COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

PREPARATION FOR AND RESPONSE TO THE DECEMBER 2009 SNOWSTORM

SPECIAL REPORT OF THE DIVISION OF ENERGY REGULATION

August 18, 2010

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EXECUTIVE SUMMARY

This report presents the results of an analysis by the Virginia State Corporation Commission Staff ("Staff") of the preparedness and responsiveness of three of the state's electric utilities[1] relative to power outages and service restoration following the December 2009 snowstorm. The report addresses the three utilities' preparations prior to the storm, describes the severity of the storm's impacts relative to previous storms as well as the 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 conclusions and recommendations.

The snowstorm resulted in significant impacts on the three utilities' electrical infrastructure and customers, including unprecedented impacts for a winter storm in localized areas of APCo's territory;[2] however, the factors involved were, for the most part, beyond the control of the utilities. These factors primarily included the depth and heaviness (water content) of the snow, the inaccessibility to mountainous terrain, and the heightened susceptibility to windthrow[3] of trees both inside and outside of the utilities' rights-of-way. Unlike many previous winter storms in Virginia, the December 2009 snowstorm can be characterized largely as a "whole tree" event; that is, much of the damage was caused by uprooted and broken trees falling on the utilities' lines and poles.

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[1] Appalachian Power Company ("APCo"), Kentucky Utilities Company d/b/a Old Dominion Power Company ("ODP"), and Powell Valley Electric Cooperative ("PVEC")

[2] For example, nearly 600 utility poles replaced; approximately 100,000 customer outages for up to eighteen days in APCo's territory.

[3] In forestry, *windthrow* refers to trees uprooted or broken by wind. The risk of windthrow to a tree is related to the tree's size (height and diameter), the size of the crown, the anchorage provided by its roots, its exposure to the wind, and the local wind climate. Contributing factors can include tree damaged root systems due to past prolonged drought, saturated ground from excessive rainfall, and tree senescence.

As a result of its investigation, the Staff has concluded that the utilities' overall preplanning and restoration efforts following the snowstorm were, except in some isolated areas, reasonable and satisfactory by historical levels of performance after catastrophic storms. Except for these isolated areas,[4] the time required for full restoration of service following the snowstorm was neither unexpected nor unreasonable from the Staff's perspective given the number of customers impacted, the extent of damage, and the inaccessibility of facilities. 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.

The Staff also found no major problems with overall scheduling of work or deployment of linemen in the field; however the Staff believes there were isolated areas where mutual aid was under-deployed, and some mutual aid linemen reportedly were not accustomed to working in mountainous terrain nor trained in the use of rigging practices necessary for such work. In addition, the Staff found little evidence of deficiencies in the condition and maintenance of the utilities' distribution system infrastructure. Finally, although lessons were learned and improvements should be implemented, the Staff found no major problems with the utilities' storm management operations.

The Staff believes however that utilities generally 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 not already doing so intensify their efforts to work with municipalities and educate property owners with respect to the potential long-term benefits of removing aging, overgrown trees that exist outside of the

[4] Isolated areas refer primarily to portions of Lee, Wise Scott, Russell, Dickenson and Buchanan Counties.

utilities' rights-of-way, since these trees present a growing danger to the companies' distribution lines.

The Staff also identified some findings, formulated recommendations, and established reporting requirements specific to Appalachian Power. During the course of the investigation, the Staff received several comments from the public and local government officials suggesting the need for improved communications. In this regard, APCo 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. APCo also needs to revisit and establish improved communication protocols with local emergency management officials. APCo has already taken a number of steps to address each of these identified issues.

In addition, the Staff recommends that APCo, PVEC, and ODP (1) more aggressively maintain distribution rights-of-way, (2) review deployment plans for mobilization of mutual aid and contract personnel following a major storm with the goal of deploying additional resources in key areas, (3) review storm management models for potential improvements relative to communications and management responsibilities, (4) evaluate logistics management alternatives for the purpose of supporting additional field resources in remote areas,[5] (5) consider physically relocating specific circuits to minimize susceptibility to damage and to increase accessibility for repair, and (6) review and update plans and protocols for communication with the public and emergency

[5] For example, consider retaining an independent contractor to provide staging, catering, and sleeping arrangements for mutual aid linemen who could otherwise not be readily accommodated by the local community infrastructure.

management personnel. The Staff has asked the utilities to provide a written response to all recommendations in this report by December 1, 2010.

INTRODUCTION

Virginia experienced a major snowstorm on December 18 and 19, 2009, that blanketed the state with as much as twenty-four inches of snow. Electric utilities throughout the state experienced outages as a result of the storm; however, Appalachian Power ("APCo"), Kentucky Utilities Company d/b/a Old Dominion Power Company ("ODP"), and Powell Valley Electric Cooperative ("PVEC") (collectively, "the three utilities") were most impacted. Initial reports from weather bureaus and the three utilities indicated that the snow in the far southwest areas of the state was heavier and wetter than the snow that fell in the rest of the state. This type of snow, combined with saturated ground and shallow root systems, caused entire trees to fall into sub-transmission and distribution facilities. The damage caused by these trees was catastrophic in some areas.

Initially, the three utilities reported to the Staff that service restoration would be completed by Christmas 2009. During the early stages of restoration, each of the three utilities reported that the wide scale scope of the devastation and poor travel conditions in the area hindered restoration activities. However, with the exception of a few PVEC customers, ODP and PVEC restored service to all customers as initially reported. APCo did not complete restoration to all customers until January 4, 2010.[6]

As a result of the devastated infrastructure and outages, the Staff of the Virginia State Corporation Commission ("SCC" or "Commission") received numerous inquiries and complaints from both elected officials and the public relative to the adequacy of the

[6] APCo experienced a second storm on Christmas Day that caused outages to additional customers. Generally, these customers were in a different part of APCo's territory; however, APCo had to shift resources away from the area impacted by the December 18/19 storm to the area impacted by the Christmas Day storm. This further slowed restoration.

three utilities' infrastructure and effectiveness of their restoration processes.[7] 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 the December snowstorm, the Staff submitted data requests to the three utilities and conducted field visits to their service territories to observe the terrain and conditions of the rights-of-way.[8]

The purpose of this report is to provide the results of the investigation by the Staff relative to the three utilities' preparation for and response to the snowstorm. The report addresses preparations made in anticipation of the storm, the severity of the storm's impact, restoration performance, customer and emergency management 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 pre-existing 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, snowstorms have the potential to inflict significant widespread destruction if the snow is wet, heavy, and adhesive. Preplanning efforts for such storms typically involve meteorological forecasting, training employees for various storm roles, preparing

[7] APCo, primarily
[8] March 22–25, 2010, the Staff conducted field visits in southwest Virginia.

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 three utilities employed different levels of sophistication relative to meteorological forecasting, all three utilities reported tracking the storm and initiating preparations prior to the storm. APCo, ODP and PVEC anticipated widespread outages, substantial infrastructure damage, and the need for an extensive recovery effort. The utilities' storm centers were activated; inventory levels of necessary supplies were evaluated; suppliers were contacted as necessary; tree contractors and linemen were notified; and mutual assistance crews were called as necessary. In addition, news releases were issued during and after the storm.

As would be expected, the preparations implemented by the utilities prior to the arrival of the snowstorm varied by utility. Generally speaking, however, the utilities' preparations appear to have been reasonable based on their responses to informal data requests after the storm. 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.

DECEMBER 2009 SNOWSTORM IN PERSPECTIVE

The second major winter storm of December 2009 affected the Mid-Atlantic and Northeast on December 18th through 21st leaving behind one to two feet of snow from North Carolina to New England. The storm originated in the Gulf of Mexico and moved along the Eastern Seaboard, developing into a classic Nor'easter. At one point, the storm

was over 500 miles in width, eventually affecting fourteen states and tens of millions of Americans. The heavy snow crippled the densely populated corridor from Richmond to Boston. Blizzard conditions were reported in Philadelphia, which received 23.4 inches of snow accumulation, the city's second highest snowfall for a single event. Philadelphia typically receives 19.3 inches for an entire winter season. Washington, D.C., at Reagan National Airport, had its snowiest calendar day in history with fifteen inches of snowfall, surpassing the previous record of 11.5 inches set on December 17, 1932. Due to widespread accumulation of heavy snow, the storm was given a score of 4.03 on the Northeast Snowfall Impact Scale ("NESIS"), categorizing the storm as a low-end Category 3 ("major") winter storm and ranking it in the top 25 winter storms to affect the region.[9] The ranking is based on the amount of snowfall, the area, and the population affected.[10]

The blizzard disrupted several regions, and in some areas the snowfall rate prevented snow plows from maintaining the roads. The blizzard caused flights and trains to be canceled, and left areas without power. Kentucky, Maryland, Virginia, West Virginia, and the District of Columbia declared a state of emergency. [11]

The December 2009 snowstorm was among the most severe northeast winter snow storms in history, causing approximately one-half million customer power outages (at the peak) across the East Coast.[12] APCo VA alone incurred approximately forty-six

[9] *State of the Climate, Snow & Ice, December 2009*, NOAA, National Climatic Data Center, January 8, 2010, http://www.ncdc.noaa.gov/sotc/?report=snow&year=2009&month=12 (April 23, 2010).
[10] *The Northeast Snowfall Impact Scale (NESIS)*, http://www.ncdc.noaa.gov/snow-and-ice/nesis.php (January 15, 2010)
[11] *Snow Storm Cut Power to More than 480,000 Customers across U.S. East Coast December 18-21*, Energy Assurance Daily, U.S. Department of Energy, Office of Electricity and Delivery and Energy Reliability ("OEDER"), Infrastructure Security and Energy Restoration, (December 22, 2009)
[12] *Ibid.*

thousand customer power outages at the peak. In total, APCo VA experienced approximately 100,000 customer outages for up to eighteen days, had to replace about 587 poles and 1,310 broken cross arms, and had to restring over one hundred miles of conductor.[13]

In fact, when one considers the entire region covered by the Blacksburg National Weather Service ("NWS") Forecast Office, this was the most significant snow storm since January 6–7, 1996. The following is a summary of how this storm compares with past big snow events in the region covered by the Blacksburg NWS Office:

> Roanoke - 17.8": The highest snow event total for the month of December, and is the 4th highest all time. The last time this much snow fell in one storm was 25", January 6-7, 1996 (the record).
>
> Blacksburg - 14.4": Also the highest snow event for the month of December, and the 5th highest snow event total. The most since 21.4" fell January 28-29, 1998. Over 33" fell during the January 1996 event.
>
> Lynchburg: 12.5" is the 6th highest snow event total, and the most since 21.5" fell during the January 1996 event.
>
> Bluefield: 15" is the highest snow event since 17" fell on January 28-29, 1998. Some local areas may actually have come close to their totals from the enormous January 1996 storm. Other historic major winter storms to have hit the area include March 10-13, 1993; February 10-12, 1983; and December 25-27, 1969.

[13] Among all types of storms, Hurricane Isabel caused the most extensive power outages ever in Virginia. Isabel interrupted power to approximately two million customers of four investor-owned electric utility companies and members of eleven member-owned electric cooperatives. Some consumers in Virginia were without power for up to sixteen days. Dominion Virginia Power, the Commonwealth's largest utility, sustained the greatest impact in absolute numbers. Of DVP's two million customers in Virginia, approximately 1.8 million customers lost power for up to sixteen days, and DVP had to replace about 8,000 poles. Over sixty thousand of APCo's customers were affected by Hurricane Isabel, some of whom were without power for up to five days.

Among ice storms in recent history in Virginia, the 1998 Christmas Eve Ice Storm was perhaps the most destructive, causing power outages for approximately four hundred thousand DVP customers for up to ten days. Outside of Virginia, the January 1998 New York ice storm resulted in power outages for approximately three hundred thousand Niagara Mohawk customers, and full restoration of service required twenty-three days, even with help from foreign utilities.

