number of linemen it employs; however, the Staff has not observed a deterioration in day-to-day operations based on standard measures of performance. Nevertheless, as a result of (i) anecdotal feedback from customers and anonymous employees relative to a decline in resources, (ii) the natural incentive to reduce resources within a rate cap environment, and (iii) the belief that any deleterious effects of a reduction in resources might not materialize until years later, the Staff has determined that it is appropriate to conduct an in-depth audit of DVP's resources beginning in the fourth quarter of 2004.

³⁸ An Assessment: Virginia's Response to Hurricane Isabel. December 2003.

³⁹ The Assessment Team noted that Norfolk secured and pre-deployed 60 pumps and generators at critical locations throughout the city to maintain water and sewage. In so doing, Norfolk was the only city in the Tidewater area that did not lose water or sewer treatment capabilities.

GENERAL RECOMMENDATIONS

- Utilities that are currently not doing so should begin to provide safety-related announcements to the public before and shortly after major storms, unless and until more effective arrangements can be developed. At a minimum, such announcements should address all aspects of preparation, including stocking water, avoiding downed lines, and the proper, safe and courteous use of generators.
- Investor-owned electric utility companies and member-owned electric cooperatives (either separately or through their association) should provide the Division of Energy Regulation written procedures relative to safety-related announcements no later than February 1, 2005. The procedures should include the content of the announcements as well as how and when such announcements will be released to the public. The Staff will confer with the Department of Emergency Management regarding these procedures and provide necessary feedback to the utilities.
- Utilities should review their storm restoration labor policies to determine whether shift lengths for linemen are consistent with industry practices and the optimal balance of safety and productivity when conducting multi-day restorations.
- Utilities should evaluate the usefulness of Global Positioning System units and computer mapping to improve assessment and work management during service restoration efforts.
- The Staff recommends that utilities that are currently not doing so begin to work with municipalities and educate homeowners with respect to the potential long-term benefits of removing aging, overgrown trees that exist outside of the utilities' rights-of-way, since these trees present a growing danger to the company's distribution lines.
- Utilities should review their policies regarding the process for locating and managing downed lines, and take any additional steps necessary to prevent inadvertently energizing downed lines in the future.
- The Staff recommends that utilities continue to aggressively maintain distribution rights-of-way for overhead distribution lines and increase expenditures for tree trimming as necessary to reduce tree-related outages.

RECOMMENDATIONS SPECIFIC TO DOMINION VIRGINIA POWER

- DVP reports that it will be participating in a NEETRAC study to identify improved methods of evaluating wood pole integrity. The study is expected to be completed by the end of 2004. DVP should provide the Division of Energy Regulation an update of the results of the study and any plans to implement changes in its pole inspection and replacement programs.
- DVP should review its deployment plan for possible improvements in the mobilization of mutual aid and contract personnel following a major storm. In particular, DVP should attempt to develop plans to deploy and support additional resources in the Gloucester/Northern Neck region in the event of a similar future event because of the geographic challenges in that area. DVP should also review its plans for other similar areas that may present specific challenges.
- As documented in the report, DVP has identified a list of issues and concerns where potential improvements should be evaluated in the areas of pre-planning, assessment, restoration and post restoration. These include predicting storm impacts, expanding and training the pool of employees available for storm roles, transferring damage assessments into the trouble reporting system, disseminating information to local emergency operations centers, communicating customer-specific information such as restoration times, handling priority and emergency calls in the customer service center, and accelerating delivery of material. DVP has reported to the Staff the implementation of corrective actions or plans for additional improvements relative to the identified issues. DVP should provide an update to the Division of Energy Regulation relative to the implementation of any additional activities in these areas.
- The Staff recommends that DVP evaluate the potential for old, brittle copper wire to impact general reliability or susceptibility to major storms, and determine the need to implement a plan for locating and replacing such wire.
- The Staff recommends that DVP continue to rely primarily on mutual aid for restoration activities following catastrophic storms. The company's baseline workforce of linemen should be maintained at a level necessary to preclude excessive overtime work, deterioration in service connection completion times, and excessive restoration times following outages. Efforts should continue to focus on how to maximize the effectiveness and efficiency of the infusion of a large external work force during catastrophic outage events.
- The Staff recommends that DVP continually review and update its plan to communicate with the public during major outage events and provide the Division of Energy Regulation an annual update relative to improvements made to provide the public quicker system restoration goals and customer specific estimated restoration times.

- The Staff recommends that DVP establish a process to routinely update communication contacts and protocols with the electric cooperatives and emergency management personnel. The Staff further recommends that DVP provide the Division of Energy Regulation an annual update relative to its work in this regard.
- The Staff recommends that DVP review its point of attachment policy and report whether it can be amended or whether a plan can be developed to communicate more effectively that the service drops at the point of attachment are the customers' responsibility.
- DVP should provide a written update to the Division of Energy Regulation relative to the implementation of all recommendations in this report (including those both specific to DVP and generic to all utilities) no later than February 1, 2005.

APPENDIX
PHOTOGRAPHS OF DEVASTATION AND INFRASTRUCTURE DAMAGE
DUE TO HURRICANE ISABEL

