Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

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William A. Bonnet
Vice President
Government & Community Affairs

February 22, 2007

The Honorable Chairman and Members of the
Hawaii Public Utilities Commission
465 South King Street, First Floor
Kekuanaoa Building
Honolulu, Hawaii 96813

FILED
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PUBLIC UTILITIES COMMISSION

Dear Commissioners:

Subject: Docket No. 2006-0431
Investigation of October 15-16 2006 Outage
Information Request Responses

Hawaiian Electric Company, Inc. ("Hawaiian Electric") respectfully submits nine copies of its responses and objections to the information requests submitted by the Division of Consumer Advocacy on February 1, 2007 in the subject proceeding.[1]

Hawaiian Electric's responses to the following information requests reference material considered Company confidential and is being provided pursuant to Protective Order No. 23159: (1) CA-IR-31, pages 3-22, (2) CA-IR-32, pages 3-4, (3) CA-IR-35, page 3, (4) CA-IR-44, pages 5-6, (5) CA-IR-69, page 3, and (6) CA-IR-73, page 3.

Hawaiian Electric's voluminous responses to CA-IR-2 and CA-IR-38, subpart b, will be submitted under a separate transmittal.

An electronic copy (in Word and PDF formats) of Hawaiian Electric's responses will be submitted shortly.

Sincerely,

[signature]

Attachments

cc: Division of Consumer Advocacy (3 copies)

[1] The objections have been reviewed by Hawaiian Electric's counsel.

CA-IR-1

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 1 of 90.

The above document states that the October 15, 2006 earthquake was the "strongest earthquake recorded in Hawaii in 23 years." Based on this statement please respond to the following:

a. Provide the record of earthquakes recorded in the State of Hawaii from January 1, 1977 through the date of this information request for all earthquakes of magnitude 2.0 and higher. Provide the date and magnitude of each such earthquake on each island.

b. Provide the source for the information provided in response to part (a) of this information request. For example, is the obtained from the Hawaii Volcano Observatory (Page 12)?

HECO Response:

a. HECO has no independent knowledge or historical information as to earthquakes of magnitude 2.0 and higher. Such data is of the type generally maintained by USGS and other public agencies and would most appropriately be obtained directly from those who keep it.

HECO objects to gathering this information as it is overly broad and unduly burdensome and more appropriately obtained through other means.

Without waiving these objections, HECO believes that the information supporting this statement came from the Hawaii Volcano Observatory website. In addition, similar information can be found at the following website: http://earthquake.usgs.gov/eqcenter/eqarchives/poster/2006/20061015_image.php, which shows that the most recent earthquake in Hawaii equal to or stronger than the 6.7 magnitude earthquake of October 15, 2006 took place on November 16, 1983 and was located east-southeast of Mauna Loa, further away from Oahu than the epicenter of the October 15, 2006 earthquakes. No other earthquake since 1983 was of magnitude 6.5 or greater (this referenced page and PDF links on the page only indicates earthquakes of magnitude 6.5 or greater). See also Honolulu Star Bulletin article:

http://starbulletin.com/2006/10/16/news/story04.html.

b. See the response to part a.

CA-IR-2

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 2 of 90.

Above document states that additional information was gathered through "extensive follow up information requests, and analysis of system drawings and control schematics, relevant Company logs, studies and records, personnel interviews, and other applicable system documentation." Based on this statement please respond to the following:

a. Provide a copy of all POWER referenced documents, recordings, phone notes, e-mails, memoranda, and work papers.

b. Provide a copy of all HECO October 15-16, 2006 related documents, work papers, and communications (i.e., written and electronic).

HECO Response:

a. & b.

