7. RECOMMENDATIONS FOR HURRICANE PREPAREDNESS

Proper line maintenance and disaster preparedness could significantly reduce hurricane damage and restoration time. Most of the following recommendations would be beneficial to Caribbean utilities even without the disaster of a hurricane.

The quality of workmanship has more effect on the durability of an electrical system than any other single factor. Nothing strengthens a line more than poles set to proper depth, which is 10% of the height of the pole plus 2 feet. Anchor plates should always be installed to a depth of 5 feet. Proper compaction of backfill for both poles and anchors is critical. Utilities should encourage workers to consider what will happen to the end product in the event of a hurricane. The utility should constantly inspect the workmanship of employees and contractors.

Caribbean electrical systems are reaching the age where pole deterioration is an overwhelming problem. Pole life in the Caribbean is limited to 20 years. This amounts to a need for a 5% annual pole replacement. Replacement of all Wallaba poles with quality pressure treated poles should be the first priority.

Adequate guying both in quantity and quality is critical. All angles of five degrees or more should be guyed. Guying should be both at the primary and secondary line levels to insure proper support of a pole. Guying is much stronger than brace poles. A pole and brace pole tend to fall together, where guying tends to hold a pole in place because tension increases as the pole moves. Anchors should be tested at installation and then again tested periodically. The testing can be easily performed with the winch of a digger derrick. If the guying and anchors endure a hurricane

and proper right of way clearing is maintained, most of the rest of the utilities' outside plant will also survive.

The joint use situation, attachment of telephone and television cables needs serious review. The telephone and cable television companies should be required to install proper guying with their attachments. A joint use specification which includes proper guying and attachment methods should be developed. Pole strength and design upgrades are often necessary to accommodate the greatly increased weight and wind loading caused by telephone and cable television lines. Minimum lateral strength requirements increase 100% for telephone attachments because of the increased wind load on the larger cross section.

'Storm guying' for critical structures should be implemented. The strength of a line can be greatly improved with very little expense by installing guys in line and laterally. Canyon crossings should always have side and in-line guying. Lines constructed in soft soil and suspected high wind areas should be 'storm guyed' at least every one half mile. By 'storm guying' 5 to 10% of the structures, a dramatic reduction in disaster losses should result.

Easement maintenance is the least expensive method to prevent outages during normal operation and to minimize conductor and pole losses during a disaster. Trees which can contact power lines should be eliminated. The elimination of danger trees, which is any tree that will reach the line when it falls, would prevent much of the damage done by high winds. Line design should attempt to place lines in accessible areas, preferably near main roads. This facilitates routine troubleshooting and maintenance. In the event of a disaster, accessible lines are much more quickly restored. Likewise, the periodic elimination of brush and undergrowth help with day to day operations and greatly expedite restoration.

Emergency material stockpiles should be maintained. Such stockpiles would need to maintain only enough material to start a restoration program. A quantity of poles amounting to 5% of the poles in the system should be stockpiled. This stock needs to be rotated to prevent decay of horizontally stored poles. Conductor should be kept in reserve for emergency use. System design should limit the number of conductor sizes to three in most instances. A quantity equaling 2% of the system should to be stockpiled. An adequate supply of service cable should also be maintained. A large stock of conductor sleeves in all sizes of conductors used should be maintained. Such reserves would not be adequate to restore a system, but they will be a great help in the initial stages of restoration.

Every electric utility in the Caribbean should have a disaster plan in place before each hurricane season. Establish the priority of loads, especially those requiring generators if restoration time were to be excessive. Typical loads to be placed on generators following a disaster are hospitals, communications facilities, airports, water systems, disaster related government services, refrigerated food storage, and ice making facilities. The kilowatt and voltage requirements of these priority loads should be determined as part of disaster preparedness.

A material order system should be prepared before the hurricane season. Timely ordering of material is very critical to a restoration program. There is a significant lag time in material procurement and after a hurricane, there is competition between affected utilities for materials needed. Material is usually shipped on a first come, first served basis. In the days immediately after a hurricane, it will be difficult to find the time for the material evaluation which will be necessary for restoration. The material ordering system should be organized so that a multiplier derived from the percent of damage can be introduced and a reasonably complete material order established.

One of the first questions donor nations will ask before providing manpower is "Are materials in place or enroute?".

Small utilities should establish a plan of cooperation between neighbors. The plan should be for manpower and material purchases from adjacent countries' stockpiles.

System mapping is very helpful in restoration. Maps are also valuable in normal utility operations. Restoration crews may not be familiar with the affected nation and certainly will not be familiar with details of the electrical system. System maps will save a great deal of time in both disaster evaluation and restoration planning. Work assignments from restoration coordinators will be more easily understood by expatriot restoration crews if maps are available. Maps will also aid in having the system restored to its original configuration. A good supply of copies should be maintained.

8. RECOMMENDED INITIAL ACTIONS FOR RESTORATION BY THE UTILITY

An evaluation of the amount of damage and the extent of system losses is the first step for restoration. This evaluation should be written and available to government officials and evaluation teams of potential donor nations. It will be necessary to update and amend this evaluation as the situation and requirements are better determined.

