LOL-HECO-IR-66

Ref: "LW is normally not performed in inclement weather conditions, such as: high humidity ... rain or drizzle ... strong winds ... fog ... thunder ... very hot days ... high air-condition loads ... In addition ... lines traversing agricultural lands ... fertilizers, pesticides ... lines in coastal plains ... salt laden air ... salt fog ... salt spray" (T-5, page 10, line 21 through page 11, line 24) "the unpredictability nature of the winds in mountains" (T-3, page 12, line 25)

Question(s):

a. If Oahu has so many impossible conditions that hinder LW, why did HECO initiate LW in the first place?

b. If Oahu has so many impossible conditions that hinder LW why is HECO seeking to revive LW?

c. Please provide the documentation (both guidelines and firm rules) that HECO reviewed in determining LW climatic restrictions.

d. Is HECO aware of utilities that use LW under climatic challenging conditions?

e. What climatic restrictions on LW have been imposed by any state regulators in the US?

HECO Response:

a. The entire passage from HECO T-5 cited states:

"A. LW is normally not performed in inclement weather conditions, such as:

- High humidity (at several utilities, LW is typically not performed when humidity exceeds 85%)
- Rain or drizzle
- Strong winds (while there are no specific or general limits, many utilities stop work when the crew finds it difficult to control long insulating tools)
- Fog
- Thunder is heard, or lightning is seen within about 5 miles.

In addition, to prevent exhaustion and fatigue-related hazards, many utilities avoid LW, or interrupt work when the ambient temperature reaches high levels. No general guidelines as to the stop-work temperature levels are available and the decision to stop work is left up to the crew and the supervisor. These restrictions may clearly apply to many sections of the lines serving the Koolau and Pukele Substations, especially during the hot summer months. Unfortunately, very hot days often coincide with high air-condition loads, which may

strain system resources and prevent de-energizing of lines for maintenance.

Q. How does climate impact the use of LW on Oahu?

A. The diverse nature of Oahu's climate presents some unique challenges for LW. This is especially true for the lines in the Koolau Mountains where the conditions are ideal for accelerated corrosion, and where the high frequency of precipitation, fog, clouds, and high humidity can all hinder the ability to access the lines, and work safely using LW methods.

In addition to the climate/environmental constraints in the mountains, there are other areas on HECO's system where climate/environmental characteristics impact line maintenance needs and practices. For example, lines traversing agricultural lands are subject to contamination from fertilizers, pesticides, and burning of agricultural fields. Lines in the coastal plains are regularly exposed to salt laden air, salt fog, and salt spray."

The question and answer from which the second quote is excerpted states (the IR refers to "T-3" but the correct reference appears to be "T-5"):

"Q. Is measurable precipitation the only impediment to LW?

A. No. Fog, clouds and high humidity can all hinder the ability to access lines, and to work safely using LW methods. Rain gauges, however, only record measurable precipitation. Therefore, in addition to the days with measurable precipitation, it is likely that there would be additional days with higher than acceptable humidity (at several utilities, LW is typically not performed when humidity exceeds 85%), fog, or clouds that would further hinder the ability to use LW techniques. Additionally, the unpredictable nature of the winds in the mountains adds to the complication of accessing the mountain lines using helicopters and using LW methods."

It is important to clarify that the "Ref:" cited above encompasses two distinctly different types of considerations. The first quote simply pertains to limiting weather conditions, whereas the second quote pertains to conditions that impact the periodicity and types of maintenance actions that may be required on transmission lines. The second group of considerations does <u>not</u> preclude LW, rather it encompasses factors that should be accounted for in weighing whether LW or de-energized maintenance should be used for a particular type of maintenance action. It is also important to note that both of the above

referenced statements are general in nature and list factors that may influence LW. The statements do not suggest that all factors exist simultaneously or that they preclude LW at all times or in all locations. It should also be noted that the weather constraints referenced above were more of an issue for some lines, for example, lines in the mountains, than others.

HECO initiated an investigation into, and implemented LW on its 138kV system in response to recommendations made by Stone and Webster Management Consultants, Inc. (SWMC) following an investigation of the blackout that occurred on July 13, 1983. At the same time, load growth, system configuration and operational constraints placed increasing demands on the system. LW offered some operational advantages and flexibilities, particularly as the system was configured at that time.

The LW program evolved in response to HECO's needs. LW peaked in the mid-1990s, and then began to decline when the addition of the Waiau-CIP 138kV transmission lines increased operational flexibility to much of the 138kV system. This allowed the performance of de-energized maintenance tasks on much of the system without creating an unreasonable impact on system reliability.

b. While the need for LW on HECO's system diminished following the addition of the Waiau-CIP 138kV transmission lines, there are still portions of the system that could benefit from its use. Further, the availability of LW capability during certain emergency situations could prevent outages and/or reduce their duration. As load growth continues, new areas of the system and scenarios may be identified that could benefit from the availability of LW techniques. Mr. Stewart's understanding is that HECO is in the process of revising and refining its transmission line maintenance program. While the structure and design of this program is still under development, there are some aspects of this process that are worthy of

note as they relate to the application of LW methods on the transmission system. This is discussed in Mr. Stewart's written testimony, HECO T-5, on pages 25 through 27.

c. There are two climatic issues that restrict live working. First, overvoltages caused by lightning can be hazardous to a worker performing live work. As a result, OSHA rules stipulate the following:

> **1926.955(c)(11)(ii)**
> Stringing and clipping operations shall be discontinued during the progress of an electrical storm in the immediate vicinity.
>
> **1926.955(e)(6)**
> Work shall not be performed during the progress of an electrical storm in the immediate vicinity.

The second issue involves the insulation properties of live working tools and equipment. Personnel safety and operational security in live line work depend on the insulation properties (i.e., the property of a material to oppose the flow of electrical current through it) of both the insulating materials and air. Factors affecting insulating materials include: temperature, altitude, moisture, contamination, impurities and aging. IEEE recommends that "work should be avoided when weather conditions would result in surface wetting of the insulated portion of the tools to the extent of causing water rivulets". Similarly, OSHA rules stipulate the following:

> **1926.955(e)(8)**
> Only tools and equipment intended for live-line bare-hand work shall be used, and such tools and equipment shall be kept clean and dry.

Other electrical utility practices are similar to those of HECO. For example, at PG&E, "no barehand live line work will be performed during inclement weather. If work is in progress and weather conditions turn bad, all work will cease, and ropes, ladders and live line tools will be removed and stored. Barehand live line work will not be performed during

the progress of an electrical storm in the immediate area." The Western Area Power Administration (WAPA) Power System Maintenance Manual states that "live-line work shall be discontinued while there is any indication of lightning or other inclement weather in the surrounding area".

d. No prudent utility would initiate a LW activity during the types of inclement weather referenced above. However, there are utilities that use LW in systems having some climatic challenges. For example, a utility may perform LW in one portion of its system while another portion of the system would be characterized as "climatically challenging", and in the latter area, LW is not a practical solution or may be used only under certain favorable conditions.

e. Most states have adopted OSHA rules and the NESC in its entirety or with appropriate modifications. In addition, some utilities have developed their own rules and guidelines that may be more stringent than OSHA and the NESC.