The documents responsive to these requests are being produced in a separate transmittal to the extent that these requests do not ask for confidential, proprietary and/or privileged information and to the extent that these requests are not overly broad, as footnoted herein.[1] These documents

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[1] HECO objects to providing all "POWER referenced documents, recordings, phone notes, e-mails, memoranda, and work papers" and "all HECO October 15-16, 2006 related documents, work papers, and communications (i.e., written and electronic)" to the extent that these request includes draft documents, work in progress, internal notes, various e-mails and attachments to the e-mails (i.e., internal written communications). These documents are privileged and confidential and should not be provided on public policy grounds. In the internal written communications and unofficial notes of internal meetings and communications, the discussions and notes are brief since HECO's personnel and consultant understand the context of the subject matter and HECO believes that it is not cost effective to spend the time to generate elaborate discussion and/or detailed notes on the subject matter. If HECO is required to produce such internal work in process documentation, then the information would have to be generated in a fashion suitable for external publication, rather than in its present form (which is suitable for internal discussions). This would be unduly burdensome and onerous, as well as counterproductive. The internal correspondences are solely intended to be a tool to communicate information internally and are an integral part of the decision making process in which thoughts are expressed. In addition, draft documents, which are attached to e-mails, are a necessary step in the decision making process and can result in candid dialogue. Were these documents subject to review by others in a regulatory proceeding, their candid nature and, therefore, their value could diminish significantly in the future, and HECO's internal communications and decision-making process would be seriously hampered.

This information request basically requests unlimited access to internal correspondence related to the request. This information request fails to balance the need for the information against HECO's need to manage. For example, the Uniform Information Practices Act (Modified), codified at H.R.S. Ch. 92F and the Federal Freedom of Information Act ("FFIA"), codified at 5 U.S.C. §552, contain broad disclosure requirements based on the public's interest in open government. However, even such broad disclosure acts provide exceptions from the broad are voluminous and certain documents are confidential. Copies will be provided to the Commission and the Consumer Advocate under a separate transmittal, and where appropriate, pursuant to Protective Order No. 23159.

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disclosure requirements that are intended to permit the efficient and effective functioning of government. It is common in such acts to protect from disclosure pre-decisional agency memoranda and notes, and/or government records that, by their nature, must be confidential in order to avoid the frustration of a legitimate government function. This is similar to the "deliberative process privilege" recognized by the Pennsylvania Public Utility Commission with respect to its own internal staff reports. See Pennsylvania Public Utility Commission v. West Penn Power Company, 73 PA PUC 122 (July 20, 1990), West Law Slip Op.

In addition, the request is overly broad or at least could be construed in that fashion, and HECO objects to the request on such grounds. The request is overly broad, because it applies to correspondence related to draft documents being prepared for this proceeding, and questions or comments from HECO's attorneys related to such documents. HECO objects to providing correspondence related to draft documents on the grounds stated above, regardless of whether such correspondence relates or reflects privileged communications with attorneys or attorney-work product. To the extent the request asks for communications that may contain the mental impressions, conclusions, opinions, or legal theories of HECO's attorneys (e.g., some attachments to e-mails include the mental impressions and conclusions of HECO's attorneys), HECO further objects to such request on the grounds that it asks for documents that are protected by the attorney-client privilege and the attorney work-product doctrine.
HECO also objects to disclosure of such requested correspondence and drafts of reports even under a protective order. The value of the correspondence (including the attachments) and the drafts of the documents will be diminished if HECO is required to provide such documents, even if documents were provided pursuant to a protective order.

CA-IR-3

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 2 of 90.

In summary, the report states: "The HECO system was in proper operating condition and appropriately staffed by personnel at the time the earthquake struck." Based on this statement please respond to the following:

a. Provide the specific basis for this conclusion.

b. Cite any applicable codes and standards of the electric power industry used to develop this conclusion.

c. Cite any power industry best practices surveys and analyses used to support or derive this conclusion.

d. Without any quick black-start capability of significant capacity (MWs) on a true "island" system by what specific logic does POWER derive this conclusion ("proper operating condition")?

HECO Response:

a. The specifics utilized to form this conclusion are detailed in the POWER Report Section 2.2 and Section 3.1.3, paragraph 1 as shown below for convenience.

