PEF Responses to E.I.W. Data Request

I. Introduction and Opening Remarks:

To be presented by PEF at the January 23, 2006 workshop.

II. Data Requests:

A. Studies completed by utility on assessment of nature and causes of storm related damages resulting the 2004 and 2005 hurricane seasons:

1. **Transmission lines and poles**
2. **Distribution lines and poles**
3. **Substations and transformers**
4. **Maintenance practices.**

(1) *Following every hurricane in the 2004 and 2005 hurricane seasons, PEF management, engineers and field personnel reviewed their observations related to the causes and nature of the damage experienced. PEF also reviewed data collected during and following each hurricane to better understand the specific impacts each storm had on PEF's transmission system. Based on these post-hurricane analyses, PEF found that structural damage constituted the majority of damage to PEF's transmission lines and poles. Given this fact, PEF believes that tornadoes and other strong wind phenomena, such as micro-bursts, played a significant role in causing the structural damage in many areas. As can be seen in the attached hurricane track maps, most pole failures occurred within a 25-mile band around the center of the storm track. In addition, as would be expected, the frequency of failures diminished with wind speed.*

Based on PEF's reviews, trees and other debris in lines also constituted a significant cause of structural damage and outages in many areas affected by the hurricanes. Failure modes for single pole structures varied with the failures occurring at the ground line, up to the middle of the poles. Additionally, some poles failed due to a cascading effect (i.e., failure of the adjacent structure causing additional stress on the next structure in the line). Tangent poles and dead-end poles failed in the approximate percentage of the overall population. In its post-hurricane analysis, however, PEF found no correlation between structural damage/failures and the presence of wood decay, wood pecker damage, knots, or irregularities in the wood poles.

Wood poles accounted for approximately 99% of all damaged transmission poles that required replacement. Wood poles account for approximately 80% of all PEF's transmission poles. Only 6 concrete/steel poles failed during cascading on line segments. To PEF's knowledge, no "engineered" poles (i.e., larger concrete/steel pole) or latticed steel towers failed during the storms. Overall, however, PEF's transmission poles performed well, with less than 2% of all poles – for all of the 2004 hurricane season -- requiring replacement.

(2) *As with its transmission lines and poles, after every hurricane, PEF assessed the damage to its distribution system and the causes and nature of the damage experienced.*

PEF also reviewed data collected during and following each hurricane to better understand the specific impacts each storm had on PEF's distribution system. In addition, PEF has engaged Davies Consulting, Inc. ("DCI"), a nationally recognized engineering consulting firm to:

- *Evaluate NESC changes related to strength requirements*
- *Research other applicable codes related to design strength*
- *Perform an age analysis of PEF facilities relative to code changes*
- *Evaluate restoration times for OH vs. UG*
- *Identify potential damage area(s)*
- *Analyze OH hardening options*
- *Analyze under-grounding opportunities*
- *Survey major storm hardening requirements nationwide.*

Based on PEF's internal review and initial results of DCI's review, falling trees and severe wind events (e.g., tornadoes and other strong wind phenomena) caused the majority of damage to PEF's distribution lines and poles.

(3) *Other than isolated wind damage to some fences and control house roofs, PEF incurred relatively little structural damage to substation equipment within the substation footprints. Based on PEF's post-hurricane analyses, vegetation contacts on transmission lines caused the vast majority of PEF's substation outages. Other storm damage requiring repairs to substations included transformer bank failures due to "through faults," switch damage due to overloads, relay damage due to water intrusion into control houses, and DC backup batteries becoming discharged.*

As a general matter, PEF was able to bring its substations back on line quickly by restoring the source lines to the substations. Attachment F shows the time taken to restore PEF substations after each of the three 2004 hurricanes.

(4) *Detailed damage assessments, noted in response to questions A(1) and A(2), indicate system damage was caused by environmental factors and not routine maintenance practices. Therefore, PEF has not initiated studies of its routine maintenance practices due to the 2004 and 2005 hurricanes.*

B. Studies underway by utility on storm damage, including anticipated completion dates:

1. **Transmission lines and poles**
2. **Distribution lines and poles**
3. **Substations and transformers**
4. **Maintenance practices**

(1) *Other than what is described both above and in the responses to the questions that follow, PEF is not currently involved in any studies specific to PEF's transmission system storm damage.*

(2) *In addition to the analysis detailed in response to question A(2) above, PEF has engaged DCI to assist with a nationwide study of electric utility storm hardening*

practices. PEF will review DCI's findings and determine what, if any, actions should be taken.

(3) *Apart from the analysis detailed in response to question B(2) above, PEF is not currently involved in any additional studies specific to PEF's system storm damage.*

(4) *Apart from the analysis detailed in response to question B(2) above, PEF is not currently involved in any additional studies specific to PEF's system storm damage.*

C. Academic, manufacturing, trade association, or other technical presentations or studies completed or underway addressing the nature and causes of storm related damages:

Apart from the KEMA study of FP&L's system as filed with FP&L's Petition for Issuance of a Storm Recovery Financing Order, FPSC Docket No. 060038, PEF is not aware of any academic, manufacturing, trade association, or other technical presentations or studies completed or underway addressing the nature and causes of storm-related damages.

D. Presentation of studies or additional factual engineering or meteorological information by other parties which might be useful in developing solutions.

As noted above, PEF has engaged DCI to, among other things, survey national requirements and assist in developing a comparative report.

In addition, the NOAA Maximum Envelope of Wind ("MEOW") has published experimental wind calculations as hurricanes pass over the peninsula of Florida. This information is included herewith as Attachment A. In summary, these wind calculations indicate that there is negligible wind reduction as hurricanes move across the narrow peninsula of Florida.

E. A map of Florida indicating the company's regional areas and the cumulative level of damaged facilities and customer outages caused by hurricanes and tropical storms in those areas from 2004 and 2005 hurricanes. Include in your response a listing of each storm, the storm wind speed, storm rain-fall, storm surge, and estimated storm restoration cost within the respective regional areas.

Please see the PEF System Map included herewith as Attachment B; Maps from the 2004 Hurricane season included herewith as Attachment C; Maps from the 2005 Hurricane Season included herewith as Attachment D; and the data table directly below.

Table E-1

	Charley	Frances	Ivan	Jeanne	Dennis	Wilma
Landfall	Aug. 13 2004	Sept 5 2004	Sept 16 2004	Sept 26 2004	July 10 2005	Oct 24 2005
Winds @ Landfall	145 mph	100 mph	125 mph	110 mph	120 mph	125 mph
Storm Surge	4.2 ft	5.8 ft	6-9 ft	4-6 ft	-	-
Rain	6-8 inches	10 inches	3-7	8-10	-	-

			inches	inches		
Estimated Cost to Restore (millions)	$152	$130	$8	$84	$3.6	$3.8

F. Current wind speed design standards for each major class of distribution and transmission equipment installed.

For transmission lines, the present design criteria for extreme wind loading are as follows:
Coastal (within 30 miles of the coast) = 135 mph, 60 deg. F, initial sag;
Inland (beyond 30 miles from the coast) = 120 mph, 60 deg. F, initial sag;
Importance factors of between 1.0 and 1.4 are also factored into the design. This design criterion exceeds that which is required by the 2002 NESC.

For distribution, there are no requirements for extreme wind loading for poles below 60 feet in height. PEF Distribution poles below 60 feet in height are required to sustain 9lb. per square foot, no ice.

G. For each hurricane in 2004 and 2005, please provide, on a regional basis if possible:

See Table F-1 below

a. Miles of overhead distribution wire replaced.
b. Number of overhead distribution wire splices.
c. Number of service drops replaced and/or re-attached.
d. Number of replaced distribution poles.
e. Number of braced distribution poles.
f. Miles of underground distribution cable replaced.
g. Number of underground services replaced.

See Table F-2 below

h. Miles of overhead transmission wire replaced.
i. Number of overhead transmission wire splices.
j. Number of replaced transmission poles and/or structures.
k. Number of braced transmission poles and/or structures.
l. Number of substations, relay stations, and switching stations repaired.

Table F-1

Distribution	Charley	Frances	Ivan	Jeanne	Dennis	Wilma
OH Wire Replaced (miles)	667	500	-	222	30	-
Splices Installed Feeder Level	3,700	1,900	15	1,280	35	1
Number of Service Drops	N/A	N/A	N/A	N/A	N/A	N/A
Poles Replaced	3,820	2,800	6	525	31	25
Number of brace poles	N/A	N/A	N/A	N/A	N/A	N/A
Transformers Replaced	1,880	1,560	15	570	137	0
Cable replaced	0	0	0	0	0	0
Services replaced	0	0	N/A	0	N/A	0

Table F-2

Transmission	Charley	Francis	Ivan	Jeanne	Dennis	Wilma
Miles of overhead wire out of service	700	1131	0	853	0	0
Number of splices	N/A	N/A	0	N/A	0	0
Number of poles/structures damaged	630	211	0	75	0	0
Number of poles/structures braced	0	0	0	0	0	0
Number of Substations out of service	83	105	0	86	0	0

H. A discussion of current reciprocal storm restoration agreements with other utilities and general storm restoration activities addressing the following:

*** Does the company ensure that facilities replaced and repaired by other utilities meet current wind speed and loading requirements?**

Yes. When contractors arrive at PEF staging sites, each crew lead is provided PEF specification packets. These specification packets incorporate PEF design and construction standards which ensures each crewmember has access to the required information to properly install poles, drill and frame to proper dimensions and install PEF supplied materials that meet or exceed NESC requirements. In addition, contract crews are assigned to qualified PEF personnel who coordinate with contract supervision to ensure each repair is completed as required. Furthermore, transmission line design issues work books to the construction crews to be used in the restoration. The work books are site specific and include replacement pole size/setting depth, all material, and framing standards. Transmission Construction Specifications are also issued to the crews.