Several determinations should come from the initial evaluation. The first determination would be the selection of high priority facilities. The lines serving high priority facilities should be surveyed to determine the repairability of the lines. Estimated material and manpower needs should then be determined as quickly as possible.

If lines to priority facilities are not restorable in a reasonable time frame, procurement of approximate size generators

should begin immediately. Determination of the most time effective shipping method should be made and then expeditious arrangements made to have the generators shipped. Those facilities which are to be maintained on generator power should be prepared for connection prior to the generators arrival.

Road clearing often destroys line and materials that a small utility will have difficulty in replacing. Attempts should be made to place power utility people with road clearing crews for areas where there are downed lines. If manpower is available, a great deal of line can be saved by having the lines removed from the road by line personnel or at least by crew under the supervision of experienced line personnel. Most importantly, the cutting of conductor to facilitate road clearing should be kept to a minimum. Wherever possible, tie the conductor out of the road way. This can be accomplished with binding twine. Move poles from the road whenever possible rather than cutting them with chain saws. Pole supplies will probably be exhausted before pole shipments arrive. Many fallen poles can be trimmed and reused.

Material ordering must be immediate. Systems on other islands have probably been damaged and there will be competition for the available equipment and materials. When restoration starts, the need for material will be immediate. Shipping time after a disaster can be very lengthy because reconstruction materials other than line restoration materials are also being shipped. Order adequate quantities of material. Restoration takes a surprising amount of material and material will be used more quickly than one would ever expect.

If the disaster has been severe, seek help from various [illegible] needs for technical assistance (manpower), material, tools, equipment and financial assistance. This written request should

Consideration should be given to hiring an expatriot restoration coordinator. A restoration coordinator should have practical experience in extensive electrical restoration. This person would have the advantage of previously experiencing the restoration process. An expatriot would not be as easily influenced by local politics even though he would necessarily be sensitive to, and understanding of, political situations. A restoration coordinator can take significant work load from the utility manager who will still have to manage the utility with the monumental additional responsibilities associated with a major restoration effort.

The assistance of local Immigration and Customs officials should be incorporated to streamline their procedures. Customs should expedite procedures for the immigration clearance of skilled labor and movement of material, equipment, vehicles, tools and repair parts. Local taxes should be waived or donors will be offended. Assistance costs incurred by the utility or government agencies in supporting restoration operations should not be billed to the donor.

If storm damage is extensive, the hiring of expatriot contractors is usually the only option. Before the selected contractor operation is mobilized, request his field supervisor to assess the needs for restoration in the areas of manpower, tools and equipment. This will also give local utility management an opportunity to evaluate the contractor. Be sure that the contractor has experience in electric power system restoration. Be sure that he will be furnishing qualified, trained personnel and modern hydraulic equipment. Have a contract available that protects both the utility and the contractor. Be sure to make preliminary arrangements for guarantee of payment such as a bank letter of credit to allow the contractor to begin work as soon as possible.

9. OFDA/USAID INITIAL ACTIONS TO ASSIST ELECTRICAL RESTORATION

The OFDA/USAID response to the need for electrical power restoration on St. Kitts, Nevis and Montserrat was well handled once a contract was executed . The initiative taken to obtain the Lloyd Electric team from USAID/Kingston and to put them to work and restoring power was very timely. The following are suggestions which could possibly improve future restoration activities.

The initial evaluation of electrical system damage could be expedited by requesting that the affected utilities provide a brief written estimate of system damage. This could be simplified by developing a form on which facts could be indicated such as the total system size, the estimated percentage of poles lost, estimated time to repair, etc. Request that utility management arrange for someone to show an evaluation team the damaged areas. Have an experienced construction person aligned with USAID to determine system damage, equipment, material and manpower needs during evaluation. It would be best to have a consultant reporting to OFDA or USAID along with a contractor representative make the evaluations. Or, in cases where utilities are self-financing the expatriot assistance, the utility should make joint review and evaluation to determine required inputs and to agree on work plans, methods and number of men required to support utility restoration activities.

An outline of initial actions for the utility would be helpful for them in many instances. Because of the shock of the disaster, it sometimes is days before utility management begins making the proper responses to the situation. The management of small utilities can often use advice on how to quickly begin restoration work.

If a technical assistance need is determined, an independent line contractor is a much better choice than a utility. Even utilities will admit that contractors are significantly more productive in construction or re-construction situations.

Contractors have a flexible schedule while utilities have a commitment to their service areas. Contractors employ personnel who are already adjusted to an 'away from home' environment. Contractors will need to see the terrain, soil conditions, and extent of damage to determine equipment and manpower needs.

There are several requirements that the contractor should meet. The personnel furnished should be trained through apprenticeship and experience in line construction and maintenance. Equipment provided should be well maintained, modern hydraulic equipment. An air compressor and air hammers should be provided. Adequate tools should be provided. The operation will require a radio system to efficiently coordinate the activities of the different crews and activities.