2.2 System Conditions at 7:00 AM Sunday October 15th

On Sunday October 15, prior to the earthquakes, the 138 kV transmission and 46 kV sub-transmission systems were in their normal configuration with all lines in service. No transmission maintenance outages were scheduled for the day. On the generation (supply) side, the generation commitments for a Sunday morning were normal. The power plant unit status from the System Load and Capacity spreadsheet from the EMS archive was as follows:

Table 1: Generation Status 0708:00 Hours October 15, 2006

Unit	Type	Status	Capacity (MW)	Output (MW)	Spinning Reserve	Excess Spin
Honolulu 8	Steam Turbine	Ramping Up	19.39	19.41	-0.02[1]	
Honolulu 9	Steam Turbine	Off Line for Maint.	0.00	0.00	0	
Waiau 3	Steam Turbine	Off Line; preparing for startup	0.00	0.00	0	
Waiau 4	Steam Turbine	Off Line; preparing for startup	0.00	0.00	0	
Waiau 5	Steam Turbine	On line; On EMS	57.00	25.43	31.57	
Waiau 6	Steam Turbine	Off Line; preparing for startup	0.00	0.00	0	
Waiau 7	Steam Turbine	On line; On EMS	87.00	50.88	36.12	
Waiau 8	Steam Turbine	On line; On EMS	87.00	62.95	24.05	
Waiau 9	Combustion Turbine	Off Line; Standby	0.00	0.00	0	
Waiau 10	Combustion Turbine	Off Line; Standby	0.00	0.00	0	
Kahe 1	Steam Turbine	On line; On EMS	86.00	46.29	39.71	
Kahe 2	Steam Turbine	On line; On EMS	86.00	36.80	49.2	
Kahe 3	Steam Turbine	On line; On EMS	89.00	48.39	40.61	
Kahe 4	Steam Turbine	Off Line: On overhaul	0.00	0.00	0	
Kahe 5	Steam Turbine	On line; On EMS	142.00	117.18	24.82	
Kahe 6	Steam Turbine	On line; On EMS	142.00	112.08	29.92	
HECO DG	Diesel	Off Line; Standby	0.00	0.00	0	
H-Power	Steam Turbine	On line; On EMS	46.00	45.86	0.14	
KLCT1	Combustion Turbine	Off line: Maintenance outage	0.00	-0.80	0.8	
KLCT2	Combustion Turbine	On line; On EMS	70.00	79.15	-9.15[2]	
KLST	Steam Turbine	On line; On EMS	20.00	13.11	6.89	
AES	Steam Turbine	On line; On EMS	180.00	179.92	0.08	
SYSTEM CAPACITY, LOAD AND RESERVE			**1111.39**	**836.7**	**274.74**	**94.74**

The Dispatch Center was properly staffed with a Supervising Load Dispatcher (SLD), a Load Dispatcher (LD) and a Trouble Dispatcher (TD). The AGC archive indicated a spinning reserve of 274.74 MW with an excess of 94.74 MW based on 180 MW minimum spinning reserve. The Dispatch Center staff were conducting routine monitoring of the system conditions and supervising the startup schedule of generation as demand for power began to increase.

Kahe power plant staffing was normal, with the exception that Kahe 4 was on overhaul that morning. Because of this, the station superintendent responsible

[1] H8 had just started and was on manual control resulting in the use of actual output of H8 for the Capacity value but with a time delay of 2 scans (4 seconds). The Output value is the actual output but with no time delay. Because H8 was increasing load at the time, Output value was greater than the Capacity value.

[2] For Kalaeloa, when only one CT is in operation (as was the case on October 15th), the correct Capacity values for Kalaeloa in single train configuration is 79 MW for KLCT1 capacity and 11 MW for KLST capacity.

for all Kahe maintenance and operations was present, along with additional maintenance crews. Waiau and Honolulu plant staffing was normal for a Sunday. The personnel were conducting their normal routines of monitoring the plant conditions. Baseload units were increasing their output as the morning load demand increased and cycling units were either on line or in the process of starting up per the unit commitment schedule.