*** How does the company ensure each temporary storm restoration activity is revisited and properly addressed?**

The Company follows a comprehensive storm plan to ensure the most effective method of restoration is utilized. During storm restoration, field personnel document all temporary installations. This information is given to the PEF Zone Coordinator at the end of each shift. This work is documented and filed at the local operations center for re-assignment during the clean up sweeps activity. The PEF management team overseeing this operations center is responsible for ensuring the temporary repairs made in their respective areas have been appropriately addressed prior to releasing contract resources or when the appropriate materials become available.

*** If 'like-kind' facilities are used to make repairs, does this mean that the company is temporarily or permanently adhering to an outdated design standard?**

No. By "like kind," PEF assumes the Staff means, for example, a 30 ft wood pole for a 30 ft wood pole, or a concrete pole for a concrete pole or a polymer insulator for a porcelain insulator. Any stock items in PEF's stores that are used for such repairs meet current standards. Therefore, repairs that are made with PEF stock materials and are installed per the specification packets are adhering to the current standard.

*** If "as-available" facilities are used to implement repairs, does this mean that the company is temporarily or permanently adhering to an un-known design standard?**

By "as-available" PEF assumes the Staff means, for example, making a replacement or repair with materials that the PEF did not issue from company stock. As mentioned above, materials used for all repairs are issued from PEF stock. All temporary repairs will be addressed as identified in the above answers. It should be noted, however, that temporary repairs are rare. The intent of PEF's storm restoration plan is to make permanent repairs at the time of restoration.

Furthermore, "as available" materials were not used in transmission line restoration. All material used was standard material used everyday in the construction of new lines or maintenance of existing lines

I. How does the company ensure post-storm sweeps find all damaged facilities that had not yet resulted in service interruptions? If the company does not do this, why not?

In performing its final sweeps, PEF personnel inspect every line on every feeder within the area affected by a hurricane. PEF views these sweeps as an integral part of its storm restoration plan and performs the inspection immediately following outage restoration. As part of these sweeps, PEF performs a visual inspection of all facilities that experienced storm outages, and all substations and transmission lines in the hurricane affected areas are inspected with infrared equipment to identify any loose connections or damaged insulation. PEF also inspects for storm damaged facilities and trees that may cause future outages. PEF assigns each damage assessor participating in these sweeps a specific group of facilities. The assessor must document any issues regarding these facilities on a map for future follow up as outlined above. Further, PEF develops work orders during the sweeps to address any issues that have been noted as a potential non-specification construction or where additional repairs are needed.

J. How does the utility document damaged facilities it discovers and what is the priority given to such repair work?

PEF Damage Assessors prepare a sweep patrol form which they submit to PEF's Damage Restoration Coordinator. This PEF coordinator is a member of the local Operation Centers Management team. This work is organized geographically and is prioritized by severity of damage in an area. PEF determines the priority for such repair work based in large part upon the risk to meeting reliability standards and potential outages resulting from untimely repair. This work is given highest priority and performed immediately and continually following restoration until complete.

From a transmission restoration standpoint, lines to generation sites and/or lines that affect the transmission grid are addressed first and then the strategy is to restore as many substations as quickly as possible by restoring or repairing lines with the least damage and the most customers affected. Lines requiring the most repair work and/or with the fewest customers affected are repaired next in order to ensure that the greatest number of customers can be restored the shortest amount of time.

K. How does the company ensure post-storm sweeps find all un-documented temporary repairs?

As discussed in responses to above questions, PEF performs storm restoration work using PEF's materials. PEF provides specifications manuals to off-system personnel prior to them performing repair and restoration work on PEF's system. This minimizes the introduction of non-standard installations or repairs. Further, subsequent to restoration efforts, PEF crews conduct physical patrols of all lines to ensure that facilities have been reasonably inspected and that needed work orders for follow up repairs are initiated. Any sub-standard or "non-spec" repairs are

noted during the sweeps, and permanent repairs are performed during the sweep repair phase.

L. How does the utility document temporary repairs that it finds in its post-storm sweeps, and what is the priority given to such work?

As discussed previously, PEF documents its findings on inspection forms and maps. PEF prioritizes repair work based upon the risk to meeting reliability standards and potential outages resulting from untimely repairs. This work is given highest priority and performed immediately and continually following restoration until complete. Further, no temporary repairs were made on the transmission system. All framing standards and material used in repairs were standard PEF line construction items.

M. Does the company ensure that the post-storm sweep and remediation activities do not further increase the back-log of normal work?

As an initial matter, it should be noted that this question assumes that PEF has back-logged work prior to experiencing a hurricane event, a fact that may or may not be true at any given time. With this qualification noted, the Company hires qualified contractors where reasonably available to support the remediation and reasonably manage the impact to normal work. PEF identifies issues and makes repairs to the greatest extent possible with visiting utilities and contractors prior to releasing them from our system. To the extent additional work remains after the storm, PEF incorporates that work into its scheduling plan in such a way as to minimize, to the maximum extent possible, the impact to PEF's normal work.

N. Does the company perform a post-storm sweep of potential problem poles after each storm?

PEF is unsure what the Staff means by "problem poles." For the purpose of this response, PEF will assume that the Staff means poles or lines on which the company presumptively has or has had reoccurring outage issues. With this assumption, PEF's final sweeps after a hurricane include all facilities that were potentially affected by the hurricane, including any poles that would meet the Staff's definition of "problem poles."

O. Is the post-storm sweep equivalent to a pole inspection?

No. A pole inspection is a more deliberate and narrowly-focused inspection. A final sweep inspection after a hurricane is a visual-based inspection of facilities to identify any damage that has not yet been repaired, and to identify any post-storm repairs that may need further attention. Unlike a formal pole inspection, there is no destructive investigation of facilities in post-storm sweeps such as pole boring, analysis of pole wood density, and the treatment and plugging of investigation ports or holes.

***If not, how is the post-storm sweep of poles different from a pole inspection?**

Please see PEF's response to the question immediately above.

P. Does the company perform a post-storm sweep of potential vegetation problem sites after each storm?

PEF is unsure what the Staff means by "potential vegetation problem sites." For the purpose of this response, PEF will assume that the Staff means sites the company presumptively has or has had reoccurring vegetation issues or problems. With this assumption, PEF's final sweeps after a hurricane include all areas that were potentially affected by the hurricane, including any areas that would meet the Staff's definition of "potential vegetation problem sites."

Q. **Is the post-storm sweep for potential vegetation problems with transmission facilities equivalent to any typical inspections that the company normally performs for transmission vegetation management? If not, how is the post-storm sweep different?**

No, post storm sweeps differ from typical vegetation inspections. Storm sweep inspections look for damaged trees, loose vegetation, access problems caused by trees, and debris that could impact PEF's facilities in areas affected by a storm. By contrast, typical vegetation patrols look more for vegetation growth and existing clearances for future trimming and/or herbicide applications.

R. Is the post-storm sweep for potential vegetation problems with distribution facilities equivalent to any typical inspections that the company normally performs for distribution vegetation management? If not, how is the post-storm sweep different?

While typical vegetation inspections and post-storm sweeps for potential vegetation problems are naturally similar to some degree, the objectives of the two activities are different. The objective of the post-storm sweep is primarily to identify storm-caused tree damage and vegetation that, due to the storm, poses a threat to system performance. By contrast, the purpose of day-to-day vegetation inspections is to verify the quality of work performed by tree trimming personnel.

S. Is the utility practicing a wind-based line clearance requirement as part of its distribution and transmission vegetation management program? If not, why not?

While PEF's vegetation management programs are primarily targeted for vegetation growth and the consideration of various tree species, PEF does consider wind conditions relative to the movement of trees and/or conductors with respect to potential encroachments upon normal line clearances under adverse weather conditions.

T. If the company has a regular pole inspection program, is the frequency of pole inspections in hurricane prone areas greater than in other areas of the territory that typically see less severe wind damage? Same question for any vegetation management programs that the company uses.

PEF notes that this question assumes that the Company has areas in its service territory that are more "hurricane prone" than others. PEF is not aware of any areas in its territory that are more hurricane prone than others. The frequency of pole inspections is the same for all areas in PEF's territory.

U. Discuss any changes to construction or management practices implemented or under consideration as a result of the damage experienced during the 2004 and 2005 storms.

Consistent with its organizational objective for continuous improvement, PEF critiqued its performance after each storm and conducted a detailed lessons learned review of its storm preparedness and restoration activities following the 2004 hurricane season. PEF identified a number of improvement opportunities and has implemented actions to improve its already strong storm restoration program. PEF has not, to date, revised any of its existing construction practices or standards, which meet all current requirements. PEF, however, has engaged DCI to review, among other things, system hardening options.

V. Discuss the requirements and benefits of under-grounding facilities.

Over the past several years, various states and private organizations have performed studies of under-grounding electric transmission and distribution facilities. Rather than attempting to detail the voluminous and complex facts and findings of those studies, PEF has assembled all such studies of which PEF is aware and provided as Composite Attachment E to this response. In summary, these studies indicate that the major benefits for under-grounding facilities are:

- *Improved aesthetics*
- *Reduced exposure to tree damage*
- *Reduced exposure to high winds.*
- *Reduced number of outages*

In addition, these studies indicate that the major hurdles for under-grounding facilities are:

- *Cost of installation*
- *Shorter life spans*
- *Higher maintenance costs*
- *Duration of outages tend to be longer*

Like distribution cable, the potential benefits from the use of underground transmission cable include improved aesthetics, narrower rights of ways and potentially fewer outages. Within the context of storm performance, it could be expected that there would be fewer outages due to less exposure to the wind and debris. However, UG transmission lines are considerably more expensive (10-15 times), outage durations are much longer (weeks vs. hours), and these systems are more susceptible to flooding from storm activity.