In summary, while the December 2009 snow storm was not the strongest winter storm to hit Virginia, it did result in localized record levels of electric utility customer outages and destruction to energy infrastructure.[14] The Staff believes that the record-level impacts caused by the snowstorm were a result of a combination of factors generally beyond the control of the utility companies, primarily (1) the widespread nature of the storm, (2) the depth and heaviness (water content) of the snow (with drifting up to four feet reported), (3) the mountainous terrain (where some lines are inaccessible by vehicle), and (4) the heightened susceptibility to windthrow[15] of those trees existing outside of the utilities' rights-of-way. In addition, APCo reported that during the snowstorm, many areas were inaccessible due to closed roads for the first few days of the event, which delayed assessment and restoration. Additionally, weather conditions reportedly hindered the use of helicopter patrols during that period. Finally, a second (ice) storm during the restoration period also contributed to the duration of the outages. According to APCo, this second storm caused the Company to shift resources to respond to new customer outages. This shift of resources caused by the second storm resulted in delays in restoring service by a least one day or more to some customers who were still experiencing outages from the December 18 snowstorm. [16]

[14] Duke lost 696,000 customers in North Carolina for up to 18 days from Hurricane Hugo in 1989 and Niagara Mohawk lost 300,000 customers for up to 23 days from the New York Ice Storm of 1998.

[15] In forestry, *windthrow* refers to trees uprooted or broken by wind. The risk of windthrow to a tree is related to the tree's size (height and diameter), the size of the crown, the anchorage provided by its roots, its exposure to the wind, and the local wind climate. Contributing factors can include tree damaged root systems due to past prolonged drought, saturated ground from excessive rainfall, and tree senescence.

[16] A National Weather Service map of the Christmas 2009 ice storm and National Operational Hydrologic Remote Sensing Center maps of the December 19 snowstorm are included in the Appendix.

UTILITY-SPECIFIC IMPACTS FROM THE STORM

As mentioned previously, the December 2009 snowstorm caused unprecedented outages and destruction to APCo's energy infrastructure. The snowstorm also impacted Old Dominion Power Company, Powell Valley Electric Cooperative, and to a much lesser extent, Dominion Virginia Power and Potomac Edison as well as other electric cooperatives. Primarily as a result of the path of the storm and the relative size of the various electric systems in the affected areas, APCo's system sustained the most damage (on an absolute basis) among all utilities in the state. For APCo, the snowstorm resulted in 3,653 work requests, and the Company estimates it replaced 587 poles and 1,310 cross arms. The total cost (pre-tax) of restoration was estimated at $35 million, including $4.2 million for tree cleanup by tree contractor services.

A comparison of the damage to APCo's Virginia system caused by the December snowstorm with some other catastrophic storms is provided in Table 1. Note for example that the number of poles replaced after the December snowstorm was significantly greater than any recent previous storm. In addition to the unprecedented damage to the Company's infrastructure, the outage duration for some of APCo's customers was also greater than with any previous storm.

Table 1. Catastrophic Storms Damage Comparison

APCo	Work Orders	Poles Replaced	Crossarms Replaced	Feet of Conductor Replaced	Customers Affected	Duration of Outage
December Snowstorm – 2009	**3,653**	**587**	**1,310**	**568,434**	**99,768**	**18 days**
Snow storm – 2/5/2010	2,220	96	113	68,401	78,710	5 days
Wind/Rain Storm – 12/8/2009	1,910	52	67	48,392	68,650	6 days
Wind Storm – 2/10/2008	2,674	126	108	65,433	110,946	5 days
Hurricane Isabel – 2003	892	88	79	unavailable	63,214	5 days

Old Dominion Power Company ("ODP") and Powell Valley Electric Cooperative ("PVEC") were also significantly impacted by the snowstorm, but not as severely as the adjacent service territory of APCo in terms of facility damage and outage duration. The snowstorm had very little impact on Dominion Virginia Power, Potomac Edison and the other electric cooperatives. Summaries of customer impacts, infrastructure damage, and costs of restoration among APCo, ODP, and PVEC are provided in Tables 2[17], 3, and 4, respectively.

Table 2. December 2009 Snowstorm Customer Impacts

Electric Utility	Total Customers Affected	Percent of Customers Affected	Total Duration of Outage
APCo	99,768	20%	18 days
Old Dominion Power	29,817	99.6%	7 days
Powell Valley Co-op	8,090	100%	7 days
Virginia Power	51,778	2.3%	2½ days
Rappahannock	9700	9.4%	2½ days
Central Virginia	1958	5.9%	2 days
MEC	2982	9.5%	< 1 day
CBEC	1567	22.2%	< 1 day
BARC	359	2.8%	< 1 day

Table 3. December 2009 Snowstorm Infrastructure Damage

Electric Utility	Poles Replaced	Crossarms Replaced	Feet of Conductor Replaced
APCo	587	1,310	568,434
Old Dominion Power	133	362	Not Available
Powell Valley	30	Not Available	Not Available

[17] Table 2 also includes customer impact data for other electric utilities and cooperatives for comparison.

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.
APCo	34.87	7.72	4.19	1.29	18.11	1.8	1.76
ODP	10.52	0.84	0.68	4.54 for line and mutual aid contractors		0.732	0.11
PVEC	0.57	0.11	0.35 for all contract labor			0.022	0.085

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 (or secondary) 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 may correspond 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 to deploy available resources within that specific area.

The restoration work that results from widespread, devastating weather events will typically 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.

Management practices are evolving to better utilize mutual aid crews. 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. This permits them to manage more visiting resources without increasing 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 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 restoring service after the December 2009 snowstorm, PVEC, APCo and ODP 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. A discussion and summaries of the resources used by the three

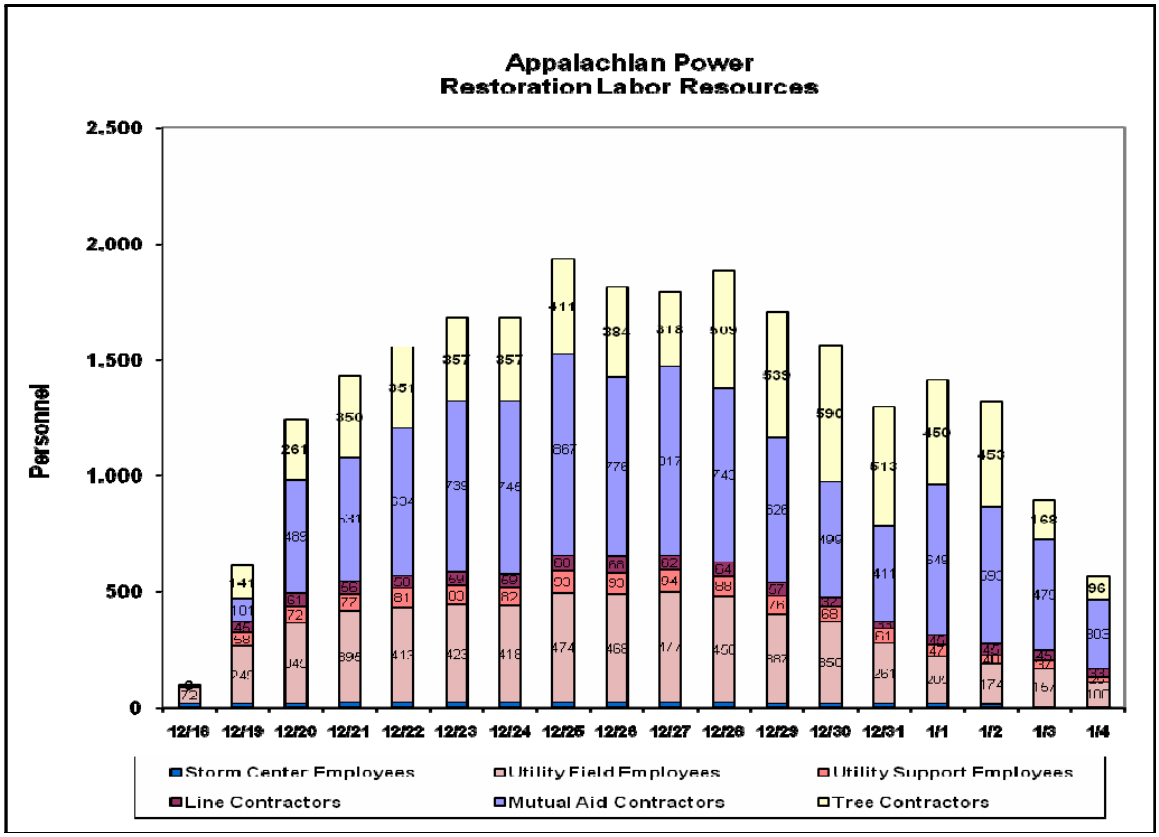
utilities and the results of the restoration effort, with an emphasis on APCo's performance, are provided below.

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, a wind and ice storm on Christmas Day, the depth of the snow, the mountainous terrain and 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, ODP and PVEC reported scheduling the large majority of their personnel to perform work during the daylight hours. 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. The majority of utilities have previously 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. PVEC reported that its field crews and supporting personnel work through the first night before sleeping; thereafter, they work approximately 16–18 hour shifts.

Appalachian Power's total labor resources for the snowstorm varied from day to day during the restoration effort but peaked at 1,950 on December 25, 2009. Included among the aforementioned labor force on that day were 867 mutual aid contractors, 68 line contractors, 411 tree contractors, 21 assessment contractors, 474 APCo field

employees, 93 APCo support personnel, and 16 APCo storm center personnel.[18] The following chart shows the number of personnel working to restore power on APCo's system on each day from December 18, 2009 through January 4, 2010. As mentioned previously, this was by far the largest deployment of resources for a post-storm restoration effort in the Company's history.

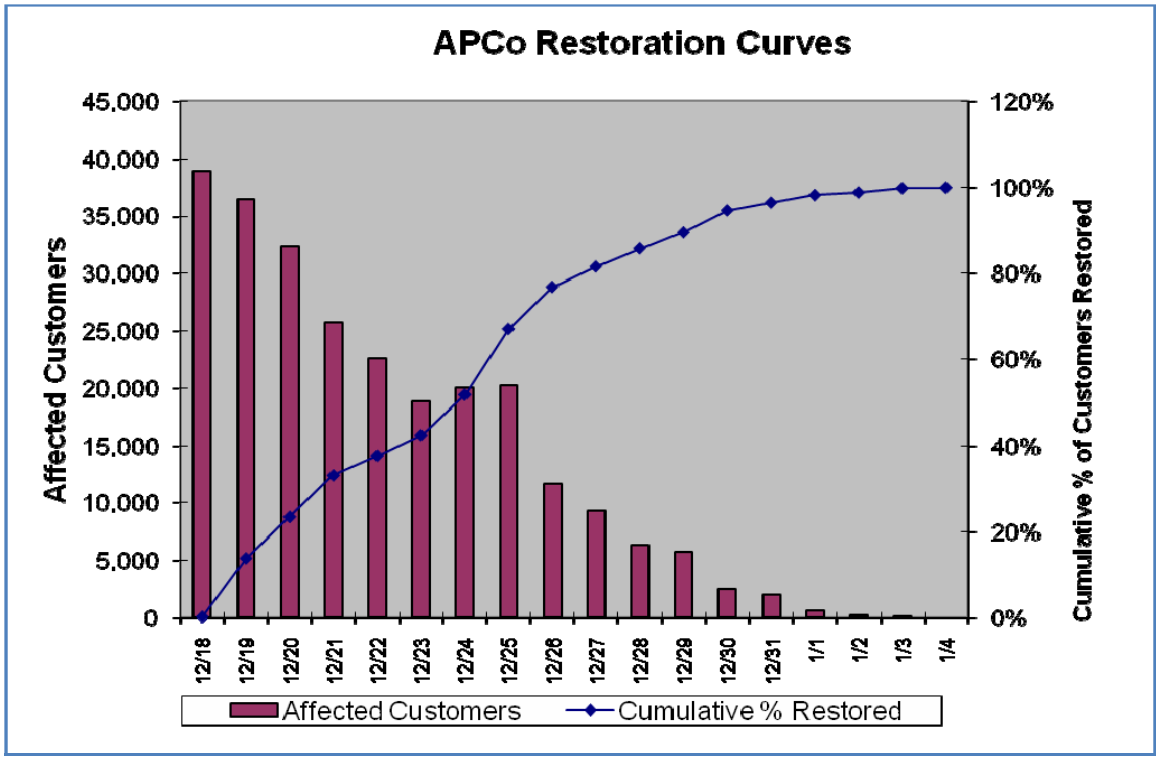


As with previous major storms, the utilities relied heavily on mutual aid linemen for restoration after the snowstorm. This is standard industry practice. The Staff agrees with this practice of relying primarily on mutual aid for restoration activities following