3.1.3 Operational Generating Capacity on October 15

The system conditions on the morning of October 15 are discussed in sub-Section 2.2 of this report, and the status of the generating units, as of 0708 hours that morning, are shown in Table 1. The capacity of plant operating at that time was 1,111 MW, substantially in excess of the consumers' demand of 837 MW. Indeed, the 275 MW of excess operating capacity, over and above the demand, was substantially greater than the 180 MW capacity of the largest unit operating. Thus, if the largest unit (on the morning of October 15th AES was operating at approximately 180 MW and represented the most heavily loaded unit on the system at the time) had suddenly and unexpectedly tripped and ceased to supply power, the remaining operating capacity could have met the shortfall.

b. None applicable. Power's conclusion was not based on any referenced codes or standards. POWER's experience within the industry is that most utilities in the contiguous United States and Canada develop internal operating procedures that conform to North American Electricity Reliability Corporation (NERC) criteria and guides for reliability, Federal Energy Regulatory Commission (FERC) regulations for interstate commerce, and Independent System Operators (ISO) or Regional Transmission Organizations (RTO) for managing generation dispatch and load service, where applicable. As an island utility, HECO is not regulated by any of these of entities. HECO has developed operating procedures, such as the ODPM referenced in the response to CA-IR-6a1 and provided in response as Attachment 28 in CA-IR-2, subpart a pursuant to Protective Order 23159, that guide HECO's operations.

c. Not Applicable.

d. The conclusion was derived based on the operating condition of the system to generate power, serve load and provide sufficient generating reserve to accommodate projected daily load increases and absorb the loss of the largest single generator on-line (which was AES at 180 MW as noted in the response to CA-IR-3a and CA-IR-6a1). This is "proper operating condition" for the normal system operation. The two main HECO power plants are equipped with black start diesels/turbines that all started (POWER report Page 49 and 51) as designed to restart the system, which is "proper operating condition" for the emergency black start system in place at that time. Installation of a large capacity, quick starting black start unit is not a requirement for the system to be in "proper operating condition" on the morning of October 15, 2006.

Other examples in support that the system was in proper operating condition on October 15 include the following:

POWER Report, Page 49 of 90: "The decision was made at about 0730 hours to start K1 and the process was started to configure the auxiliary buses. The UO and Shift Supervisor checked and started the black start generators."

POWER Report Page 51 of 90: "At 0755 hours, the Waiau staff began planning for the black start operation and started to configure the plant auxiliary buses. On October 15, W6 was designated for black start since it was in the startup process at the time of the blackout and had the most appropriate (lower) boiler drum pressure. W5 was up to full boiler pressure when it tripped and would take much longer to reduce the boiler pressure to allow black start.

At 0940 hours the Solar CT was started and the W6 auxiliary bus energized."

CA-IR-4

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 3 of 90

a. The above document states that "the main underlying cause of the outage was the seismic action of the earthquake triggering mercury switches on generating units Kahe 5 and Kahe 6." Based on this statement please provide the manufacturer, type, and model number for all mercury switches which are being referred to here.

b. The above document states "the same style of mercury switches are installed in other fluid level monitoring applications in the Kahe 3, Kahe 4, Kahe 5, and Kahe 6 generating units, specifically on the feedwater level alarms . . . ." Based on this statement please respond to the following:

 1. Provide the manufacturer type and model number for all mercury switches which are being referred to here.

 2. Identify specifically which of the referenced mercury switches did not falsely alarm during the October 15, 2006 earthquake events.