W. Discuss the available options to hardening electric utility infrastructure to hurricanes.

For the purpose of this question, PEF will assume that by "hardening," Staff wishes PEF to use the definition that Staff has previously provided, namely- "Any change from

current practices that accomplishes both a reduction in the number of service interruptions and a reduction in the cost of storm restoration." Using this definition early results indicate that the following are potential options that could be used to "harden" electric utility infrastructure:

a. Improve drainage at substations known to be prone to flooding;
b. Accelerate the replacement of wooden transmission poles with steel and concrete poles;
c. Work with all relevant stakeholders to allow more aggressive vegetation and encroachment management, including widening clearing spaces and removing danger trees;
d. Targeted facility relocation from less accessible areas to more accessible areas;
e. Review the feasibility of targeted, higher density areas for undergrounding distribution.

X. What has the company done to prepare for the 2006 hurricanes in terms of securing adequate rebuilding supplies?

In preparation for the 2006 hurricane season, PEF has identified 400 catalog ID numbers as critical items for storm restoration and has adjusted its maximum inventory levels for these items. In summary, these items include: Poles (26 unique catalog ID numbers), Transformers (12 unique catalog ID numbers); and other Associated Materials (such as pole hardware, wire, cable, sleeve, insulators, connectors, fuses, splices, etc.) (362 unique catalog ID numbers). Additionally, prior to the upcoming storm season in June, 2006, and prior to each potential Florida storm landfall during the 2006 hurricane season, PEF will:

** contact primary and secondary vendors that supply these materials to verify that they have adequate inventory levels dedicated to meet PEF's needs.*

** ensure key materials are at maximum inventory levels.*

In addition to the activities detailed above, eight material storm kits have also been designed and constructed to provide many of these same materials for staging areas. These kits can be delivered anywhere in PEF's service territory within 8 hours, and these kits have enough material for several days of restoration. An additional eight kits are located in the Carolinas and can be deployed to Florida within 24 hours. Further, during any storm restoration activity in the 2006 season, a Supply Chain Storm Center will be manned 24 hours a day with purchasing agents, warehouse personnel, and key supplier sales representatives to monitor inventory levels and to procure any additional needed material.

Y. What were the pre-2004 storm inventory levels for poles, transformers, and associated equipment that is commonly used extensively in storm restoration?

- *Poles* *$1.50M*
- *Transformers* *$0.91M*
- *Other Associated Materials* *$6.29M*
- *Storm Kits* *$0*

Z. What were the pre-2005 storm inventory levels for poles, transformers, and associated equipment that is commonly used extensively in storm restoration?

- *Poles* *$3.40M*
- *Transformers* *$1.67M*
- *Other Associated Materials* *$7.38M*
- *Storm Kits* *$0.33M*

AA. What are the expected June 1, 2006 inventory levels for poles, transformers, and associated equipment that is commonly used extensively in storm restoration?

- *Poles* *$3.4M (approx.)*
- *Transformers* *$1.7M (approx.)*
- *Other Associated Materials* *$7.4M (approx.)*
- *Storm Kits* *$0.3M (approx.)*

BB. What percentage of the inventory is rated below current safety code for the size and design of the equipment?

PEF does not know of any equipment in its stores inventory that is rated below current safety code for the size and the design of the equipment.

CC. Has the company implemented any construction or design change for overhead facilities resulting in the purchase of stronger poles compared to 2003 standards for each length of pole used by the company?

PEF has not implemented any construction or design change for overhead facilities resulting in the purchase of different class poles compared to 2003 standards for each length of pole used by the company. The company's structural design criteria are at or above the latest revision of the NESC (2002).

DD. Has the company implemented any construction or design change that avoids damage to customer facilities such as use of break-away connectors?

PEF has not implemented any construction or design changes to avoid damage to customer facilities other than those that are in place under current code and standards. With respect to "break away connectors," the only use of such devices that PEF is aware of is connectors that were developed for an experimental EPRI project. However, the range of tension requirements, ampacity, and concerns about false operations showed a device like this to be impractical, and PEF has not pursued the use of any such devices as they exist today.

EE. What impediments does the company face in implementing proper tree trimming and vegetation management programs?

By "proper tree trimming" PEF assumes Staff means a level of tree trimming tantamount to hurricane hardening. Local ordinances, easement restrictions, public concern, and limited access to private property adjacent to distribution and

transmission rights of way for tree trimming and other vegetation management activity limit the ability of PEF to perform vegetation management. Current tree trimming practices do not incorporate a "ground-to-sky" methodology. Rather, limbs are cut in a "V" methodology whereby limbs are gradually trimmed further from the lines as you move upward towards the top of the pole. This technique reduces or eliminates the removal of trees from the utility easement. While this satisfies the general public due in large part to aesthetics, it does not prevent damage to PEF lines and equipment during high wind events.

Additionally, PEF has experienced many impediments in the routing and land acquisition for transmission line rights of way. Present routing difficulties often result in transmission lines being placed in harsh environments making the lines more susceptible to tree damage, flooding, and deterioration. Difficulties in the line siting process also result in lines being placed in difficult to access areas which can extend outage times and increase restoration costs. Existing environmental regulations limit the clearing of vegetation and trees, and general notice permits limit clearing to a certain level that essentially limits the width of the cleared right of way. Further, PEF's need to side trim trees adjacent to lines in public right of way is often in conflict with county or local ordinances, and is often subject to public and political resistance.

FF. Has the company implemented a construction or design change for underground such as using marine/submarine grade underground facilities compared to 2003 standards for areas prone to flooding and/or storm surge zones?

PEF has not implemented any construction or design changes for underground facilities compared to 2003 standards for areas prone to flooding and/or storm surge zones. PEF has, however, expanded its availability of insulated secondary covers for use in coastal zones subject to flooding.

GG. Has the company implemented a construction or design change for substations to improve wind and debris protection relative to the 2003 standards?

PEF has not implemented a construction or design change for substations to improve wind and debris protection relative to the 2003 standards. As noted in response to above questions, PEF found no significant debris-related damage to PEF substations in the 2004 and 2005 hurricane seasons. As a general matter, for debris to cause adverse damage to substations, the debris must be large enough to bridge phase- to- phase and/or phase- to -ground design clearances, a situation that is usually unlikely. Because of these facts, no design changes have been made. However, there was some damage to substation fences at several PEF substations. PEF is reviewing whether an upgraded, more wind resistant fence design could be utilized at certain of PEF's older substations.

HH. What studies have been conducted on the relative storm outage and damage restoration times for areas served by distribution facilities which are totally or partially located underground, compared to areas served entirely by overhead distribution facilities?

PEF has engaged an outside consultant, DCI, to collect and analyze storm outage and damage restoration results related to underground installations in an effort to identify strengths and weaknesses with current applications. It should be noted that underground

installations eventually terminate to overhead facilities, which will subject downstream customers to those overhead storm risks previously identified.

II. What are the required construction and safety constraints on burying transmission and distribution facilities?

Since the majority of new installations for residential distribution construction (developed communities) are installed underground, PEF assumes that the Staff is requesting a response for existing overhead distribution facilities. Construction constraints would include, but are not limited too, obtaining an easement for burying existing overhead facilities including PEF, third party phone, cable and fiber optic circuits. Existing underground facilities such as natural gas, water and sewer lines would require specialized trenching and shoring or jack and bore operations. Underground road crossings and specialized splice boxes that support roadway traffic may be required on high traffic roadways and intersections. In addition, service feeds for all of the utilities to the customer would require an overhead to underground conversion at an additional cost to the customer. Lines and equipment that are connected to the source utility grid would require either transformer boxes, switch gear boxes, or pedestals to be installed.

In general, a 40-50 ft wide cleared private right of way is required per transmission circuit. Private right of way is also usually required due to conflicts with other utilities, and due to the need for large vaults for splice and transitions that will not fit in public right of way. Vaults are placed every ¼ to ½ mile. Depending on the number of circuits and voltage of the lines, a continuous trench must be excavated (ex: 10ft wide by 6 ft deep per circuit or larger), and in Florida, a trench of this depth usually requires well point or dewatering. Thermal concrete is often used to create a continuous duct bank and is surrounded with thermal backfill. Specialized contractors are used to perform the construction and cable splicing activities. Road, river, lake, and wetland crossing create other complexities and are usually accomplished using directional drilling technology. Depending on the required capacity of the power line, a gas or oil filled pipe type cable may be required. These types of cable systems require pumping stations at the ends of the cable and cathodic protection systems throughout the length of the cable run.

JJ. What steps are required to secure rights of way to bury facilities and what problems do we face in doing so?

The steps generally required to secure a right of way ("R/W") to bury facilities involve the following :

<u>R/W from FDOT / County</u> - A state/county permit is required.

<u>R/W from a City (within their limits)</u> – Usually, franchise agreements state that a permit is not required. If no franchise agreement is in place, a city permit is required.

<u>R/W from a Private Land Owner</u> - An individual easement is required.

The permitting problems that PEF face involve these different entities granting PEF permits in a consistent and timely fashion (i.e. could be a week, could be six weeks). Individual easements from private land owners may present additional problems. For example, some land owners may be more receptive and responsive than others when PEF

asks for an easement across their property. In some instances, PEF may be forced to resort to condemnation proceedings to obtain these easements if property owners will not provide them to PEF.

To obtain a permit, PEF generally does the following:

A. Fill out paperwork /application for permit with associated entity (FDOT, County, etc.);

B. Prepare and include location /cross-sectional drawing : cross-section of road (R/W) with dimensions / depths of facilities to be installed;

C. Pay submittal fee to associated entity.

To obtain an easement on private property, PEF generally does the following:

A. Fill out an easement checklist including tax ID;

B. Include a drawing of the associated project;

C. Send package to Land Agent to file and send to customer for signature.

The steps to secure land rights/easements for underground transmission are similar to those for securing overhead transmission rights. Permitting will likely be more difficult as a trench is being opened the entire length of the line versus digging holes for each pole every 400' to 800'. Excavated material has to be stored on site during construction, and some may have to be disposed off site. Typically, a minimum of a 40' to 50' wide right of way is required to construct underground facilities. Vaults are placed every ¼ to ½ mile (typ. 8'x8'x 28'). Directional boring technology must be used under roads, waterways and other physical obstacles. The use of public right road rights of ways is usually not conducive for parallel transmission lines due to the width of the trench, vault requirements, and conflicts with other utilities.