Arrangements for logistic support if made by OFDA, USAID or the utility can expedite getting work forces into the field and in getting restoration underway. These logistics include lodging arrangements similar to those previously described in this paper; permission to install a radio system; arrangements for transportation vehicles; an arrangement for personnel to clear local Immigration and for equipment to clear Customs; and numerous other details specific to the situation. To the extent possible, the contractor should be consulted for his specific needs and requirements.

A Memo of Understanding should be presented to the recipient utility before technical assistance arrives. Areas of consideration include the desirability for the recipient to provide fuel for equipment, security if needed, suitable staging areas, access to easements, assistance with mechanical repairs, specified shipping costs, specialized occasional use equipment such as bulldozers when required and line construction materials to extent feasible.

OFDA should consider placing a project manager onsite throughout the project. Because of the experience and integrity of Lloyd Electric, a full time project manager was not necessary in this instance, but OFDA nor a utility cannot consistently rely on that to be the situation. Considering the cost of a restoration project, a manager should be present to monitor and document the contractor's performance. A project manager with USAID or OFDA authority could also work with recipients to encourage the timely performance of their obligations to the project. The project manager would also be in the position to serve as a restoration coordinator wherever there was a need for one.

Contracting officers should consider possibility of and the advantages of paying per diem on a reimbursement plus handling basis with a specified ceiling. This would discourage a contractor from providing a substandard food and housing situation to his personnel for the sake of making additional profit on per diem. This situation did not occur under the Hugo restoration contract, but this is a real possibility from contractors with high profit motivation. This should be a concern of OFDA, USAID and the utilities because substandard lodging and meals results in worker dissatisfaction and higher personnel turn over rates which results in loss of or substandard production.

10. CONCLUSIONS

The total time frame for the OFDA funded technical assistance to St. Kitts, Nevis and Montserrat was from September 27, 1989 until January 9, 1990. Lloyd Electric was on the project for a total of 109 calendar days.

On St. Kitts, mobilization was completed between September 27 and October 3, 1989. Technical assistance was provided to St. Kitts from October 3 to October 16, when electrical service was restored.

The Lloyd Electric crews worked on Nevis from October 3 until November 18, 1989. Service was restored to Nevis at this time.

Lloyd Electric personnel were on Montserrat from November 18, 1989 through January 9, 1990. When the OFDA contract expired on January 9, 1990, MONLEC employed Lloyd Electric to continue restoration until February 16, 1990. It is estimated that power will be 90% restored to Montserrat at that time and probably 100% restored by March 15, 1990.

As a direct result of electrical restoration in these three countries, the OFDA funding made possible the normal operation of the water systems, government services including police and fire departments, tourism, industry (light manufacturing), and retailing, including refrigeration for food. The foundation for the recovery of a normal way of life has been provided to these three islands by the restoration of the electrical systems.

The personnel of Lloyd Electric made many friends in the eastern Caribbean. A mutual respect was developed between all the donors (including other Caribbean nations) and the utility personnel. A comradery was established with fellow tradesmen from several nations.

As a result of the presence of Lloyd Electric linemen, ~~presence~~, the people of these nations have had personal contact with Americans, not as tourists, but as working people. The bottom line is that the people of St. Kitts, Nevis and Montserrat watched friendly and helpful Americans working six days a week from daylight to dark to bring electricity back to their communities. Many residents were effusive in expressing their appreciation. This project has made a very large and positive impression about the United States and the U. S. linemen on these three small islands.

Restoration activities on the three islands of St. Kitts Nevis and Montserrat were accomplished between September 27, 1989 and January 9, 1990 and utilized 2121 person days of assistance. The overall costs for labor, equipment and materials was approximately US$1,900,000.

With considerable pride we note that during the entire operation, there were no time loss injuries although the crews worked 12 hours a day, six days a week from dawn until dark.

We take this opportunity to thank the various electricity departments, the government authorities of the islands, BEI, RDO/C and OFDA for their cooperation and support.

DOCUMENTO ORIGINAL INCOMPLETO

Annex 7

HURRICANE HUGO
POWER RESTORATION PROJECT
DAILY LOG

DATE : _____

LOCATION : _____

ACTIVITIES : _____

CREW NO. 1. _____

_____

2. _____

_____

3. _____

_____

CONTACTS : _____

_____

LOCATION : _____

ACTIVITIES : _____

CREW NO. 4. _____

_____

5. _____

_____

6. _____

_____

Problems/Difficulties: _____

_____

_____

_____

GLOSSARY

AID	Agency for International Development
BDD	British Development Division
CIDA	Canadian International Development Agency
D of E	Department of Electricity
Danger Tree	Any tree which if it fell would strike or interfere with a power line
Digger Derrick	Combination purpose truck with hydraulic power auger, crane boom and aerial bucket attachment
JPS	Jamaica Public Service Co., Kingston, Jamaica
KV	Kilovolt = 1000 volts
LV	Low Voltage
MONLEC	Montserrat Electricity Services Limited
OFDA/W	Office of Foreign Disaster Assistance of the Agency for International Development in Washington, D.C.
RDO/C	Regional Development Office for the Caribbean in Bridgetown, Barbados
Staging Area	Storage area for keeping mobile equipment at night and for storage of construction materials
USAF	United States Air Force