HECO Response:

a. The manufacturer, type, and model number for the Kahe 5&6 Electro-hydraulic system mercury switches are provided below:

 Manufacturer: Magnetrol

 Type: Displacer type liquid level switch

 Model: A153 series, Westinghouse instrument number 71FL2.

b. Feedwater heater level alarm information for K3, K4, K5 and K6 is provided below:

 1. The mercury switches are provided on attached page 2.

 2. To the best of our knowledge, the mercury switches on the feedwater level alarms on K3 (four out of the 5 feedwater heater switches), K5, and K6 falsely activated on October 15, 2006 as a result of the earthquake. K4 was in the middle of an overhaul (planned maintenance) on 10/15/06.

Unit	Instrument No.:	Service Description:	Manufacturer:	Model No.:	Type:	Foreign Print No.:
Kahe 3	3 HLA-1	Heater No. 5 HLA	Mercoid	H221S-4821-C1H-75	Mercury	367-7
	3 HLA-2	Heater No. 4 HLA	Mercoid	H221S-4821-C1H-75	Mercury	367-7
	3 HLA-3	Heater No. 3 Drip Pot HLA	Mercoid	H211S-4821-C1H-60	Mercury	367-6
	3 HLA-4	Heater No. 2 Drip Pot HLA	Mercoid	211S-4821-C1-60	Mercury	367-8
Kahe 4	3 HLA-5	Heater No. 1 Drip Pot HLA	Mercoid	211S-4821-C1-60	Mercury	367-8
(overhaul)	4 HLA-1	Heater No. 5	Mercoid	221S	Mercury	367-16
	4 HLA-2	Heater No. 4	Mercoid	221S	Mercury	367-16
	4 HLA-3	Heater No. 3	Mercoid	211S	Mercury	367-15
	4 HLA-4	Heater No. 2	Mercoid	211S	Mercury	367-15
Kahe 5	4 HLA-5	Heater No. 1	Mercoid	211S	Mercury	367-15
	5 HLA-16	Heater 51 High Level Alarm	Magnetrol	291-S12	Mercury	36700-
	5 HLA-5	Heater #52 Hi Level Alarm	Magnetrol	291-S12	Mercury	36700-
	5 HLS-1	Heater #56 Hi Level Alarm	Magnetrol	601-S12	Mercury	36700-
	5 HLS-2	Heater #55 Hi Level Alarm	Magnetrol	291-S12	Mercury	36700-
	5 HLS-3	Heater #54 Dr Tank Hi Level Alarm	Magnetrol	291-S12	Mercury	36700-
Kahe 6	5 HLS-4	Heater #53 Hi Level Alarm	Magnetrol	291-S12	Mercury	36700-
	6 HLA-1	Heater #66 HLA	Mercoid	201WT-4821-C1-75	Mercury	K6 3-6-7.1/3
	6 HLA-16	Heater #61 HLA	Mercoid	201WT-4821-C1-75	Mercury	K6 3-6-7.1/3
	6 HLA-2	Heater #65 HLA	Mercoid	201WT-4821-C1-76	Mercury	K6 3-6-7.1/3
	6 HLA-3	Heater #64 HLA	Mercoid	201WT-4821-C1-77	Mercury	K6 3-6-7.1/3
	6 HLA-4	Heater #63 HLA	Mercoid	201WT-4821-C1-78	Mercury	K6 3-6-7.1/3
	6 HLA-5	Heater #62 HLA	Mercoid	201WT-4821-C1-79	Mercury	K6 3-6-7.1/3

CA-IR-5

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 4 of 90.

The above document states that "actions by HECO personnel were reasonable, responsible and conducted in a professional manner." Based on this statement please respond to the following:

a. Provide the complete roster of HECO management, EMS staff, and power plant staff on duty and/or who responded to the October 15, 2006 earthquake and island-wide blackout. Provide the name and job title/assigned position of each person as of October 15, 2006.

b. Provide access for interview and/or deposition of each HECO management staff, EMS staff, and power plant staff who were on duty and/or responded to the October 15, 2006 earthquake and island-wide blackout. Interviews and/or depositions will be scheduled for the week of April 9, 2007. In addition, since there may not be sufficient time to conduct an interview/deposition of all personnel identified in response to part (a) of this information request, the Consumer Advocate will provide a list of the HECO personnel selected for interview/deposition on or before March 26, 2007.

c. Provide the Building Code and Seismic Building Codes which were the basis of design and construction for each of the power generating units on Oahu. Provide the year in which each unit entered service and cite the codes which were utilized.