KK. What outreach attempts have the utility made to educate consumers and local governments about the requirements and benefits of under grounding facilities?

- *The South Coastal community relations team has worked with Asset Engineering Project Managers to coordinate and schedule information meetings for homeowners. They have attended meetings in St. Pete Beach, Treasure Island, Indian Rocks Beach, Tarpon Springs, and other locations.*
- *PEF has worked with corporate communications to develop a Phase I (general info) presentation for homeowner groups.*
- *PEF has developed an under grounding "fact sheet" for use at customer meetings.*
- *PEF has met with various municipalities to discuss under grounding both individually and through the BIG C (Beach Communities combined organization).*

LL. Using Staff's definition of "storm-harden" as any change from current practices that accomplishes both a reduction in the number of service interruptions and a reduction in the cost of storm restoration:

***Has the company assessed potential storm-hardening activities for each of the company's regional areas?**

PEF has engaged an outside consultant to assist in the development of this process. This initiative is on-going.

***For each regional area for which an assessment has been done, provide the estimated reduction in customer service interruptions, the estimated annual cost for the program, and the estimated avoided storm restoration costs for any storm-hardening activities the utility has implemented in the last five years that significantly reduced storm caused service interruptions and/or restoration costs.**

Please see answer above.

***If applicable, list any local, legislative or regulatory barriers the company encountered in implementing these measures.**

Please see answer above.

MM. What programs or activities has the company implemented to reduce the number of transformers that are replaced due to storms?

PEF conducts a pad mounted transformer maintenance program which details the inspection, repair, and replacement process for these units. By identifying at-risk transformers prior to failure, this program has reduced the number of underground transformer failures during storm restoration efforts.

NN. What programs or activities has the company implemented to reduce the damage to substations due to storms?

PEF has maintained its inspection, maintenance, and repair/replacement activity; has upgraded some of its existing substation infrastructure, has replaced any equipment damaged by storms; has purchased small portable generators that can be located in the field as needed to provide power to keep battery banks charged; and has continued assessment and replacement of substation equipment identified as nearing end-of-life where possible.

OO. Are the current federal (NESC) standards for wind resistance adequate for Florida, given the intensity of hurricane winds experienced in 2004 and 2005.

Yes. During the last two NESC revision cycles (1993-2005), the possible need to increase wind loading on distribution poles has been debated and discussed by utility engineers, consultants, and representatives from the general public. This debate has involved persons from all parts of the United States. The overwhelming evidence produced during these discussions and debates clearly showed that falling trees, broken tree limbs, and other airborne debris are the primary causes of power outages during wind related storms. Data from all three hurricanes that occurred on PEF's system in 2004 revealed that less than 2% of PEF's poles were replaced due to storm damage. The majority of these poles were damaged by trees falling on them. Furthermore, in September, 2005, members of NESC Subcommittee 5 (Strengths and Loading) voted to

reject all proposals to increase wind loading requirements for poles below 60 foot in height above ground level in the 2007 edition of the NESC.

PP. What are the estimated miles of existing overhead distribution facilities (feeders and laterals) that are built to a grandfathered standard compared to current standards?

The NESC strength and loading requirements for distribution height poles have remained essentially the same since the 1977 NESC edition. There have been minor changes and additions to the NESC (in strengths and loading) over the years since, but these were done more for clarification purposes and for additional loading requirements for transmission height poles. Therefore, the overwhelming majority of PEF's distribution system would meet present day loading requirements and would not be built to a "grandfathered" standard. Also, many of PEF's lines have been re-conductored, re-located, or upgraded to a higher voltage since 1977. Furthermore, many of PEF's lines built prior to the 1977 edition of the NESC have been upgraded out of necessity to accommodate joint use companies, especially in the rural areas. Therefore, the amount of "grandfathered" facilities on PEF's system should necessarily be relatively insignificant.

QQ. What is the estimated miles of existing overhead transmission facilities that is built to a grandfathered standard compared to current standards?

All of PEF's overhead transmission facilities meet applicable NESC code requirements. In the context of this data request, PEF assumes that by "grandfathered standard," Staff means the NESC extreme wind map standards. Based on this assumption, the NESC extreme wind maps have changed some throughout the history of the NESC code publications, with various degrees of substantive implications. Thus, with regard to the current extreme wind standards, many of PEF's transmission facilities constructed prior to 2001, which meet code, could technically be considered "grandfathered" in some fashion. However, all of PEF's transmission lines constructed prior to 1991 were designed to the higher NESC Grade B construction, and used 36 pound per square ft (psf) wind pressures for design purposes. All of PEF's 500 kV and much of the 230 kV system was also designed to a higher standard. Furthermore, in 1995, PEF began using only concrete or steel poles for new transmission lines and discontinued the use of wood maintenance replacement poles in early 2001.

RR. As a percentage of total existing substations, how many substations were damaged to the extent of being inoperable during the 2004 hurricane season? In the 2005 season?

In 2004, Fort Green #1 and Citrusville Substations were the only substations left in-operable as a result of storm damage. Of 387 PEF substations, this represents 0.5% that were damaged to the extent of being inoperable. Both of these substations serve a single industrial customer.

In 2005, no substations were damaged to the extent of being inoperable.

SS. Based on the utility's experience, are current federal (NESC) standards for wind resistance adequate, given the intensity of hurricane winds experience in Florida in 2004 and 2005?

Yes. Please see responses to other related questions in this document.

TT. Should higher standards be required for all construction in damage prone areas, including restoration of facilities following a storm?

PEF notes that this question assumes that the Company has areas in its service territory that are more "damage prone" than others. PEF is not aware of any areas in its territory that are more damage prone than others. With this qualification-no. As discussed in detail in response to Question OO and other questions above, there is no substantial evidence available today that justifies increasing the strength of structures over the present NESC requirements. Although a very small percentage of the total number of poles on the transmission system failed due to storm effects, the vast majority of poles that did fail were wood poles. Further study may be warranted to determine whether accelerating the replacement of wood transmission poles with concrete or steel poles would make the system less susceptible to storm damage.

UU. How should appropriate standards and zones be determined?

Appropriate standards and zones should be determined the same way it has been done since 1913, namely, by experts in the industry that write and revise the NESC. Every edition of the NESC has been revised and upgraded as experience and needs of the industry have dictated. The NESC is also updated as newer and more accurate data comes available in the future. The NESC will continue to be updated to meet the needs of the general public, and this is the best procedure to determine appropriate standards and zones.

VV. What is the estimated cost and man-hours required to inspect and upgrade all existing overhead distribution facilities to current design standards?

PEF assumes the Staff believes that there have been major changes to the design standards over the course of time which would indicate overlapping weaknesses in the system. PEF construction design and standards have not dramatically changed with respect to wind loading. Standards/construction changes have primarily addressed updated clearance requirements for pole attachments and lightning protection.

WW. What is the estimated cost and man-hours required to inspect and upgrade all existing overhead transmission facilities to current design standards?

A high-level estimate of the cost to replace all wood transmission poles on PEF's system with concrete or steel poles would be $800 million to $1 billion. The estimated man hours associated with this work are between 5 and 7 million man hours. Additional, significant study would be required in order to provide a more accurate estimate.

XX. What is the estimated cost and man-hours required to inspect and upgrade all existing substations to operationally withstand debris laden wind?

Since only two substations (0.5%) on PEF's system received wind damage that affected the operation of the substation, PEF feels that its existing substations currently can operationally withstand the type of debris laden wind that PEF experienced during the 2004 and 2005 hurricanes.

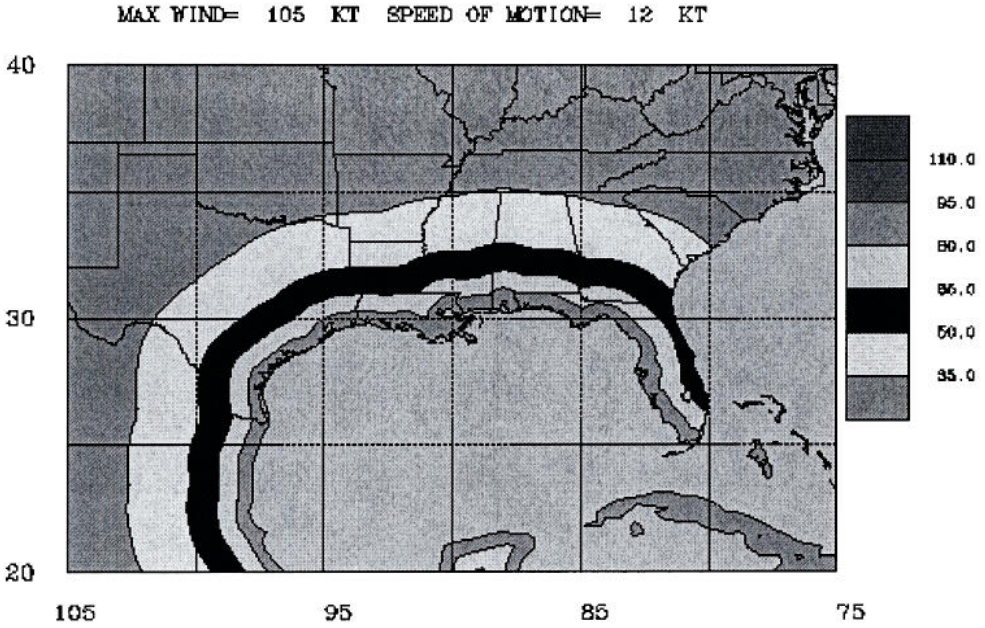
III. Closing Remarks:

To be presented by PEF at the January 23, 2006 workshop.