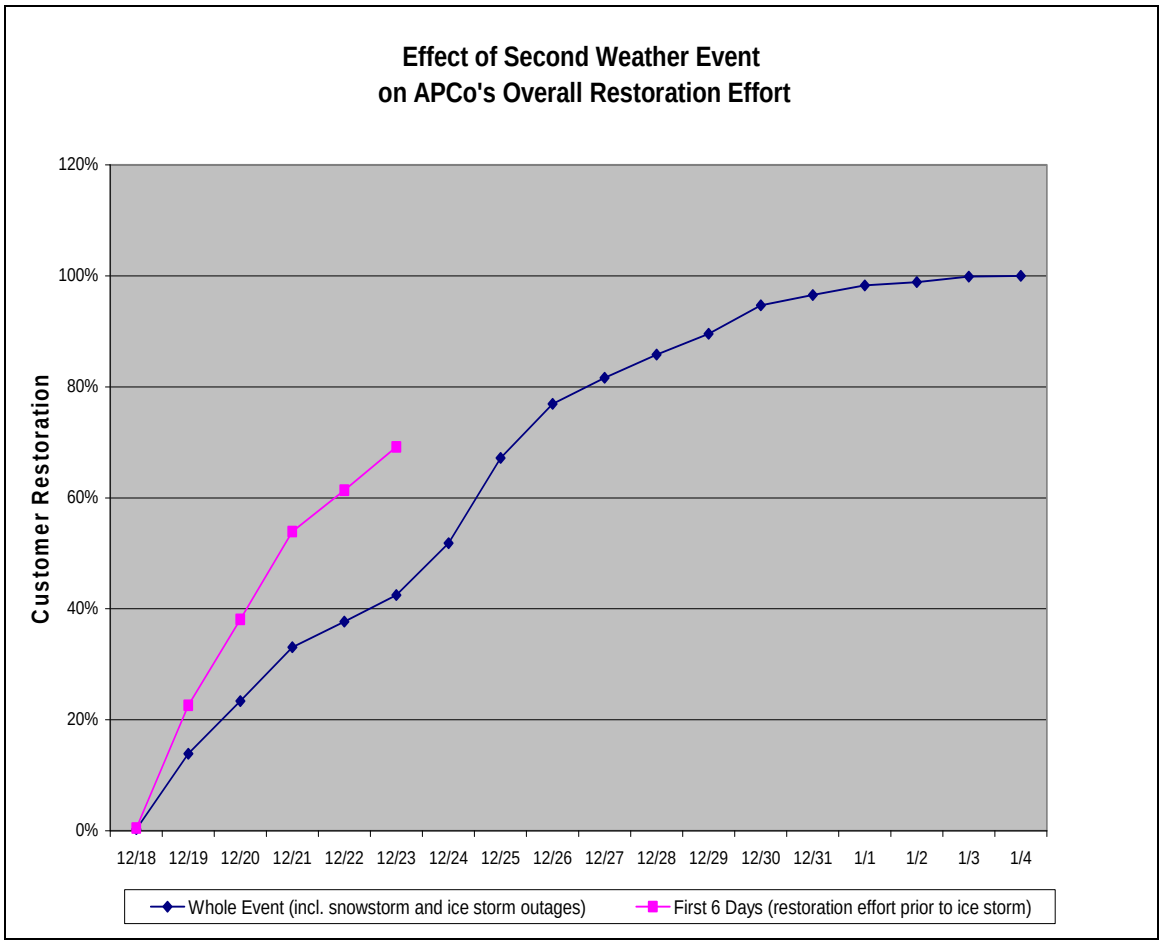
[18] Not all of the various employee/contractor types peaked on December 25. For example, tree contractors peaked at 590 on December 30.

catastrophic storms, which are unlikely to occur on a regular and consistent basis. The Staff believes a utility'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.

The following chart presents the restoration curves for APCo's customers. The "affected customers" at the beginning of each day includes those customers whose service remained out from the original snowstorm, all new outages (including those affected by the subsequent ice storm and other events), and any customers for whom a crew was dispatched to investigate a "no-interruption" call typically involving a hazard during the period of the storm event. The "cumulative percent restored" is the percentage of customers restored through the end of each day and is based upon the absolute total number of customers affected over the full restoration period of December 18, 2009 through January 4, 2010.



APCo had restored approximately seventy percent of its customers from the first storm by December 23, 2009 (day 6 of the outage) prior to the advent of the ice storm; however, the chart indicates only approximately forty percent restored because it is based on total interruptions from not only the snowstorm but also all subsequent events. As previously indicated, APCo's policy with respect to restoration priority is to complete the jobs that will restore the greatest number of customers first. This policy was repeated after the Christmas Day ice storm, even though it required relocation of restoration personnel to the newly affected areas. The effect of the Christmas Day ice storm on the restoration effort is depicted in the following chart.



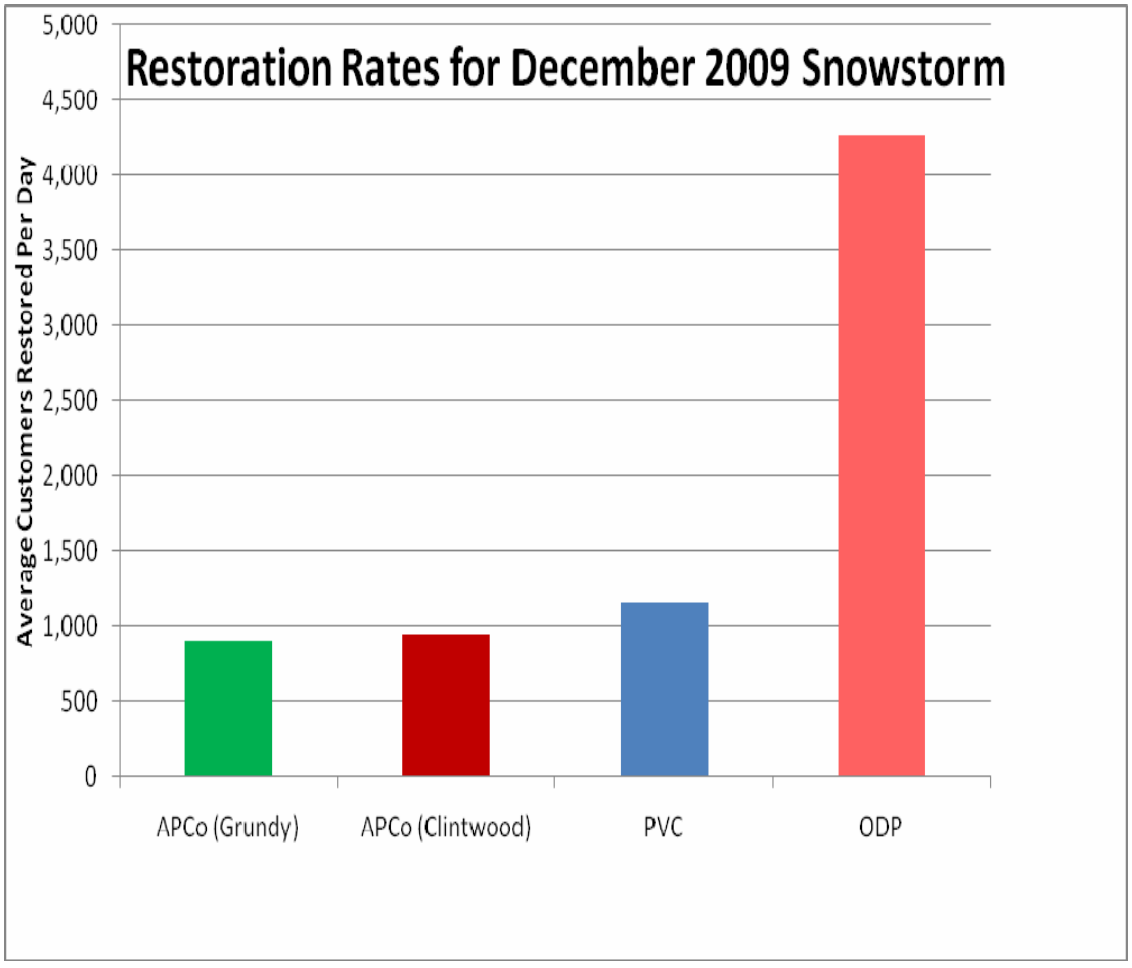
While acknowledging that their performance was not perfect and that improvements are needed in some areas, APCo claimed a number of major successes with respect to safety, resource management, community involvement, communications, logistics, employee dedication, and planning. The Staff believes several deserve mention. In particular, APCo (as well as ODP and PVEC) deserves recognition for successfully managing a large labor force during the extended outage without any major injuries. In addition APCo noted that it had secured and coordinated the largest number of different contractors in the Kingsport district and mobilized the most specialized heavy equipment for a single event in the Company's history. Also, APCo initiated the first widespread use of community facilities to house and feed restoration personnel. Finally, the Company underscored the dedication and performance of its employees.

COMPARISON AMONG APCO, PVEC AND ODP

Introduction

As previously noted, the APCo, PVEC, and ODP systems sustained the most damage in the state from the December 2009 snowstorm. While other utilities were able to recover and restore power to their customers in a few days (ranging from less than one to two-and-one-half days), PVEC and ODP required seven days, and APCo required significantly more in some districts. With respect to APCo, the Company was able to restore a significant percentage of its customers in much of its territory within seven days; however the restoration effort went into a third week in areas of their Kingsport District. Restoration operations in APCo's Clintwood and Grundy areas were particularly difficult and protracted which resulted in concerns expressed regarding the relative efficiency of the restoration efforts in those areas, the condition of the

infrastructure, and the adequacy of vegetation maintenance practices. Therefore, for the purposes of this section, the Staff has focused its attention on a comparative analysis among PVEC, ODP, and the Clintwood and Grundy areas of APCo.[19] The average restoration rates following the December 2009 snowstorm for APCo (Clintwood/Grundy areas separately), ODP and PVEC are provided in the following chart. ODP's restoration rate was approximately four times that of PVEC and APCo (in Grundy and Clintwood).



[19] The Staff's focus on the Company's Clintwood and Grundy areas (comprised primarily of Buchanan, Dickenson and the northern part of Wise Counties) in its analysis is in no way meant to minimize the lengthy outages in other areas such as the Company's Lebanon and Gate City areas which consist primarily of Russell and Scott Counties.

Table 5 provides a comparison of a number of key variables among PVEC, ODP, and the Clintwood and Grundy areas of APCo's territory that were reviewed for this analysis.

Table 5.

	PVEC	ODP	Grundy	Clintwood
Customers	8,090	29,931	12,845	12,656
Distribution Circuit Miles	875	1161	962	1106
Square Mile Area	Not available	511	465	453
Customers Interrupted	8,090	29,817	11,532	11,379
% Customers Interrupted	100%	100%	90%	90%
Broken Poles	30	133	163	237
Broken Crossarms	n/a	362	472	462
Conductor Restrung (miles)	n/a	n/a	43	30
Work Orders Issued	n/a	1234	544	779
W.O.s per 1000 Customers	n/a	41.2	42.4	61.6
Customers per Circuit Mile	9.2	25.8	13.4	11.4
Linemen (daily maximum)	78	787	364	554

PVEC vs. APCo and ODP

A review of the key variables in Table 5, terrain and topographical maps of the service territories, local National Weather Service reports, and the snowfall maps developed by the National Oceanic and Atmospheric Administration provided a clearer understanding of the different challenges faced by PVEC, ODP and APCo (see the Appendix for relevant topographical and weather maps). Relative to PVEC, it appears that ODP and APCo experienced greater storm effects and had to deal with more difficult terrain for the restoration. In particular for example, Staff compared PVEC's territory with APCo's Grundy area territory. Both PVEC and the Grundy area exhibit similar characteristics with respect to size of service area, number of customers, miles of distribution circuits, and customers interrupted. However, the magnitude and therefore the impact of the snowstorm in the Grundy area appears to have been much worse based on snowfall maps and destruction of infrastructure. In particular, in the Grundy area alone, APCo experienced over five times the number of broken poles as PVEC (163 vs. 30).