HECO Response:

a. Providing the complete roster of HECO management, EMS staff, and power plant staff on duty and/or who responded to the October 15, 2006 earthquake and island-wide blackout is overly broad as it includes individuals who are not critical and/or relevant to the issues of this proceeding and would impinge upon the personal privacy of HECO's employees.[1]

Without waiving its objection, HECO responds as follows:

System restoration was guided by the Incident Command Team (ICT). A list of the employees involved in the ICT was provided pursuant to Protective Order 23159 in response to CA-IR-7, subpart a. Hundreds of employees from all departments and process areas of

[1] The public disclosure of the names of HECO employees involved in the response effort could invade the privacy of those employees and potentially subject them to being personally contacted or their names being used by non-parties to this proceeding for ulterior purposes.

the Company responded to the October 15, 2006 outage over the course of 10/15/06 and 10/16/06. In addition to the key Operations area staff with direct responsibility for system restoration (System Operations, Power Supply Operations & Maintenance, Construction & Maintenance, Engineering, Project Management, Power Supply Services, Environmental, Power Supply Engineering, Customer Service and Support Services), executives, managers, supervisors, and numerous other employees from Corporate Excellence, Corporate Communications, Customer Solutions, Energy Solutions, Finance, General Counsel, Government & Community Affairs, Government Relations, Strategic Initiatives, and Public Affairs arrived at the Company's Ward Avenue Emergency headquarters (Dispatch Center) between 7:30 a.m. and 8:30 a.m. and their areas of responsibility remained well staffed through the duration of the outage. HECO will work with the Consumer Advocate to identify employees who are appropriate to respond to the Consumer Advocate's request on a mutually agreed upon basis.

b. See response to a.

c. The following table indicates the year in which each unit entered service and the building code that was used for the design basis. Any seismic design criteria used in unit design came from the applicable building code. No separate Seismic Building Codes were applicable.

HECO GENERATING UNIT	YEAR BUILT	BUILDING CODE IN EFFECT/USED IN DESIGN
Honolulu 8	1954	1952 UBC
Honolulu 9	1957	1952 UBC
Waiau 3	1947	1943 UBC
Waiau 4	1950	1946 UBC
Waiau 5	1959	1955 UBC
Waiau 6	1961	1955 UBC
Waiau 7	1966	1961 UBC
Waiau 8	1968	1964 UBC
Waiau 9	1973	1970 UBC
Waiau 10	1973	1970 UBC
Kahe 1	1963	1958 UBC
Kahe 2	1964	1961 UBC
Kahe 3	1970	1967 UBC
Kahe 4	1972	1967 UBC
Kahe 5	1974	1967 UBC
Kahe 6	1981	1970 UBC

UBC = Uniform Building Code

CA-IR-6

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 4 of 90.

a. The report refers to the "approved HECO operating procedures" (here and also on page 16).

1. Does this refer to a document transmitted by letter dated September 24, 1992 (i.e., The "Production Department Operating Division Policy Manual" (ODPM) is dated September 1992)?
2. Is September 1992 the most current version of this document?
3. Is there any provision to review and update this Manual on a periodic basis?
4. If so, how often does HECO conduct a review and update the Manual?
5. If this is not the most current revision, provide a copy of the most current revision.

b. The report states: "They have performed regular training; . . . ."