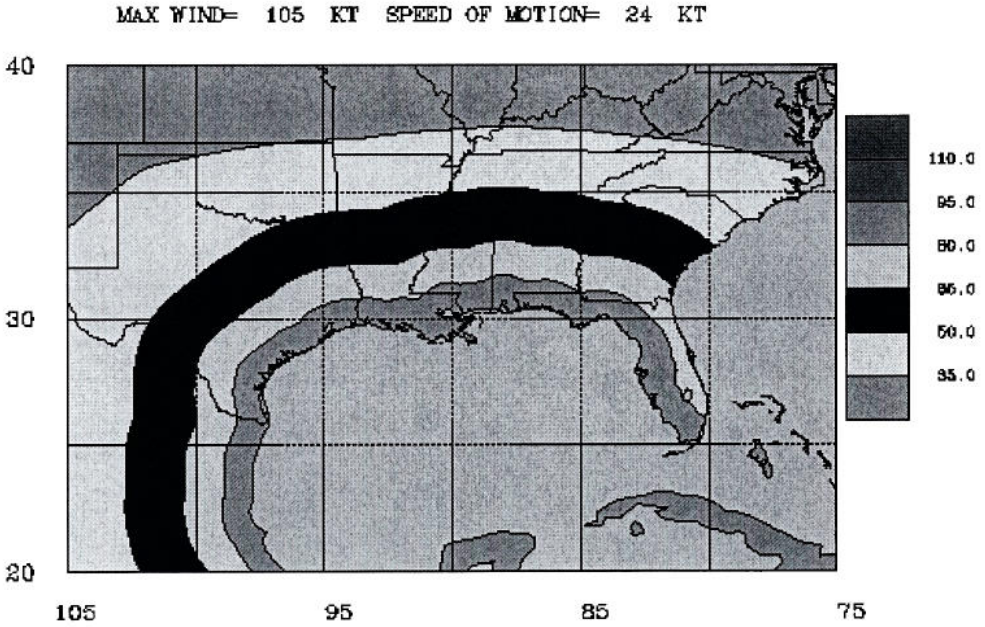
Attachment A
NOAA Maximum Envelope of Wind (MEOW)

Hurricane Landfall from the Gulf of Mexico

Category 3 (14 mph forward speed)



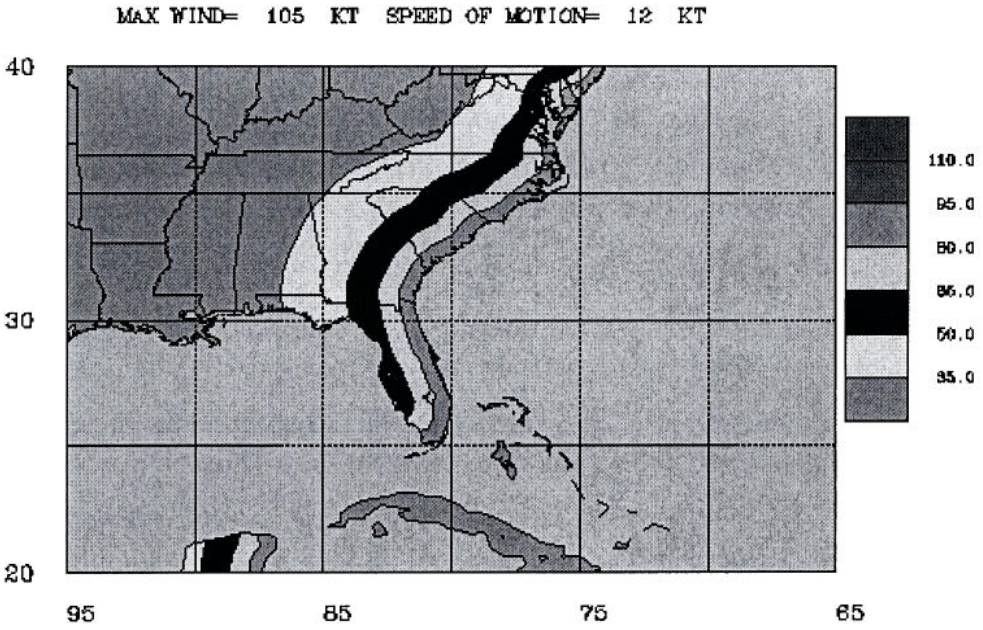
Category 3 (28 mph forward speed)



Attachment A (continued)
NOAA Maximum Envelope of Wind (MEOW)

Hurricane Landfall from the Atlantic

Category 3 (14 mph forward speed)



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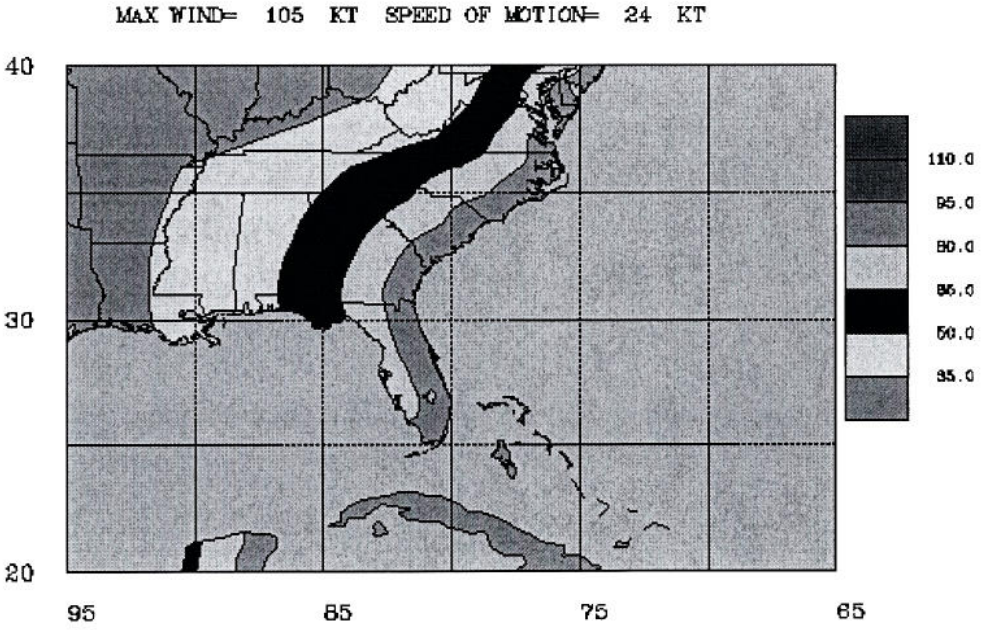
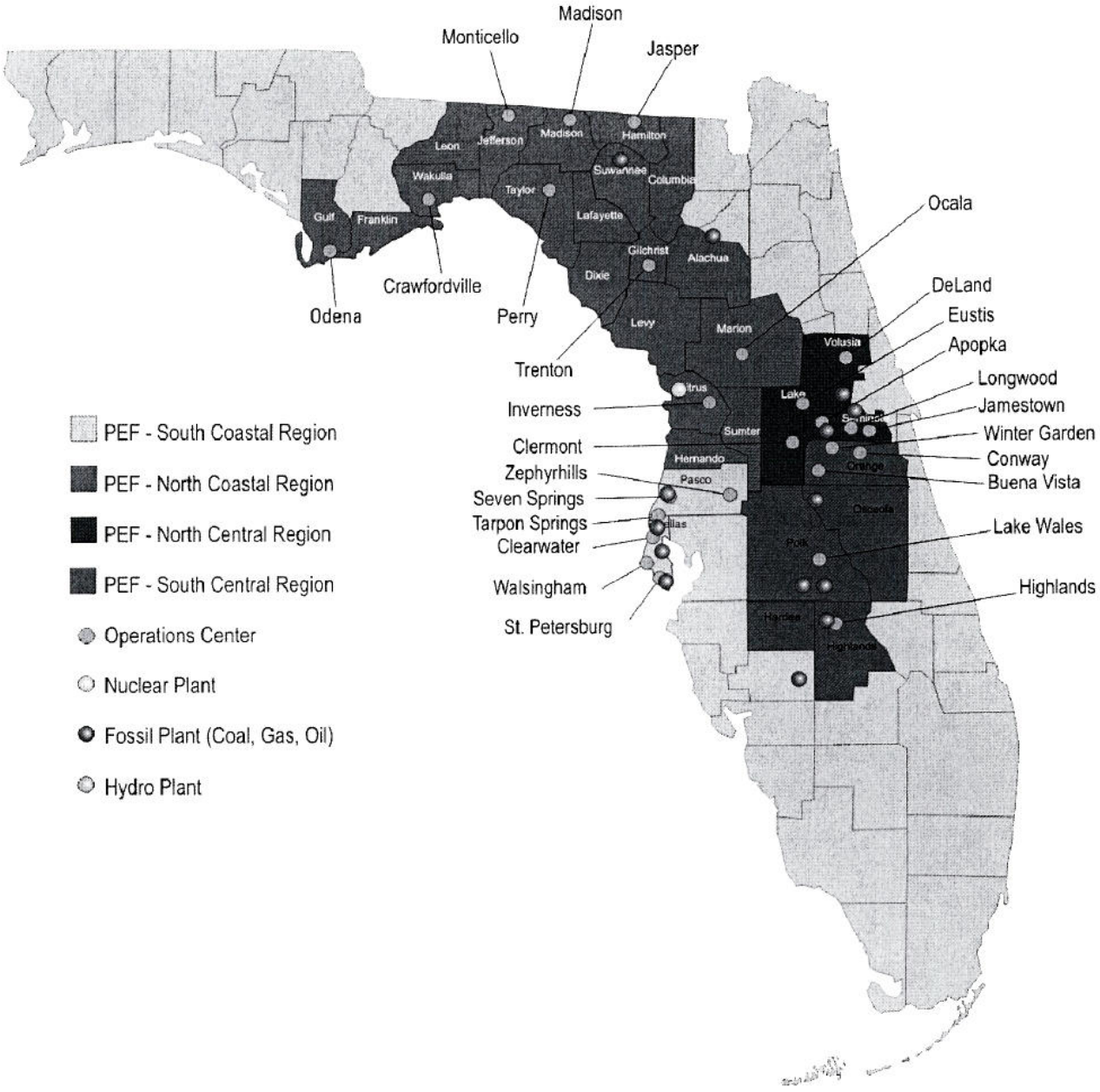