Given the extent of the destruction and difficult terrain, a longer restoration period in both ODP's and APCo's territories would not be unexpected. However, ODP was able to restore service within the same period of time as PVEC (7 days) most likely because of the high number of linemen employed relative to PVEC. For example, ODP's one day maximum number of linemen in the field exceeded PVEC's total number of linemen by a factor of about ten (787 vs. 78). Based on this initial analysis, it appears that ODP's restoration was reasonable given the number of outages, extent of the damage, and resources used for the restoration. ODP had significantly more damage but was able to

compensate by employing a much larger force of linemen.[20] APCo sustained even more infrastructure damage than ODP; however, given the extended length of the outages in portions of APCo's territory, the Staff decided to conduct further analysis before developing conclusions relative to APCo's performance.

APCo vs. ODP

To address the concerns described above, the Staff also conducted a comparative analysis between APCo's restoration (in the Clintwood and Grundy areas) and ODP's restoration. ODP's territory consists primarily of Wise County.[21] APCo's Clintwood area is adjacent (northeast direction) to ODP's territory and includes most of Dickenson County but also portions of Wise and Buchanan Counties. The Grundy area is northeast of Clintwood and consists primarily of most of Buchanan County, but also small portions of Dickenson and Russell Counties. With respect to a comparative analysis, a comparison could be made between ODP and the Clintwood and Grundy areas, either separately or combined. For the purposes of this section, the Staff chose to compare ODP with the Clintwood area alone, because the two areas are adjacent and have roughly the same number of distribution circuit miles. However, the ODP territory has more than double the number of customers as the Clintwood area and therefore more than double the customer density (customers per circuit mile). This twofold customer density could account for ODP having more than twice the number of outages and could explain up to a twofold higher restoration rate relative to APCo.

[20] Among the three utilities, PVEC's system sustained the least damage but required seven days to fully restore service partly as a result of employing a relatively small labor force; however the Staff acknowledges that a small electric cooperative may not have the resources of a large investor owned utility.
[21] ODP's territory also includes small portions of Lee, Scott, Russell, and Dickenson Counties.

The Staff believes a case can be made that the snowstorm was more severe and had a greater impact on APCo's territory based on snowfall totals and infrastructure damage, leading to a much longer restoration. For example, the National Weather Service reported that the snowfall in Clintwood was particularly wet (and therefore heavy and adhesive) and significantly wetter than the snow that fell in the Norton area of ODP's territory. The following summary of the storm in Buchanan and Dickenson Counties was provided by the National Weather Service local office in Charleston, West Virginia:

> Dickenson and Buchanan Counties were hit hard by heavy wet snow. . . . The heavy wet snow was described as like walking in cement with huge flakes falling. Roads over the higher terrain quickly became impassible. Tree limbs began to snap when snow accumulations reached around 4 inches. By 1900E on the 18th, Nora on Long Ridge in Dickenson County already had a 7 inch accumulation. By 2000E, Clintwood measured 8 inches. By midnight, the heaviest snow rates were over, but less intense snow continued to fall until the afternoon on the 19th. The total snow accumulations from the storm were just 5 to 7 inches along some of the river valleys, such as near Grundy. Near Clintwood, the snow accumulation was 11 inches. However, amounts of 1 to 2 feet of snow were measured above 2000 feet. For example, Nora measured 16 inches. . . . The pop, cracks, crashes, and boom sounds were heard as numerous tree branches and even whole trees fell to the ground.[22]

With respect to infrastructure damage, the Clintwood area experienced nearly eighty percent more broken poles (237 vs. 133) and almost thirty percent more broken cross arms (462 vs. 362) than ODP's territory. In addition, as indicated by terrain and topographical maps and confirmed by the Staff's field inspections, the Clintwood area (which includes most of Dickenson County as well as a sizeable portion of northern Wise County) has some of the harshest terrain in the state, which significantly complicated the restoration effort for APCo. According to the 2008 Dickenson County Comprehensive Plan:

[22] Email from Chris Leonardi, rlx.webmaster@noaa.gov, (May 29, 2010)

> In this mountainous region, flat land even a few acres in extent are rare, and valley slopes are very steep. The surface is deeply and maturely dissected by streams, with the water courses being only a few miles apart but separated by ridges that rise 500 to 1,000 feet above them. The valleys are deep, narrow and V-shaped, with little or no flat bottomlands."[23]

That portion of APCo's Clintwood area in northern Wise County has much the same type of terrain as Dickenson County. On the other hand, while some of ODP's territory in Wise County has similar topography, it also contains less harsh hilly and rolling ridge land suitable for farming and urban type developments.[24]

Another complicating factor that certainly contributed to APCo's outage duration was the Christmas Day ice storm which caused the Company to shift resources to respond to new customer outages. This shift in resources resulted in delays in restoring service by at least one day to some APCo customers who were still experiencing outages from the original snowstorm. Finally, the Company identified a number of other factors apparently unique to APCo[25] that may have contributed to the length of the outage in the Clintwood (and Grundy) areas:

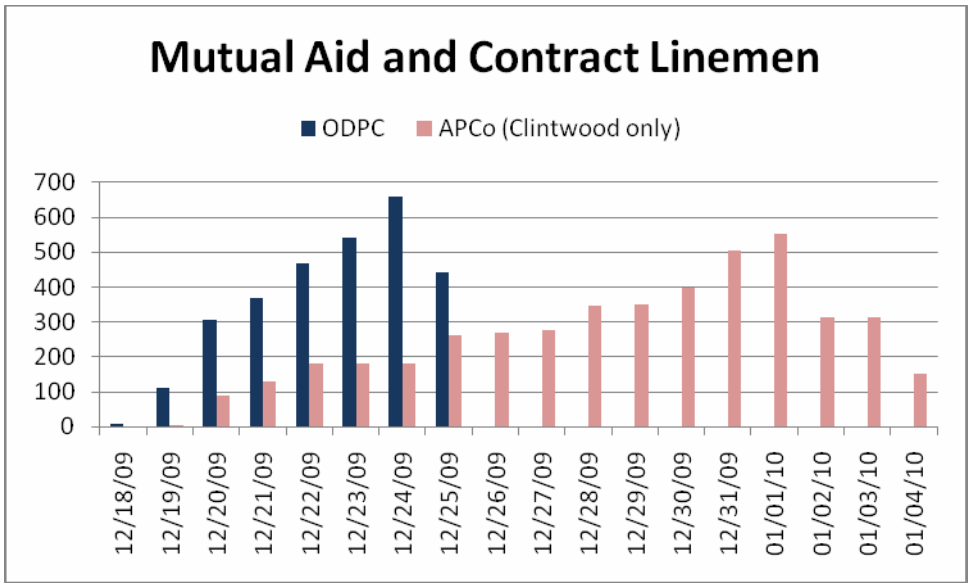
- Loss of water to Dickenson and Buchanan Counties shifted focus to those facilities and strained logistical support for repair crews.
- Roads, especially side roads, were difficult to use even a week after the storm.
- Most of the work that had to be done was well off of the roads, requiring manual techniques.
- Copper thieves worked during the storm stealing copper from substations and from downed power lines increasing the amount of work that needed to be done.

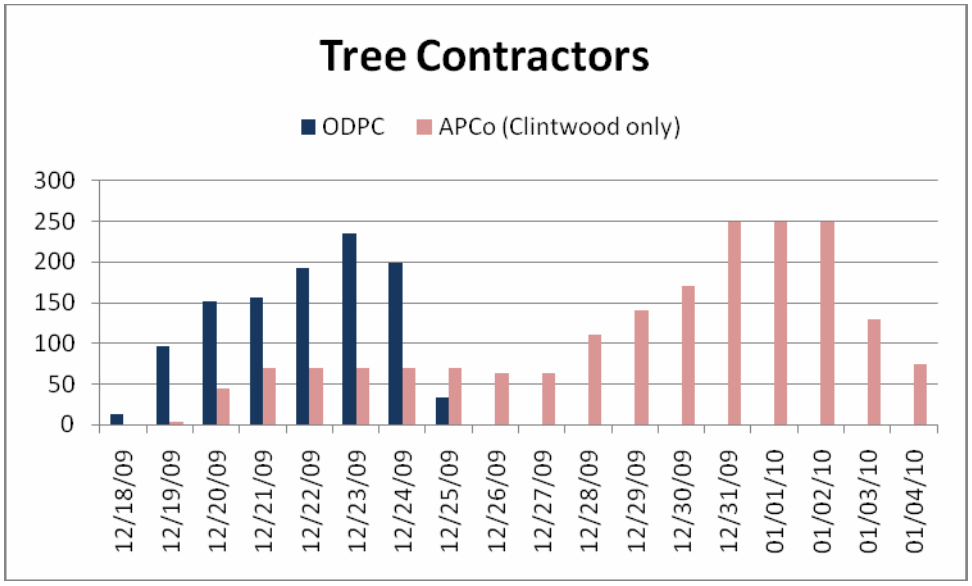
[23] Dickenson County Comprehensive Plan, 2008, p.11
[24] Wise County Comprehensive Plan, 1998
[25] ODP reported that these factors did not result in any delays in its restoration.

The Staff believes a protracted restoration in certain areas of APCo's territory was inevitable given (1) the greater facility damage impact of the storm, (2) the more mountainous terrain, (3) the addition of the Christmas Day ice storm, (4) the difficulty accessing facilities, and (5) the other complicating factors listed above; however, Staff was unable to determine that these factors fully accounted for the eleven-day difference (eighteen days vs. seven days) between ODP's restoration and APCo's (in the nearby Clintwood and Grundy areas). Regardless of the Staff's conclusion that a protracted restoration in certain areas was inevitable, the Staff is concerned that there may have been some management and/or logistical factors relative to the deployment of resources that further contributed to the longer duration in those areas.

For example, ODP reported that it had deployed a maximum of 658 off-system mutual aid and resident contract linemen in its territory by day six of the outage (December 24). APCo reported that it had deployed 180 mutual aid and contract linemen in the Clintwood area by day six. In other words, by day six of the outage, APCo had deployed approximately one fourth the number of mutual aid and contract linemen as ODP for an area that is approximately the same size and has approximately the same number of circuit miles. A similar comparison can be performed to show that ODP was able to deploy more tree contractors than APCo. Charts comparing resources deployed by day of the outage are provided on the following page.

Furthermore, in response to a Staff data request (Question 1-009) regarding the need for mutual aid, APCo reported that it had learned on December 24th, the sixth day of the outage, that ODP was planning to release approximately 600 workers from Norton on Christmas Day. APCo reportedly "assessed the status of its restoration efforts and concluded that most of its needs had been met, there were few new outages at that time,





and the logistics (safety, lodging, support) of adding more people to the area would be difficult." Based on this assessment, APCo requested and received twenty crews, or a total of ninety-one external line personnel, to begin work in the Clintwood/Grundy area on December 27th. With this influx of new linemen, APCo reported that it eventually achieved (by day eleven of the outage) a daily maximum of approximately 761 mutual

aid and contract linemen in the Clintwood and Grundy areas combined.[26] In just the Clintwood area, the daily maximum of approximately 554 mutual aid and contract linemen was reached on day fifteen. APCo indicated that it did not have an accurate count of the Company's own line resources used in these areas on a daily basis; however there were approximately 150 Company line employees who worked in the Clintwood and Grundy areas on various days throughout the major event.

The Staff is concerned (1) that APCo's field investigation teams might have underestimated the number of linemen needed in the Clintwood and Grundy areas and/or (2) that APCo failed to manage the logistics necessary to accommodate the number of linemen needed to accomplish a timely restoration. In order to further validate or discount these concerns, the Staff performed additional analysis. The Staff determined that it would be worthwhile to compare APCo's performance after the December snowstorm in the Clintwood and Grundy areas with that of DVP's performance in the Gloucester/Northern Neck areas after Hurricane Isabel in 2003, given certain similarities with geographic constraints and restoration performance. The results are provided in the following section.