1. Do the Dispatch Center personnel have a person devoted full time to training?
2. Provide a detailed description of all training provided.
3. What personnel are required to take training?
4. Provide copies of records indicating who received training for each type of training class conducted.
5. Provide copies of proficiency evaluations for those who received the training identified in response to part (b)4 of this information request.
6. Provide details of the program that assures ongoing proficiency.

c. The report states: "The system restoration plan developed after the outage by the operations staff was reasonable. . . ."

1. Is there any type of restoration plan already developed, prior to an incident (such as the Incident Response Manual described on page 37)? Explain.
2. If so, does this plan provide specific steps to be taken, but allow for variations required by specific situations?
3. Provide a copy of this document plan.
4. Why are steam units used for black start purposes rather than other faster starting units?

5. List and explain the "critical restoration issues" that is referred to in the last paragraph on page 4.

HECO Response:

a.

1. Yes. On page 4 of 90 of the POWER Report, POWER Engineers was referencing the "HECO Production Department Operating Division Policy Manual (ODPM)" dated September 1992 with respect to the portion of the report statement "appropriate generation available to supply load and reserves…" ODPM Section I, Part A, Page 1 of 2 specifies the generation scheduling criteria for appropriate operation on the HECO system. This is the same ODPM document referenced on page 16 of 90 of the POWER Report.
2. Yes. The current version of the HECO Production Department ODPM is dated September 1992.
3. The ODPM is in the process of being updated.
4. There is no set time period for updating the document. Updates to the ODPM prior to 1992 were issued in 1986 and 1989.
5. A copy of the ODPM is provided as Attachment 3 in response to CA-IR-2, subpart a, pursuant to Protective Order No. 23159.

b.

1. The Dispatch Center personnel in the Operating Division of the System Operation Department are trained by a full-time Technical Trainer who is a staff member of the Operating Division. Currently the Technical Trainer position is vacant, however, a person from Engineering has been providing the training to the dispatchers for the new

Siemens Energy Management System and is preparing the training materials for the new SPL Worldgroup Outage Management System. In addition, two experienced training consultants are used to provide training for new load dispatchers. A team of engineers has been providing the System Dynamics training to the dispatchers and the power plant operators. This training is focused on the electrical system response during an electrical system upset. This includes the change in the system frequency when generators are lost and what actions are necessary to stem the declining frequency. The System Dynamics Presentation is provided pursuant to Protective Order 23159 as Attachment 38 in response to CA-IR-2, subpart a.

2. Technical training includes: training modules for the SLD, LD and TD positions, specific training in the systems like the Energy Management System and On-the-Job hands-on training with incumbent dispatchers.
3. The Supervising Load Dispatchers, Load Dispatchers and the Trouble Dispatchers are required to complete formal training.
4. Specific records of the type requested in this subpart b for each dispatcher that has been trained are not available. HECO currently has 6 qualified supervising load dispatchers, 4 qualified load dispatchers and 5 qualified trouble dispatchers. Each dispatcher must complete the requisite training before being allowed to assume a position on shift. Therefore each supervising load dispatcher, load dispatcher and trouble dispatcher has completed the training requisites.
5. There are no "proficiency evaluations" created specific to each dispatcher's completion of a particular training module. To the extent that this information request may seek employee-specific, overall annual performance records, HECO objects and further

declines to provide such information, even under a protective order, on the grounds that doing so would impinge upon the personal privacy of HECO's employees.

Without waiving its objection, HECO responds as follows:

As stated in subpart b.4 above, each of HECO's qualified dispatchers has satisfactorily completed the requisite training before being allowed to assume a position on shift.

6. On the job training and individual refresher courses such as the System Dynamics class provide a means to ensure on-going proficiency. System Operation is in the process of creating a formalized plan for refresher training on the new EMS with the purchase and installation of the dispatcher training simulator.

c.