Attachment B

Progress Energy Florida System Map

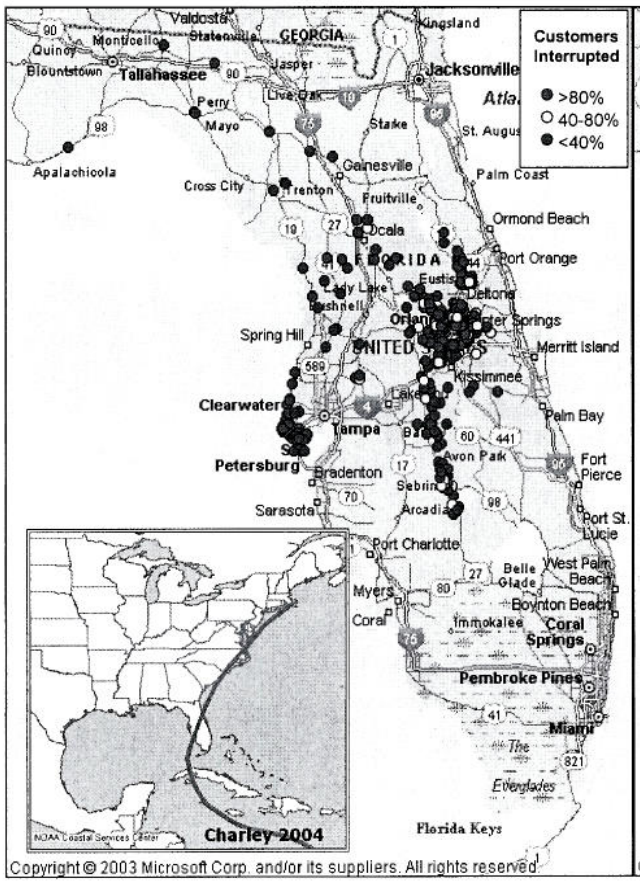


Attachment C

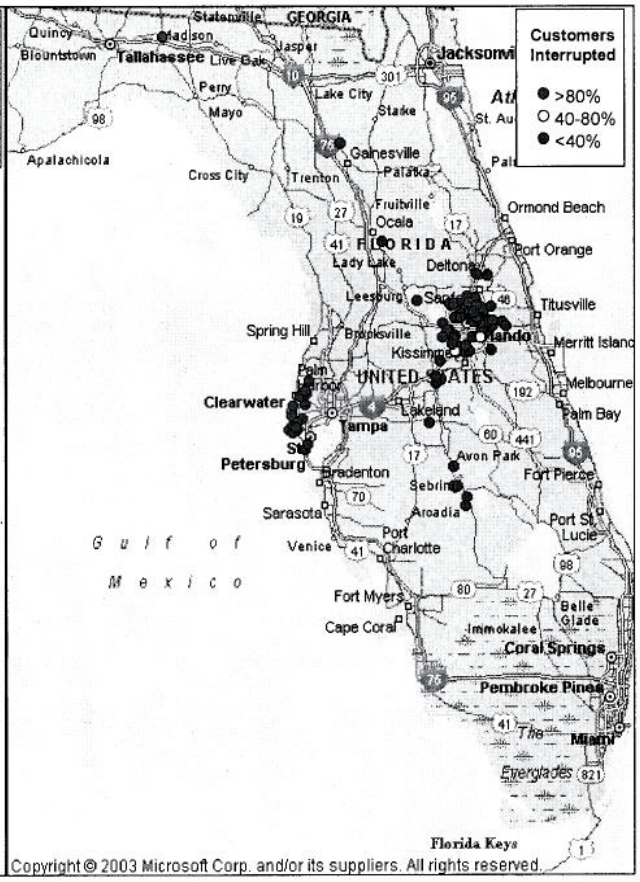
Hurricane Season – 2004

Hurricane Charley

OH Construction Outage Severity

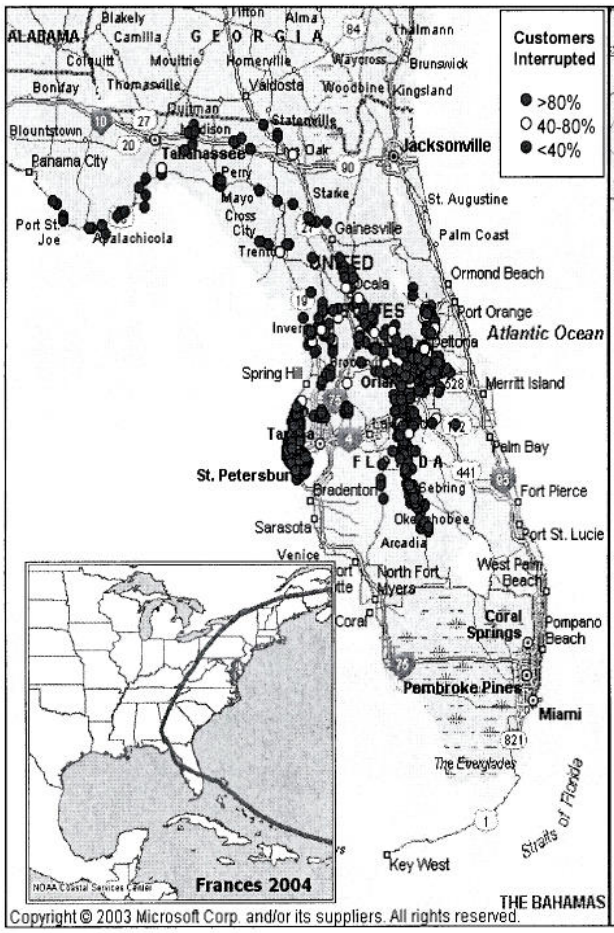


UG Construction Outage Severity



Hurricane Frances

OH Construction Outage Severity



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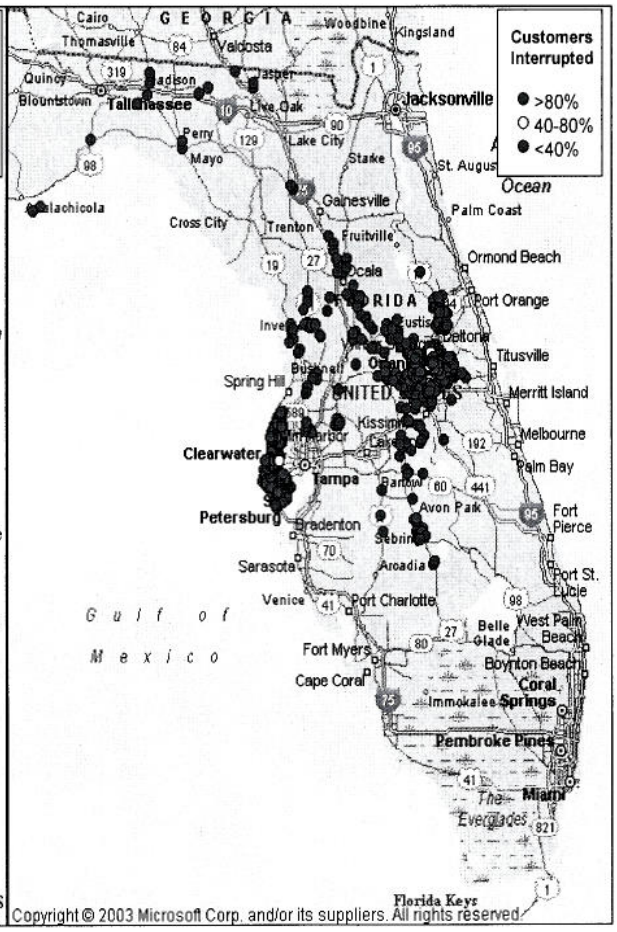
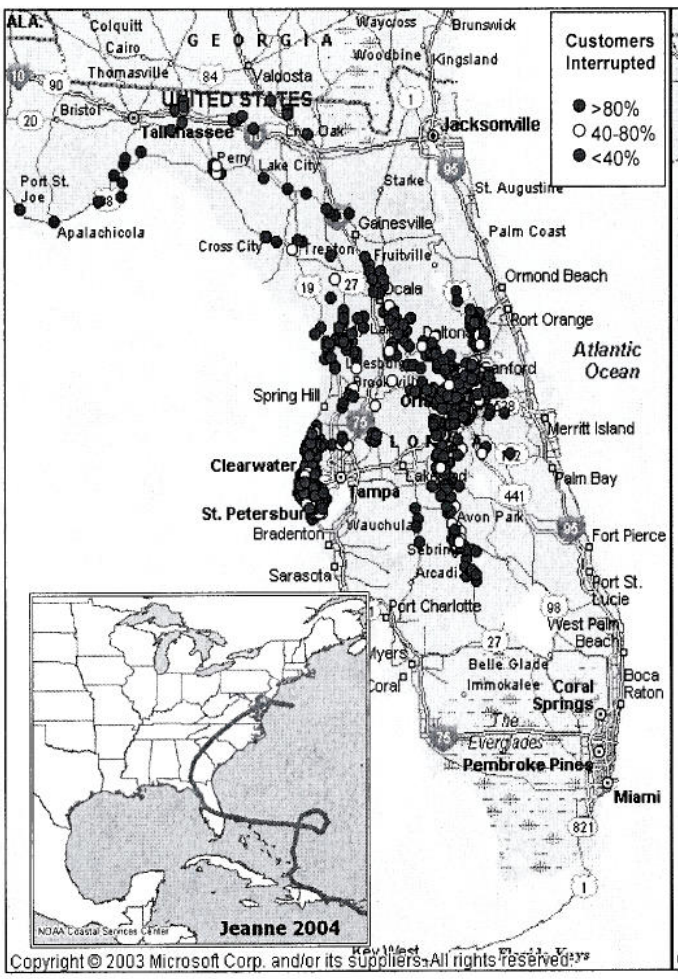