COMPARISON OF APCO AFTER THE SNOWSTORM WITH DVP AFTER HURRICANE ISABEL

The December 2009 snowstorm was not the first major storm in Virginia for which the restoration effort extended into a third week. While the restoration effort after the December 2009 snowstorm approached nineteen days, the restoration effort following Hurricane Isabel in 2003 reached sixteen days in some areas of DVP's system. Both

[26] The maximum daily number of 761 APCo-related mutual aid and contract linemen in the Clintwood/Grundy areas occurred on December 30, 2009, and included 728 mutual aid contractors and 33 line contractors; however, this did not represent a coincident peak as the number of line contractors peaked at 44 on January 4, 2010.

Hurricane Isabel and the December 2009 snowstorm were whole tree events that resulted in prolonged restoration efforts and record impacts on the energy infrastructure. Although Hurricane Isabel was more widespread in its effect on DVP's territory, the Staff believes a case can be made that the December 2009 snowstorm created similar hardships in certain areas of APCo's territory. In particular, the Staff was interested in investigating the similarities between the restoration effort in APCo's Grundy and Clintwood areas following the December 2009 snowstorm and the restoration effort in DVP's Northern Neck and Gloucester areas after Hurricane Isabel. In each situation, the utilities were faced with geographical constraints, excessive infrastructure damage, and under deployment of resources. These are discussed in more detail below.

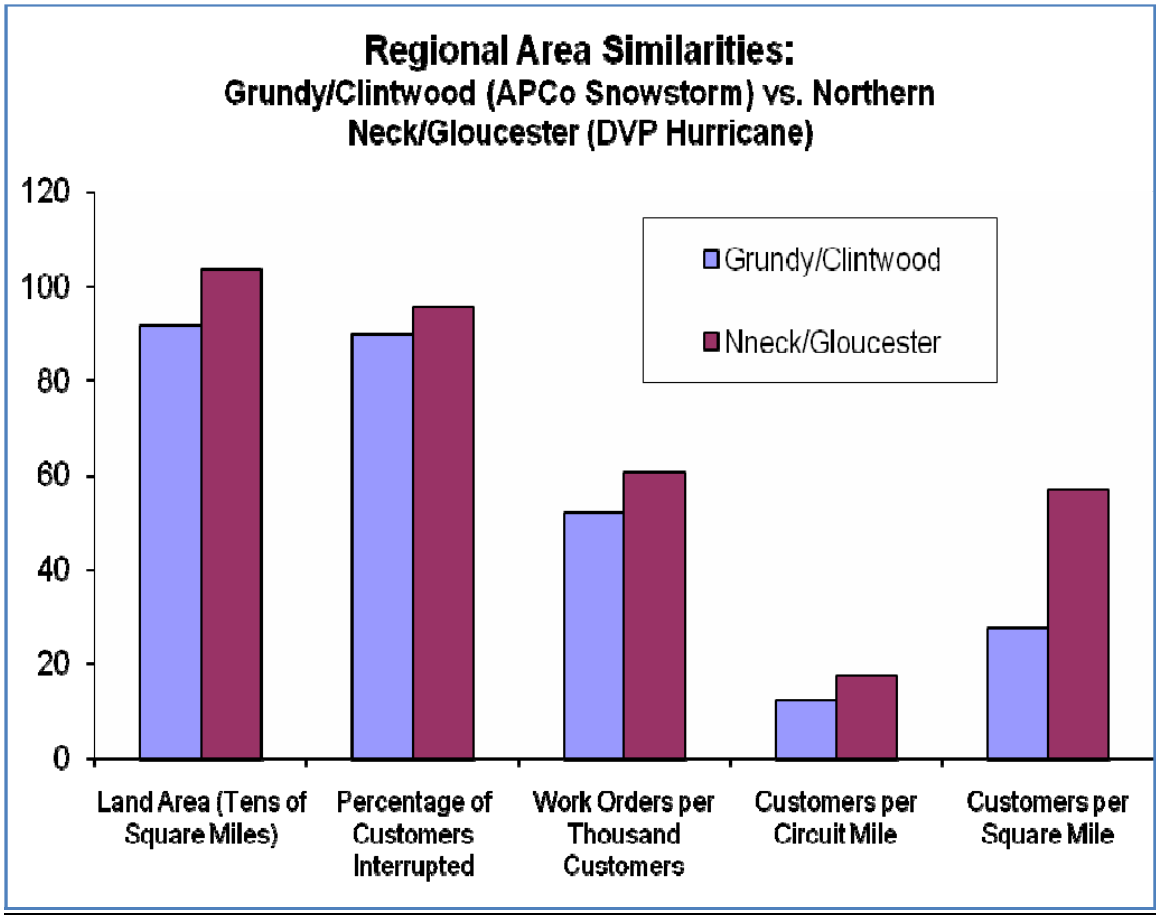
First, although the terrain in these areas is completely different, both exhibit geographical constraints that can hamper restoration efforts. Gloucester's geography, consisting of hundreds of fingers of land jutting into the Chesapeake Bay, lends itself to a high number of radial lines with few customers per circuit 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. Likewise, the mountainous terrain in APCo's Clintwood/Grundy areas presented restoration challenges and consists of a number of radial lines with even fewer customers per circuit mile. APCo reported that roads in the area were difficult to use even a week after the snowstorm and most of the work that had to be done was well off the road requiring manual techniques for material hauling, tree trimming, and facility repair.

Second, Hurricane Isabel's impact was greatest in the Gloucester and Northern Neck regions of DVP's territory, based on maximum and sustained wind speeds. And DVP's Gloucester and Northern Neck regions sustained a substantially greater number of damage locations, broken poles and broken cross arms than did nearby cooperatives. Within DVP's own territory, the Gloucester/Northern Neck region sustained more damages per 1000 miles of distribution circuit than any other region. Likewise, the impact of the December 2009 snowstorm appeared to be greatest in the Clintwood and Grundy areas of APCo's territory. According to APCo the National Weather Service reported that the snow that fell near Clintwood was the wettest in the state, and therefore the heaviest. APCo's Clintwood and Grundy areas sustained a substantially greater number of damage locations, broken poles and broken cross arms than did other areas of APCo's territories or nearby utilities and cooperatives.

Third, after Hurricane Isabel, resources had been under-deployed to the Gloucester/Northern Neck region in the initial stages of the outage. DVP had executed a resource deployment plan based on the Company's own meteorological forecasts and those of the National Weather Service; however, more damage was inflicted in those areas than anticipated. In addition, the community was unable to support a large influx of field personnel and uprooted trees limited the early accessibility of some circuits. As a result, in effect, resources had been under-deployed to the Gloucester/Northern Neck region in the initial stages of the outage. Mutual aid and Company resources from the central regions of the state were eventually diverted to Gloucester/Northern Neck to correct this deficiency. Likewise, after the December 2009 snowstorm, resources had been under-deployed to the Clintwood and Grundy areas in the initial stages of the

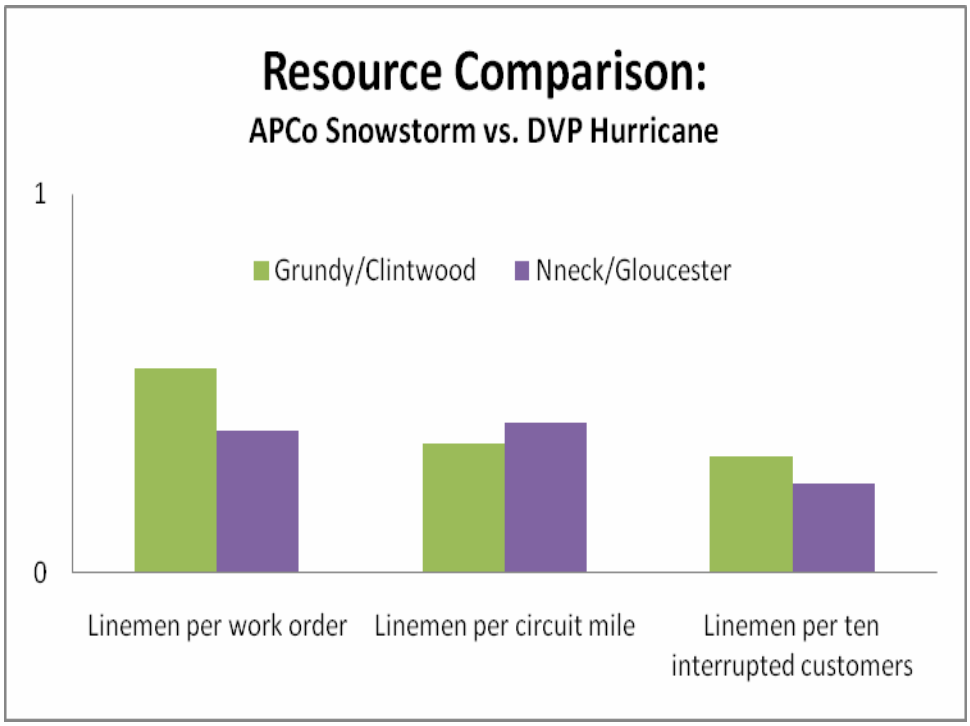
outage. APCo reported that access and logistical support issues limited its ability to send crews into the area. In addition, the loss of water to Dickenson and Buchanan Counties shifted focus to those facilities and strained logistical support for repair crews.

In order to further test the similarities in the challenges faced, resources assigned, and restoration accomplished by APCo in 2009 (in Grundy and Clintwood) and DVP (in Northern Neck and Gloucester) in 2003, the Staff performed a comparative analysis using a number of different metrics as depicted in the following chart.

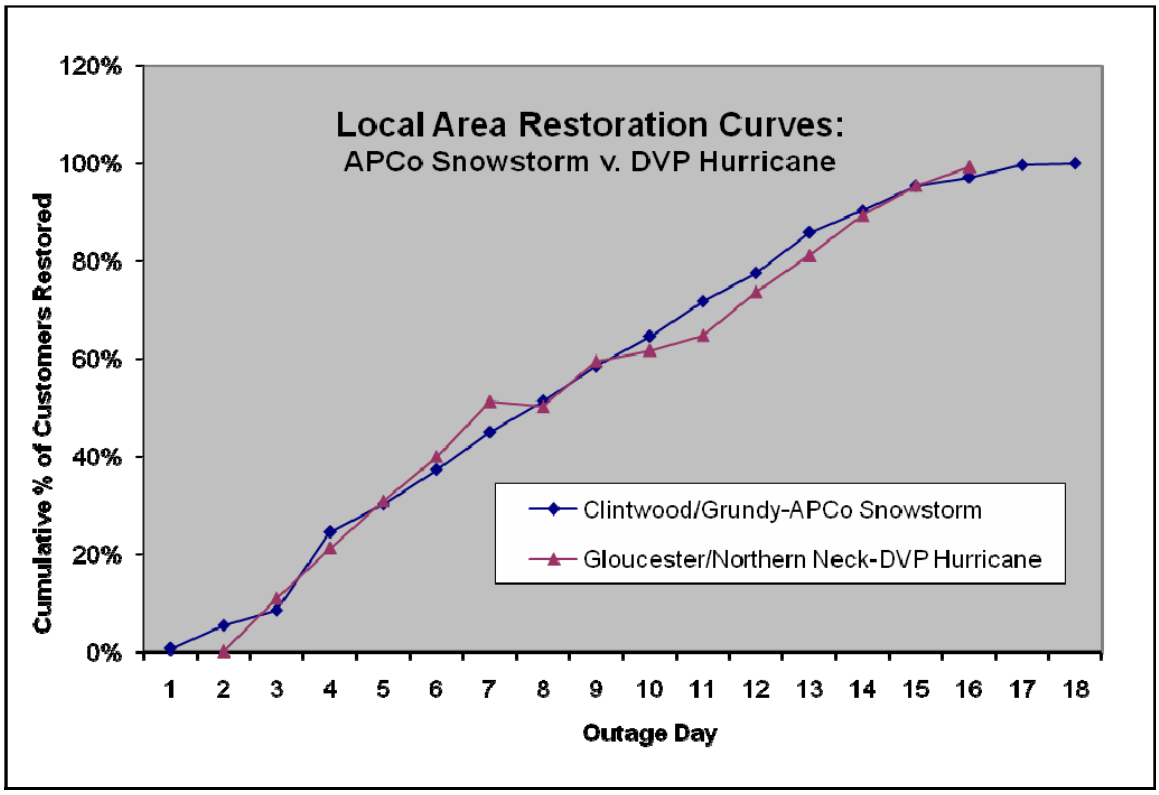


Although the combined Grundy/Clintwood land areas and the combined Northern Neck/Gloucester land areas are of similar magnitude and certain other regional

similarities exist on a normalized basis, on an absolute basis DVP's Northern Neck/Gloucester area has roughly 2½ times more customers and sixty percent more circuit miles than APCo's Grundy/Clintwood area. In addition, DVP's Northern Neck/Gloucester area sustained roughly 2½ times more customer outages and 2½ times more work orders following Hurricane Isabel than APCo's Grundy/Clintwood area following the December 2009 snowstorm. It comes as no surprise to find that DVP assigned approximately 2½ times more linemen to the area. Similarities in the restoration effort remain even when certain other metrics are normalized. For example, as shown in the following chart, the peak number of linemen assigned per work order, per circuit mile, and per interrupted customer were the same order of magnitude for both APCo and DVP in the localized areas.



Finally, the following chart indicates that the restoration curves for both APCo (in the Clintwood/Grundy areas after the snowstorm) and DVP (in the Gloucester/Northern Neck areas after Hurricane Isabel) were nearly identical.



The Staff believes the foregoing analysis confirms that geographical constraints, excessive infrastructure damage, and under-deployment of resources contributed to the unprecedented outage in portions of APCo's territory. Similar circumstances contributed to unprecedented outages in portions of Virginia Power's territory after Hurricane Isabel in 2003. Although some of the factors that contributed to the unprecedented duration of the outages were beyond the control of the utilities in both circumstances, the Staff has concerns similar to those raised relative to DVP's restoration after Hurricane Isabel,

namely, an apparent lack of resources deployed in certain geographical areas. Given the results of the analysis in the preceding section, the similarities described herein relative to both the snowstorm and Hurricane Isabel, and the Staff's concerns, the Staff is making recommendations similar to some made for DVP in the Staff Report on Hurricane Isabel. These recommendations address the deployment of resources in remote areas that present challenging conditions.

The Staff recognizes that 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 APCo's overall 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 impassable roads, 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. Although a standard of perfection is not expected, the Staff requests that APCo review its restoration plan for possible improvements in estimating resource needs, the mobilization of mutual aid and contract personnel following a multi-region event, and logistics to accommodate a larger workforce. In particular, APCo should attempt to develop innovative ways to deploy and support additional resources in the Clintwood and Grundy areas in the event of a similar event given the special conditions that exist in those regions. Other regions with similar special conditions should be considered as well.

RIGHT-OF-WAY MAINTENANCE

Following the December 2009 snowstorm, certain customers and representatives of local governments expressed concerns about the adequacy of the utilities' right-of-way maintenance practices and the potential correlation of such practices to the destruction of distribution infrastructure during the snowstorm. Based on investigation and analysis, the Staff has developed some recommendations relative to right-of-way maintenance which will be discussed in detail in subsequent paragraphs; however, the Staff believes the utilities have made good faith efforts to increase annual spending on tree trimming and to employ aggressive trimming. Unfortunately, the right-of-way maintenance practices employed currently did not prevent the extensive destruction from the snowstorm. However, the Staff believes that the snowstorm event was of limited value for assessing the effectiveness of the utilities' tree trimming programs because much of the damage to the utilities' infrastructure was due to whole trees being uprooted.

The widespread destruction of utility infrastructure from whole trees is not without precedent in Virginia. Climate conditions in the years prior to the snowstorm and the severity of the storm provided a situation similar to that encountered in 2003 with Hurricane Isabel. The following conclusions taken from a 2004 Staff Report relative to Hurricane Isabel are also relevant for the December 2009 snowstorm:

> The Virginia State Climatology Office concluded that the destruction of the trees was inevitable due to the presence of an aging and overgrown forest of urban and suburban trees. Contributing factors included tree damaged root systems due to past prolonged drought, saturated ground from excessive rainfall, and sustained storm force winds.[27]

[27] *Preparation for and Response to Hurricane Isabel by Virginia's Electric Utilities*, Special Report of the Division of Energy Regulation, (September 20, 2004)

The three years prior to the snowstorm were years of extreme drought. According to NOAA, the "Drought of 2007–2009 which affected most of the Blacksburg/Roanoke WFO Hydrologic Service Area was the worst since the 2000–2002 drought. By some measures it surpassed that drought . . . ."[28] 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. 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.[29] Following the drought years, 2009 was much wetter than normal. Therefore, the factors contributing to the toppling of whole trees during the snowstorm may have included tree damaged root systems due to past prolonged drought, shallow roots, saturated ground from excessive rainfall, sustained high winds, and heavy, adhesive snow.

During the Staff's field visit to the utilities' territories in March, the Staff did not observe any obvious deficiencies in the condition of the utilities' rights-of-way; however, admittedly, the Staff was able to observe only a fraction of the total miles of right-of-way. In addition, the Staff analyzed tree-trimming-related historical data collected on an annual basis in an attempt to determine whether there appeared to be any spending cuts or deterioration in service related to right-of-way maintenance practices. The results of the Staff's investigation into the utilities' vegetation management practices are provided as follows.

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[28] *The 2007-2009 Drought*, Peter Corrigan, NOAA 'Bout Weather, Spring 2009 Edition, NWS, Blacksburg, Va., http://www.erh.noaa.gov/rnk/Newsletter/Spring_2009/drought/drought_07_09.html

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

PVEC

PVEC conducts vegetation management and trims trees along approximately one thousand miles of overhead distribution right-of-way in Virginia in order to maintain reliability and protect the distribution system during periods of extreme weather. Like most utilities in the state, PVEC employs a cycle-based approach to tree trimming. Specifically, the Co-op maintains its rights-of-way by means of a five-year tree trimming cycle in which it trims trees along approximately 200 miles of overhead lines per year. According to annual reports provided by PVEC to the Staff, unit spending on tree trimming programs increased from $1,700 per mile in 2000 to $2,264 per mile in 2009. However, during that same time period, the average outage duration per customer (excluding major storms) increased by approximately thirty-five percent (from 3.9 hours to 5.3 hours), although only a portion of the increase would probably be attributable to tree outages. The Staff believes that PVEC may be able to improve reliability to its customers with some enhancements to its vegetation management practices.

ODP

Like PVEC, ODP has approximately 1,000 miles of overhead distribution right-of-way which it maintains by trimming trees along an average of approximately 200 miles of overhead lines per year on a five-year cycle.[30] According to annual reports provided by ODP, unit spending on tree trimming programs increased significantly from $2,400 per mile in 2001 to $4,667 per mile in 2008. However, during this same period of time, both the annual number of tree-related outage events and the duration of tree-related outages increased significantly. The Staff believes that ODP may be able to reduce the number and duration of tree-related outages with more aggressive tree trimming.

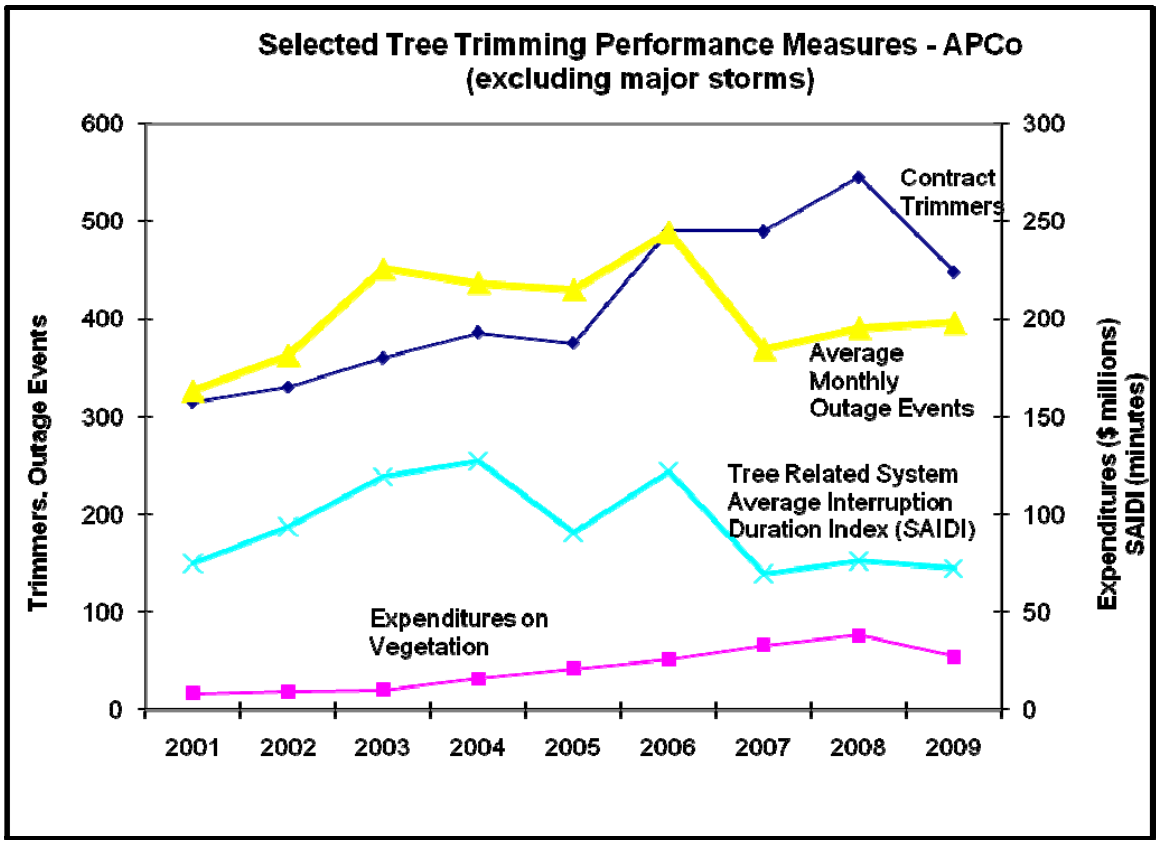
[30] ODP reportedly employed a tree trimming cycle of between three and four years in 2000 and 2001.

APCO

APCo routinely trims trees along the right-of-way corridors that carry a system-wide network of nearly 27,000 miles of overhead lines to its customers. Unlike most utilities in the state, APCo's current policies and practices follow a performance-based approach, rather than a cycle-based approach, designed to focus distribution right-of-way maintenance resources where, theoretically, they can produce the greatest improvements in service reliability. Under the performance-based approach, APCo uses four sources of information to determine where right-of-way maintenance should be performed: (1) regularly scheduled visual inspection to assess the condition of approximately twenty percent of the distribution circuits each year, (2) reliability data, (3) customer density, and (4) specific customer complaints.

As the following graph indicates, total spending on tree trimming programs reportedly increased from $8.5 million in 2001 to $38 million in 2008, representing an annual average compound growth rate of roughly twenty-five percent; however, Staff notes that spending decreased in 2009. Part of the historical increase was attributed to increases in both routine tree trimming and tree removal. For 2008, funding included approximately $25 million total for routine tree trimming and $11.5 million for tree removal, while in 2009 funding for routine trimming and tree removal decreased to approximately $16.8 million and $8.9 million, respectively. In addition, the number of contract tree trimmers has also increased steadily from 2001 through 2008 before decreasing in 2009. Although the average monthly number of tree related outage events and the average outage time attributed to tree-related outages increased for much of the

decade, these indices returned to earlier levels in 2007, 2008 and 2009. The Staff believes APCo may be able to reduce tree-related outages and the impact of whole trees on its infrastructure by improvements to its vegetation management practices.