Attachment C (continued)

Hurricane Jeanne

OH Construction Outage Severity



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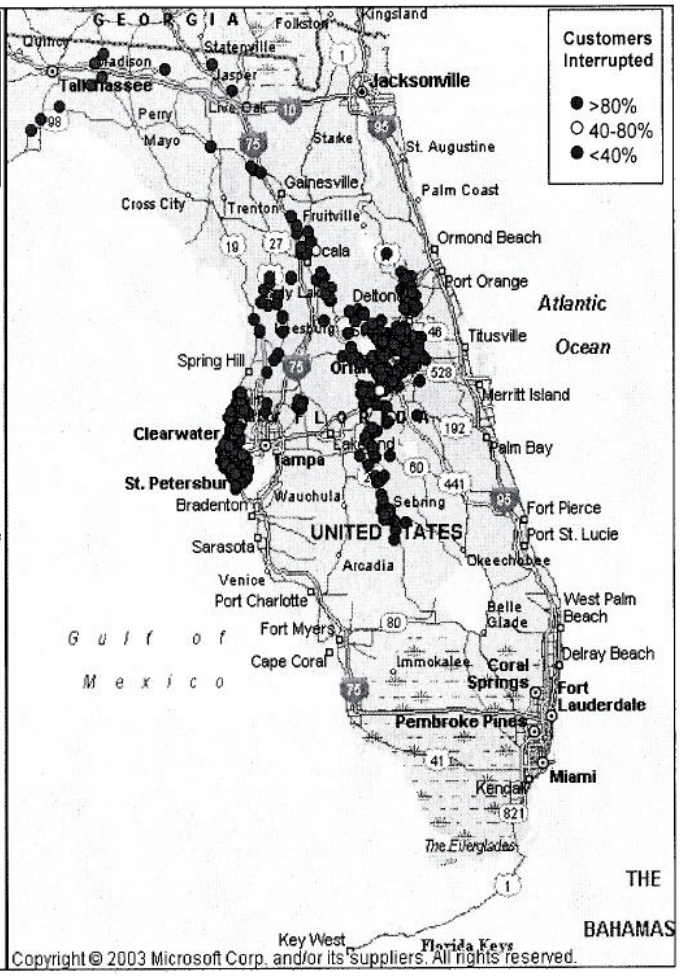
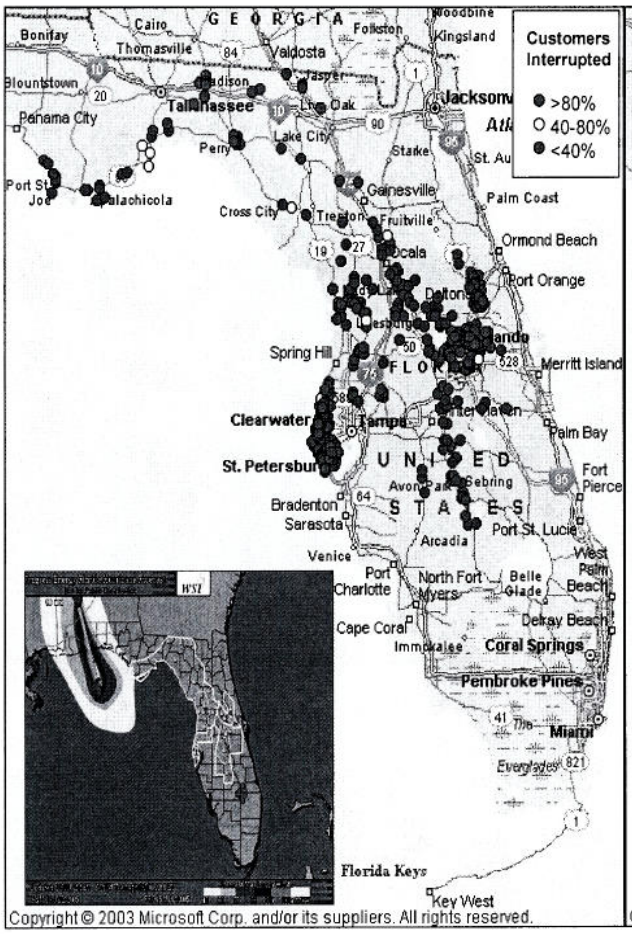


Attachment D

Hurricane Season - 2005

Hurricane Dennis

OH Construction Outage Severity



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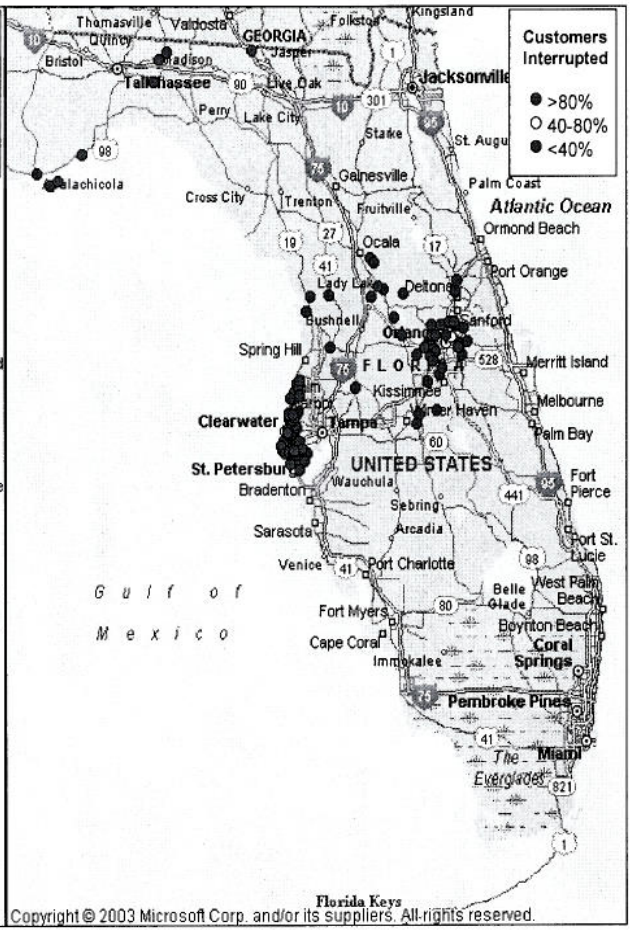
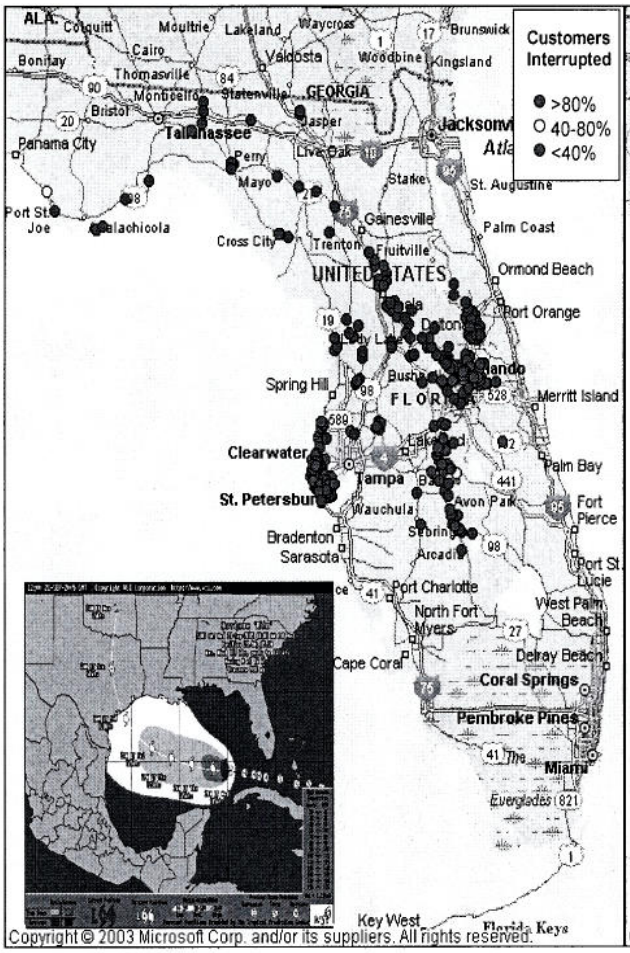