Staff's Assessment

As mentioned previously, the Staff believes the utilities have made good faith efforts to increase annual spending on tree trimming and to employ aggressive trimming; however, based on an analysis of certain reliability data, it appears the companies may need to enhance their vegetation management practices in order deal with an aging and overgrown forest of urban and suburban trees. Regarding the companies' right-of-way ("ROW") vegetation management practices, the Staff recommends that the utilities

maintain the full widths of their rights-of-way[31] and increase expenditures for tree trimming as necessary to stabilize tree-related outages. While the Staff did not find significant deficiencies in the companies' right-of-way clearing on its limited post-event field visit to southwest Virginia, it is the Staff's opinion that many areas could use more aggressive trimming. The Staff believes that aggressive trimming is especially critical along circuits in remote off-road locations that are difficult to access, and that cycle trimming may be more conducive to regularly addressing such needs in a timely manner. The Staff also recommends that the utilities attempt to educate municipalities and landowners of the potential long-term benefits of removing aging, overgrown hazard trees that exist outside of the utilities' rights-of-way but nevertheless present a growing danger to the companies' distribution infrastructure.

With respect to a change in APCo's approach to trimming, the Staff notes that APCo has previously expressed an interest in returning to cycle trimming. For example, in pre-filed written testimony before the West Virginia Public Service Commission ("PSC"), Philip A. Wright, APCo's Vice President of Distribution Operations, indicated the following:

> However, if sufficient funding were approved, the Companies would prefer a more aggressive cycle-based approach which calls for all ROW to be maintained approximately every four years, in which event there is little doubt that ROW conditions could be improved. As Company witness Eads notes in his testimony, the Companies intend to make a reliability filing in the near future in which they will present for the Commission's consideration a specific proposal for an enhanced approach to ROW maintenance.[32]

[31] APCo uses forty-foot ROW: ODP uses forty-foot ROW for three-phase lines, but only thirty-foot ROW for single phase lines; DVP, the state's largest utility, uses thirty-foot ROW for all distribution lines.

[32] *Direct Testimony and Exhibits of Philip A. Wright*, General Investigation into Power Outages that Occurred During and After the Winter Storm on December 18 and 19, 2009, West Virginia PSC Case No. 10-0019-E-GI, January 29, 2010, pp. 20-21

In addition, in a case before the Virginia Commission, APCo witness Wright stated in pre-filed written testimony that "APCo recognizes the benefit of a cycle-based approach to vegetation management over the long term and needs to eventually implement such a program. However, the Company realizes that now is not the time to implement this program given current economic conditions."[33] The Staff recommends APCo more aggressively maintain distribution rights-of-way and evaluate the benefits of a return to cycle trimming. The Staff recommends that PVEC and ODP consider a shorter trimming cycle and more aggressively maintain distribution rights-of-way in areas where reliability has declined and/or in areas where the potential impact from trees during catastrophic storms is significant.

MAINTENANCE OF WOOD UTILITY POLES AND OTHER EQUIPMENT

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 APCo during the snowstorm, 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 are provided in the following paragraphs.

[33] *Direct Testimony of Philip A. Wright*, SCC Case No. PUE-2009-00030, p. 10

According to Osmose Utilities Services, Inc. ("Osmose"),[34] 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 twenty-five percent or more are decaying and weakened.[35] Such inspection programs typically include visual inspections, sounding and boring tests, and ground-line treatments with insecticide/fungicide. APCo contracts with Utility Pole Technologies ("UPT") Inc., a division of Asplundh, to conduct a comprehensive inspection and remedial treatment program for their wood poles. ODP has contracted with UPT to implement a formal inspection program beginning in October or November. DVP contracts with Osmose. PVEC employs a full-time pole inspector.

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. In 2008, UPT inspected over 500,000 poles for APCo which replaced 744 poles. APCo also reinforced 752 poles in 2008 and replaced another 188 wood poles as a result of damage from major storms in 2008. Since 1992, ODP has used linemen to inspect its poles as routine work was conducted in an area; however, as previously mentioned, ODP plans to implement a formal inspection program starting in October or November 2010. ODP plans to complete the inspection by 2013 and to inspect poles on a 10-year cycle thereafter. DVP inspects its poles on a twelve-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. Powell Valley Electric

[34] Osmose provides services and products designed to extend the useful life of critical utility infrastructure.
[35] *Overview: Asset Management and Pole Maintenance*, Osmose, www.osmose.com, (January 22, 2004)

Cooperative employs a full-time pole inspector to perform pole inspections on an eight-year cycle. Prior to 2007 PVEC had relied on random inspections of its wood poles by field linemen and engineers. APCo maintains its pole inspection data in a central in-house Oracle database for tracking and reporting purposes, while ODP maintains its pole records in Smallworld GIS. PVEC uses a GIS mapping database.

The utilities generally attributed wood pole failures during the December 2009 snowstorm directly or indirectly to tree contact. According to APCo, 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 confirmed these observations during its field visit in March.

The Staff is aware that some concerns have been expressed relative to the possibility that the utilities' infrastructure might be old and, therefore, in poor condition. However, according to Daniel O'Neill, a former Director of Navigant Consulting,[36] age alone is not always a determinant of equipment condition. In fact, O'Neill stated 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 noted 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 after Hurricane Isabel in 2003, the Staff contacted the National Electric

[36] *Reliability Tradeoffs*, Electric Perspectives, (January/February 2004)

Energy Testing Research and Applications Center ("NEETRAC").[37] According to the NEETRAC's program manager for mechanical systems,[38] 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.

The Staff believes APCo's, ODP's, and PVEC's approaches to the inspection and maintenance of their wood utility poles is reasonable and comparable to other utilities; therefore the Staff makes no recommendations at this time. In addition, the Staff has determined that APCo's inspection and maintenance of its overhead wires and devices is reasonable and comparable to other utilities. The Staff also found no evidence that any potential lack of maintenance of electrical wires had any impact on the extent of the outage. With respect to the contention that heavier wire should be used or that the existing wire had deteriorated, the Staff notes that using heavier wire than required by industry standards might actually result in an unintended consequence of more broken poles, as the heavy wire (when pulled by a fallen tree) could impart more force on a pole before the wire breaks. Furthermore, the existence of old, brittle wire would probably preclude the possibility of the wire pulling down a utility pole. However, the Staff is not advocating that utilities tolerate the existence of old, brittle copper wire and recommends that utilities implement a plan for locating and replacing such wire in a timely manner.

[37] 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.
[38] Paul L. Springer III, PE, landline communication, January 21, 2004

COMMUNICATIONS

Effective communication is a key component to the successful recovery from a major outage incident such as the December snowstorm. During such events the public relies on both the utility and government officials to provide individuals and businesses, as well as operators of local critical infrastructure facilities (e.g., water pumping stations, hospitals, etc.) with sufficient information to develop plans for coping with the loss of electric service for an extended period. The public also seeks a sense of assurance that service restoration is being well-managed, progress is being made, and that life will return to normal as quickly as possible. Accordingly, it is essential for utilities to plan and execute effective major-outage communication protocols for effective communications with customers and public officials, including emergency management personnel, during major events. Failure to do so will result ultimately in the loss of public confidence.

Effective communication following a major weather event can be extraordinarily complex because of the initial lack of information relative to the scale and scope of facility damage, 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 APCo, 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 raised relative to APCo during and after the storm.

Communication with Consumers

As a result of the outages caused by the snowstorm, the Commission Staff received approximately 160 consumer complaints and inquiries. The vast majority of these calls were from APCo consumers. The primary concern expressed by consumers was related to estimated restoration time. Most callers were simply looking for information relative to when their service would be restored. Consumers expressed frustration that they could not get an accurate estimated restoration time ("ERT") from APCo and, as a result, could not adequately make plans for their families. Additionally, consumers indicated that the ERT provided by the Company changed frequently throughout the restoration effort adding to their frustration and sense that the Company was either being untruthful or was not competent.

Of equal concern was the Company's inability to provide accurate system restoration goals. Throughout the first week of the restoration effort, the Company continually provided information indicating that service restoration would be completed on or about Christmas. In a press release issued on December 21, 2009, the Company stated "while many people will have power restored today and tomorrow, some areas will not be restored until the end of the week." In a later press release issued on Thursday, December 24, 2009, the Company stated "most customers still without electricity should have service restored by Friday night. In areas with extensive damage (Boone, Logan and Mingo Counties in West Virginia, and Buchanan, Dickenson, Russell, Scott and Wise Counties in Virginia), the restoration effort will continue through the weekend." Ultimately, the Company did not complete restoration until more than a week after these system restoration estimates. Such inaccurate estimates led to customer confusion and

anger. Consumers expecting to have their service restored on or before Christmas were not only angry, but became skeptical about the Company's ability to manage the restoration effort. This skepticism likely led to an increase in the number of complaints.

According to APCo, the Company's philosophy related to providing ERTs has not changed recently. Essentially, the Company's plan is designed to provide ERTs that evolve during the course of the major storm restoration effort. Following a major storm the Company initially sets a general event ERT that is reported to all customers. Once the Company is able to complete an initial assessment of the damage in the field, it modifies the ERT to better match the Company's expectations for specific geographic areas. All consumers in each specific geographic area will receive this revised projected ERT. Finally, once crews arrive in the field, a final ERT is developed based on a detailed damage assessment performed by the field crews. This newly revised ERT is then provided to customers directly impacted in the area being worked by these crews.

Understandably, the Company cannot provide specific restoration information immediately after major storms that result in significant infrastructure damage and customer outages. Damage assessments must be conducted to develop reasonable ERTs. In this storm, the rugged terrain and difficult travel conditions further complicated the assessment and restoration process. However, the Staff strongly believes that the Company should review its philosophy related to providing ERTs in an effort to improve its ability to provide realistic general restoration targets and reasonably accurate customer specific ERTs as soon as possible following such events. Failure to provide such reasonably accurate ERTs reduces the public's confidence in the utility and negatively impacts the consumer's ability to adequately plan for the extended outage.

Communication with Emergency Management Officials

In addition to the consumer complaints, several localities expressed concern with the adequacy of communications with APCo. The Staff attempted to discuss the Company's performance with government representatives from each of the hardest impacted counties including Buchanan, Dickenson, Russell, Scott, and Wise. While the Staff was not successful in its attempt to speak with representatives from all the counties, the localities the Staff did speak with indicated that generally they need the following information after a major outage: (1) locality specific information relative to the number of their citizens that are without power and (2) accurate ERTs relative to their critical infrastructure, such as 911 centers, major medical facilities, and pumping stations. Such information is consistent with what Staff has found in post storm reviews of previous storms.

Each locality the Staff spoke with indicated that APCo failed to adequately communicate. Specifically, emergency managers did not have direct contacts within the Company. Instead, they were required to call the Company's general call center number to obtain information. Such a process was time consuming and frequently resulted in receiving incomplete information. As a result, the county representatives were unable to communicate as effectively as possible with their citizens.

According to APCo's communications plan, the Company utilizes its external affairs managers to communicate with localities both prior to and during a major storm restoration. Specifically, the external affairs managers communicate with county administrators and legislators. The Company relies on these county officials to forward relevant information to emergency managers. Prior to a storm, the external affairs

managers provide county administrators and legislators information related to storm projections and Company actions being taken to prepare for the storm. The Company typically utilizes email to make such notifications. After a storm has occurred, the Company provides the localities updates that include: number of outages, general outage locations, damage assessments, and general ERTs. Such updates are typically provided daily via email, but may be supplemented with telephone calls and faxes. The Company states that in addition to the email updates, localities may contact external affairs managers if they have specific questions or concerns. As necessary, the external affairs managers work with APCo distribution personnel to obtain answers to the questions and provide responses to the localities.

The localities stated that this plan was not sufficient during a major event such as the December 18 snowstorm. In short, they found it difficult at times to reach anyone within the Company. As stated above, more than one locality indicated that it did not have contact information for Company personnel and instead was required to call the general APCo call center number to get information. In such situations, the call center personnel were typically not capable of providing adequate responses. Furthermore, the localities could not get adequate information relative to the restoration of their critical facilities. The localities indicated that APCo'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.

Locality concerns related to adequate communication is not new and not isolated to APCo. Following Hurricane Isabel in 2003, the Staff heard similar concerns from

localities within Dominion Virginia Power's ("DVP") service territory. In its report following Hurricane Isabel, the Staff recommended that DVP establish a process to routinely update communication contacts and protocols with emergency management personnel and the electric cooperatives. Similarly, at this time, the Staff recommends that APCo make a concerted effort to work with each locality in its service territory. First, the Company should develop a process for communicating directly with emergency managers in addition to the county administrators and legislators. Second, the plan should allow emergency managers the opportunity to contact Company officials directly rather than require emergency managers to contact the Company call center when it has questions or concerns. Third, APCo should work with each locality within its service territory to develop a comprehensive list of critical facilities. The Staff understands that no utility can guarantee uninterrupted service, even to critical facilities. Therefore, it is important that APCo advise localities that there is no guarantee of uninterrupted service and that the locality should be prepared to deal with extended interruptions of electric service in certain circumstances. Fourth, APCo should include in its plan a process for routinely updating contact information and critical facility lists. It should be understood that while the Staff believes that APCo 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.

In conclusion, the Staff believes that APCo should review and improve its plans and protocols for communicating with the public, emergency management coordinators, and restoration partners, including the process for developing and providing customers with reasonably accurate ERTs.

RECENT ENHANCEMENTS AND LESSONS LEARNED

Electric utilities typically perform post storm critiques and then implement corrective actions for lessons learned in an effort to improve future restoration efforts. The following are responses from ODP, PVEC, and APCo to Staff data requests on actions implemented since 2003 and lessons learned from the December snowstorm.

ODP

In response to a Staff data request relative to enhancements in restoration that had been implemented since Hurricane Isabel in 2003, ODP provided the following comments:

> ODP has continued to prioritize storm restoration based on critical customers, such as hospitals, customers with "life support equipment", police stations and government detention institutions, fire, nursing homes, essential communications services, water and sewage services, transportation and defense-related services, and circuits with the highest density of customers.
>
> In 2003-2004, a centralized outage management system (OMD) was implemented that manages outage events across the [E.ON U.S.] Companies. This system has improved facility information and can better predict device outages based on customer calls.
>
> In addition to the OMS, the Companies are implementing numerous communication improvements for customers. Estimated restoration times ("ERTs") are now being provided to customers via Voice Response Systems, and Customer Service Representatives. Interactive Online Outage Maps will be made available by the end of the first quarter of 2010. The Companies are also exploring other channels of communication, such as email, texting, and automated outbound calling for providing estimated restoration times.
>
> Since 2003, the Companies have expanded its membership in mutual assistance participation. Today, the Companies maintain active memberships in Great Lakes Mutual Assistance ("GLMA"), Midwest Mutual Assistance ("MMA"), and Southeastern Electric Exchange ("SEE").
>
> The Companies have adopted an Incident Command System ("ICS") structure for responses to emergencies and outage events. The structure is one component of the National Incident Management System ("NIMS"), and accommodates all types and sizes of emergencies. Finally, the ICS provides for standard communications during emergencies to key stakeholders, both internal and external to the Companies.

With respect to lessons learned after the December 2009 snowstorm, ODP noted that it conducts post storm reviews after every significant weather event impacting service deliverability, to help better prepare for future events. A review of the lessons learned in three major categories from the snowstorm produced the following opportunities for improving future storm responses:

1. Customer Outage Information. "Customers continue to desire and need more accurate and timely information pertaining to outages affecting their homes and businesses. Lessons learned from the storm validated Company plans to deploy an interactive web based application which will enable customers, emergency response agencies, government officials, and the public to view outage information and predicted restoration durations in various formats."[39]

2. Expanded Use Of Technology. Although wireless/cellular communications capabilities remain a challenge in mountainous areas, such "technologies would have been beneficial during the restoration effort to expedite information exchanges with field personnel and reduce the need to have field resources check in at the storm management center or staging area to assign work or exchange information." "The [E.ON U.S.] Companies continue to assess and deploy mobile technologies in various operational maintenance areas, and plan to begin implementation of expanded mobile technologies and applications in outage restoration areas during the period 2010–2012."

3. Emergency Coordination. "Throughout the storm event, ODP established and maintained proactive communications with local and state government officials as well as local emergency management agencies. This practice fostered a positive partnership with the communities and key leaders, enhancing the restoration effort and customer communications. Associated feedback from local emergency management and government has been positive. ODP will continue proactive communications in future weather events."

[39] The Staff notes that an interactive web based application may not be available to certain customers during a power outage even though the use of wireless technology has become more widespread.

PVEC

PVEC reported the following comments in response to the Staff's data request relative to lessons learned from the snowstorm:

> Our experiences have shown that each district better handles its service restoration by dispatching and working independently. In the event of major storms and as off-system contract crews arrive, it is advantageous to break existing utility field crews into individual "bird dogs" to facilitate greater production and efficiency by the off-system contractors. It is usually advantageous to split up contract tree trimming crews to individually assist the various line crews. For PVEC's terrain, it is advantageous to secure off-system contractors with four-wheel drive vehicles during the early part of power restoration. Even though the Christmas 2009 snow storm caused much damage, these damages were limited due to PVEC's strong right-of-way clearing and pole inspection programs.

APCo

In response to a Staff data request relative to Company philosophy regarding restoration management, APCo noted that its overall methodology regarding restoration management remains basically unchanged. However, the Company did provide the following information regarding a number of enhancements in restoration that had been implemented since 2003:

- Installed global positioning technology on all APCo vehicles equipped with 800 MHz radios to allow electronic transmission of information relative to outage causes and estimated restoration times to the Customer Solution Centers.

- Developed the Customer Outbound Information Notification System ("COINS") to automatically call customers for verification of return to service.

- Continued training of employees on the service restoration process and defined storm roles for each employee as identified in the Service Restoration Plan ("SRP").

- Identified locations across APCo's entire service area that could be utilized to stage large numbers of crews working to restore service during major weather events.

- Upgraded servers for the PowerOn Outage Management System in order to increase the user capacity of the Outage Management System.

- Increased the number of assessor teams who can receive and respond to trouble orders electronically, and equipped the assessors with personal voltage detector devices to enhance safety.

With respect to lessons learned after the December 2009 snowstorm, APCo provided copies of their district post-storm debriefs. The Staff attempted to aggregate and summarize the debriefs as follows:[40]

1. The roles of Company employees need to be reviewed; sufficient employees need to be properly equipped to fill necessary positions; employees need more training on some parts of the Service Restoration Plan ("SRP") such as the circuit coordinators, crew guides, information coordinators and damage assessors; and changes need to be implemented to improve communications between key positions.

2. The Company needs to have meetings with local planning authorities in order to improve the content, coordination and implementation of a disaster plan for major storms with catastrophic impacts.

3. The list of staging areas needs to be reviewed and alternatives considered based on population density and circuit routes. The Company needs to consider establishing central staging areas in remote areas with the goals of optimizing communications and operations and remotely operating PowerOn. The Company needs to ensure the availability of sufficient resources to serve all staging areas.

4. Logistics management should be separate from restoration management.

5. The Company needs to ensure that incoming line crews are managed efficiently, qualified to climb poles and work in mountainous terrain. Logistics for these crews need to be managed efficiently.

[40] The Staff has attempted to capture the most general lessons learned; however, this list does not include every district-specific improvement listed by the Company.

CONCLUSIONS[41]

- The record-level impacts caused by the December 2009 snowstorm 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 heavy snow and storm-force winds of those trees existing both inside and outside of the utilities' rights-of-way.

- Unlike many previous storms in Virginia (but similar to Hurricane Isabel in 2003) the December 2009 snowstorm can be characterized as a "whole tree event" with respect to the root cause of the devastation to the electric utility infrastructure. That is, much of the damage was caused by uprooted trees falling on the utilities' lines and poles – as opposed to being caused merely by broken tree limbs.

- 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.

- The loss of power to water and sewer pumping and treatment stations created a variety of problems in certain localities. For example, APCo reported that the loss of water to Dickenson and Buchanan Counties shifted focus to those facilities and strained logistical support for repair crews.

- The time required for full restoration of service following the December 2009 snowstorm was for most customers one week or less. Given the number of customers impacted and the extent of the damage, the outage durations for most of these customers were (from the Staff's perspective) neither unexpected nor unreasonable. However, Staff believes that the time required for full restoration of service for some PVEC and APCo customers could have been shorter.

- The Staff is concerned that the utilities may have utilized inadequate vegetation management, insufficient resources, and/or inadequately trained personnel in localized areas.

- APCo 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. APCo failed to communicate as effectively as possible with local emergency management personnel during the restoration effort. The failure was the result of poor maintenance of communication contacts and protocols. In addition, APCo did not have a completely up-to-date list of critical facilities, including critical water pumping stations, which hampered communications.

[41] The findings and conclusions summarized and listed in this section are the result of one or more of the following: (1) analysis of utility company responses to data requests, (2) meetings and conference calls with utility company management, (3) meetings with local county officials, (4) literature surveys, (5) utility territory field inspections, (6) customer complaints, and (7) analyses from other storm investigations.

RECOMMENDATIONS

- The Staff recommends that utilities that are currently not doing so begin to work with municipalities and educate landowners 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 companies' distribution lines.

- The Staff recommends that utilities aggressively maintain distribution rights-of-way for overhead distribution lines and increase expenditures for tree trimming and removal as necessary to reduce tree-related outages. The Staff also recommends APCo more aggressively maintain distribution rights-of-way in areas where reliability has declined and evaluate the benefits of a return to cycle trimming. PVEC and ODP should evaluate the benefits of more aggressive trimming and a shorter trimming cycle (for example, three or four years) in areas where reliability has declined and/or in areas where the potential impact from trees during catastrophic storms is significant.

- The Staff recommends that PVEC, ODP and APCo continue to rely primarily on mutual aid for restoration activities following catastrophic storms. The 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.

- PVEC, ODP and APCo should review deployment plans for possible improvements in the mobilization of mutual aid and contract personnel following a major storm.[42] In particular, APCo should attempt to develop plans to deploy and support additional resources in remote regions such as Buchanan, Dickenson, Russell, Scott, and Wise Counties in the event of a similar future event because of the geographic and logistical challenges in those areas.

- PVEC and APCo should evaluate logistics management alternatives for the purpose of supporting additional field resources in remote areas. For example,

[42] The Staff notes that ODP has already implemented a number of improvements as a result of recent major storms affecting the KU System and identified areas of continued focus based on its investigation following the December 2009 snowstorm. For example, ODP has (1) adopted an Incident Command System structure that separates management responsibilities for storm restoration, logistics, and communications, (2) employed a mobile command center, (3) contracted with an independent contractor to provide staging, catering, and sleeping arrangements for mutual aid linemen who could otherwise not be readily accommodated by the local community infrastructure, (4) made plans to expand mobile technology, and (5) established and maintained proactive communications with local and state government officials as well as local emergency management agencies.

consider retaining an independent contractor to provide staging, catering, and sleeping arrangements for mutual aid linemen who could otherwise not be readily accommodated by the local community infrastructure.

- PVEC and APCo should review the general concepts of the National Incident Management System ("NIMS") Incident Command System Structure ("ICS") to determine if there are any potential improvements that could be applied to the Company's existing distribution system service restoration plan.

- As documented in the report, APCo has identified (in district debriefs) a number of lessons learned where potential needs and improvements should be evaluated in the areas of pre-planning, assessment, restoration and post restoration. Staff recommends APCo evaluate these potential improvements and report the results to the Staff.

- APCo should upgrade the PowerOn System to enable a query of the number of work orders completed by day.

- APCo should evaluate the potential use of a Mobile Command Center in remote areas to facilitate communications and to support the storm management center.

- The Staff recommends that APCo review and update its plan to communicate with the public during major outage events with a focus on providing quicker system restoration goals and customer specific estimated restoration times.

- The Staff recommends that APCo establish a process to routinely update communication contacts and protocols with emergency management personnel.

- PVEC, ODP and APCo should provide a written update to the Division of Energy Regulation relative to the implementation of all recommendations in this report no later than December 1, 2010.

- APCo should also provide written updates of corrective actions taken or planned relative to the lessons learned and listed in the district debriefs no later than December 1, 2010.

APPENDIX

In the course of its investigation, the Staff reviewed a substantial amount of data and numerous maps from a number of different sources which are too voluminous to include in the report; however, this Appendix includes the following maps that provided important perspective to the Staff's analysis and conclusions.

- Topographic map of ODP and APCo areas in southwest Virginia
- National Operational Hydrologic Remote Sensing Center ("NOHRSC") snow depth map of the December 2009 snowstorm
- National Weather Service maps of the Christmas 2009 ice and high wind event