Hurricane Rita

OH Construction Outage Severity



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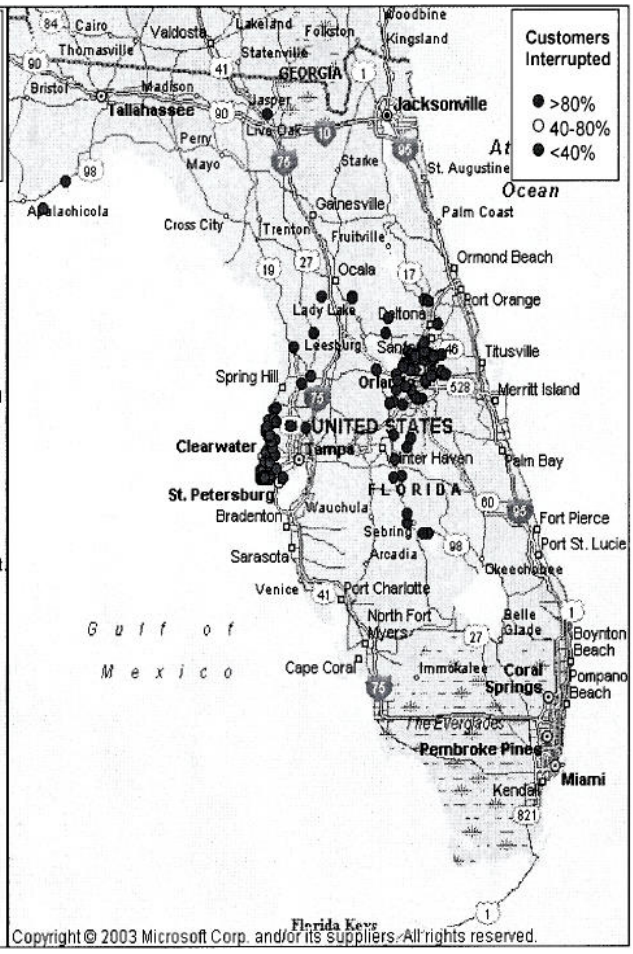
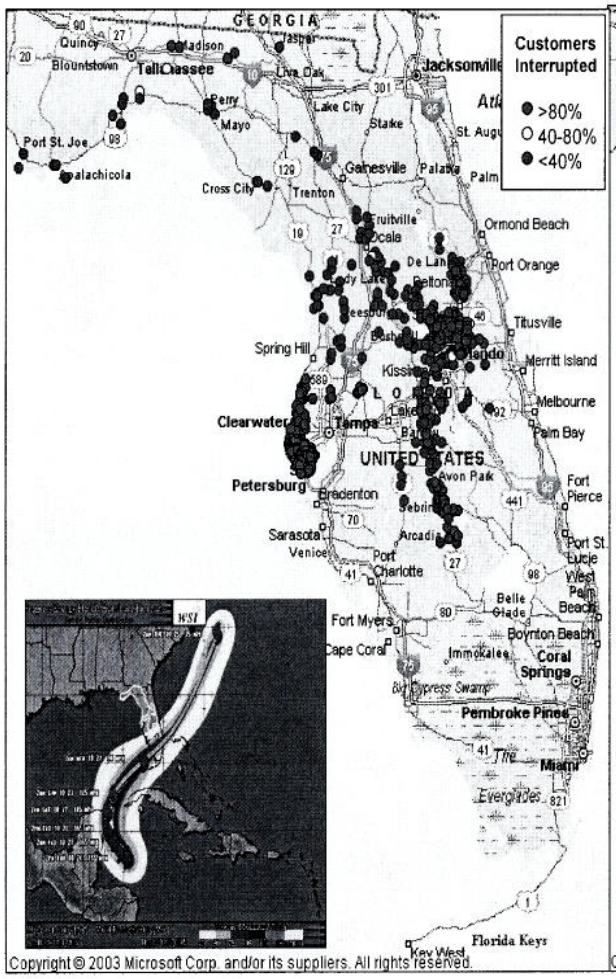


Attachment D (continued)

Hurricane Wilma

OH Construction Outage Severity



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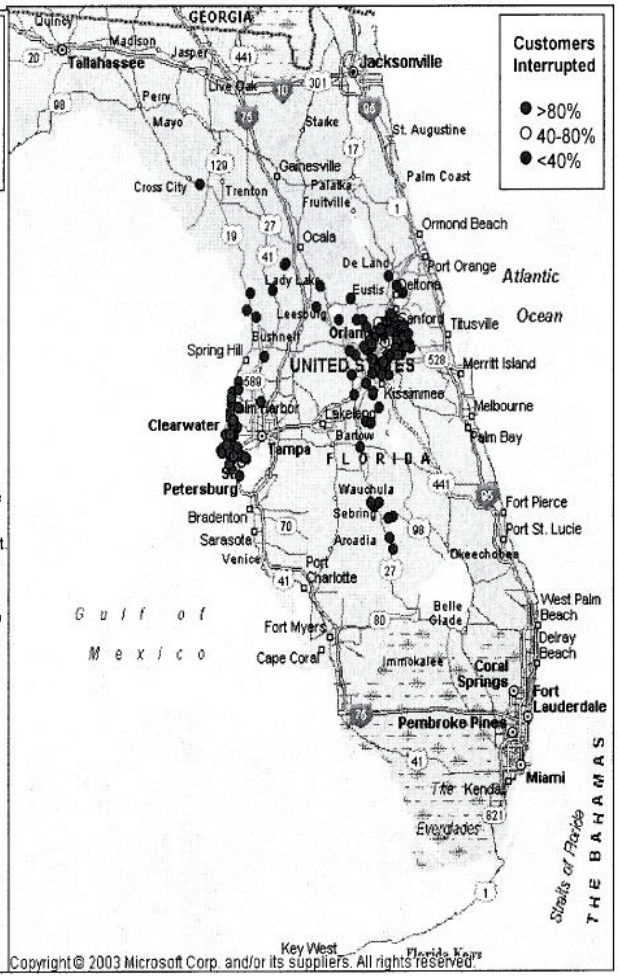
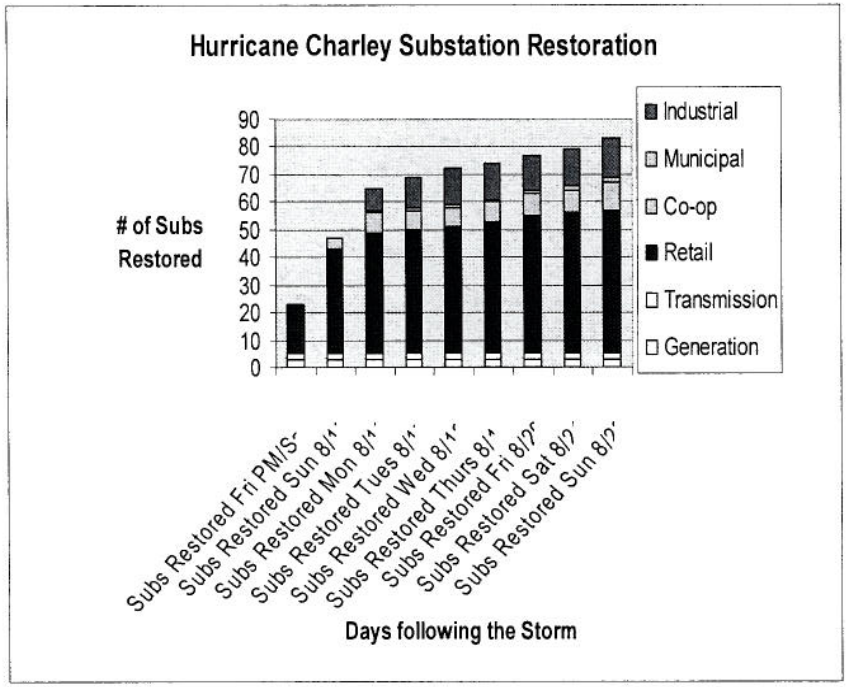
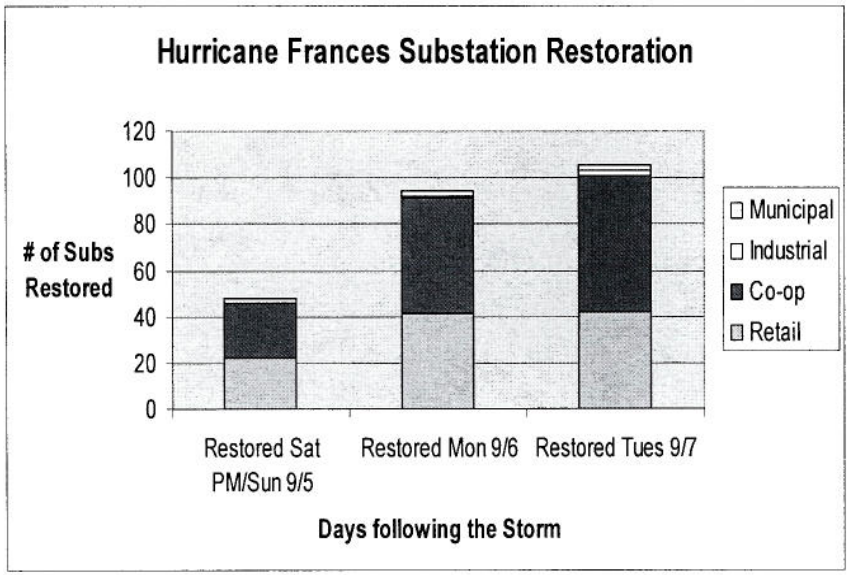
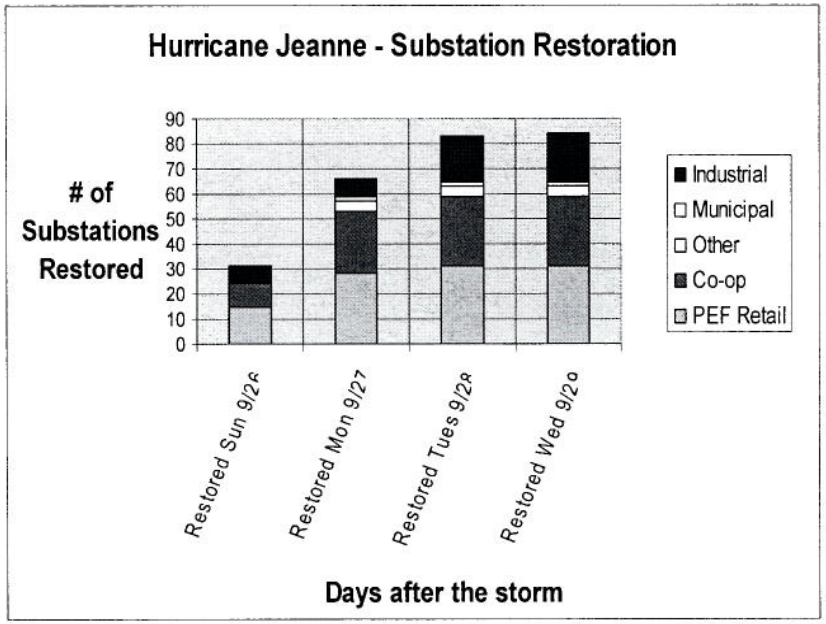


Attachment E

Attachment F







Progress Energy