1. HECO does not have a single static published restoration plan for recovering from a total blackout condition. HECO responds to system emergencies using a team approach through the Incident Command Team (ICT) organization where the collective experience and knowledge of HECO's subject matter experts are utilized to develop response plans specific to each event. The Incident Response Manual (IRM) is intended to provide procedures and guidance for assembling an incident command team, onsite response teams, communication protocols and resources to respond to incidents on a case-by-case basis.
2. Not applicable.
3. Not applicable.
4. When the majority of the HECO fleet was designed and built (1950s), liquid fired combustion turbines were not common in the size preferred for the system. In the 1960s when the last of the HECO generating fleet was designed, HECO identified the

need for baseload generation of appropriate size (90-140 MW+) capable of efficiently burning residual fuel oils. Additional factors considered in the selection of generation type include having sufficient inertia to provide system stability and consideration of the spinning reserve and quick-load pickup operating requirements. As a result, the HECO system is comprised mostly of high pressure/high temperature steam generating units. The first black start unit, a 750kW Solar, was installed at Waiau in 1968, when only steam units existed on the HECO system. Therefore, when the Waiau combustion turbines, W9 and W10, were installed in 1973, black start capability already existed at Waiau Station.

Subsequent to island-wide or near island-wide outages in 1983 and 1984, which were transmission system separation events, additional black start capability was installed at Kahe in 1986 along with 138 kV transmission system enhancements. Adding black start capability at Kahe diversified HECO's ability to black start Oahu and provided flexibility in starting either Waiau or Kahe in the event of an island-wide outage caused by a variety of scenarios ranging from natural disasters to homeland security.

It should be noted that the new CIP combustion turbine generator will have the capability of black starting directly onto the 138 kV bus. This capability will allow other units on the system to startup in parallel.

5. Some of the critical restoration issues were provided in the list of Incident Command Team primary objectives listed on page 38 of the report. In addition, other issues were mentioned throughout the report and include the following, although not totally inclusive, page 39 "visually inspected the stations and lines for any apparent seismic

damage.", page 40, "Their primary concern was the ability to manage the incremental load demand initially carried by a single steam unit operating at limited capability (approximately 70% drum pressure, single burner operation) and the potential for that unit to trip off line. Moreover, they were also concerned that unstable unit operations could result in exceeding environmental operating limits, thus requiring a forced manual shutdown of the unit." (See response to CA-IR-38, subpart a), and page 43, describing the frequency and voltage swings HECO was experiencing and the concerns it had.

CA-IR-7

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 4 of 90.

a. The above document refers to "HECO Incident Command" (here and on page 38). Based on this statement please respond to the following:

   1. Provide staffing of the Incident Command.

   2. When was the Incident Command implemented?

   3. What was the Incident Command's authority during the events of October 15 and 16, 2006?

b. The document also refers to "System Dynamics and Generation Unit Response During Normal Operation and System Disturbances" training. Based on this statement please respond to the following:

   1. Provide a copy of the document describing this training.

   2. Provide the training schedule with hours of training required for each employee in all areas.

   3. Is black start training only provided for operators at the Kahe Generating Station? Explain.

   4. If not, what other operators at the other generating stations receive black start training? Explain.

   5. What is the frequency of such black start training and exercises?

HECO Response:

a. The following is provided in response to this request.

   1. Attached page 4 shows HECO's Incident Command organizations chart. Each position in the IC organization has a primary and backup person to ensure adequate coverage. If both primary and backup personnel are available and respond to an IC call, one will be designated as the primary and the other will either be reassigned or scheduled to support a later shift if the response goes beyond the first operating period. Also the incident command structure is designed with sufficient flexibility to meet the requirements of the

emergency response. At the minimum the on-scene person in charge can assess what resources are necessary to respond to the emergency. As information about the emergency unfolds, other sections of the incident command structure can be called upon to provide assistance with higher levels of authority being engaged. If the emergency is a very large incident then the full incident command organization may be activated with the Incident Commander overseeing the response.

2. HECO transitioned to an Incident Command organization approximately 5 years ago. One of the reasons why this took place was that it better defined the roles and responsibilities for individuals responding to an emergency situation thus ensuring a more concerted response.

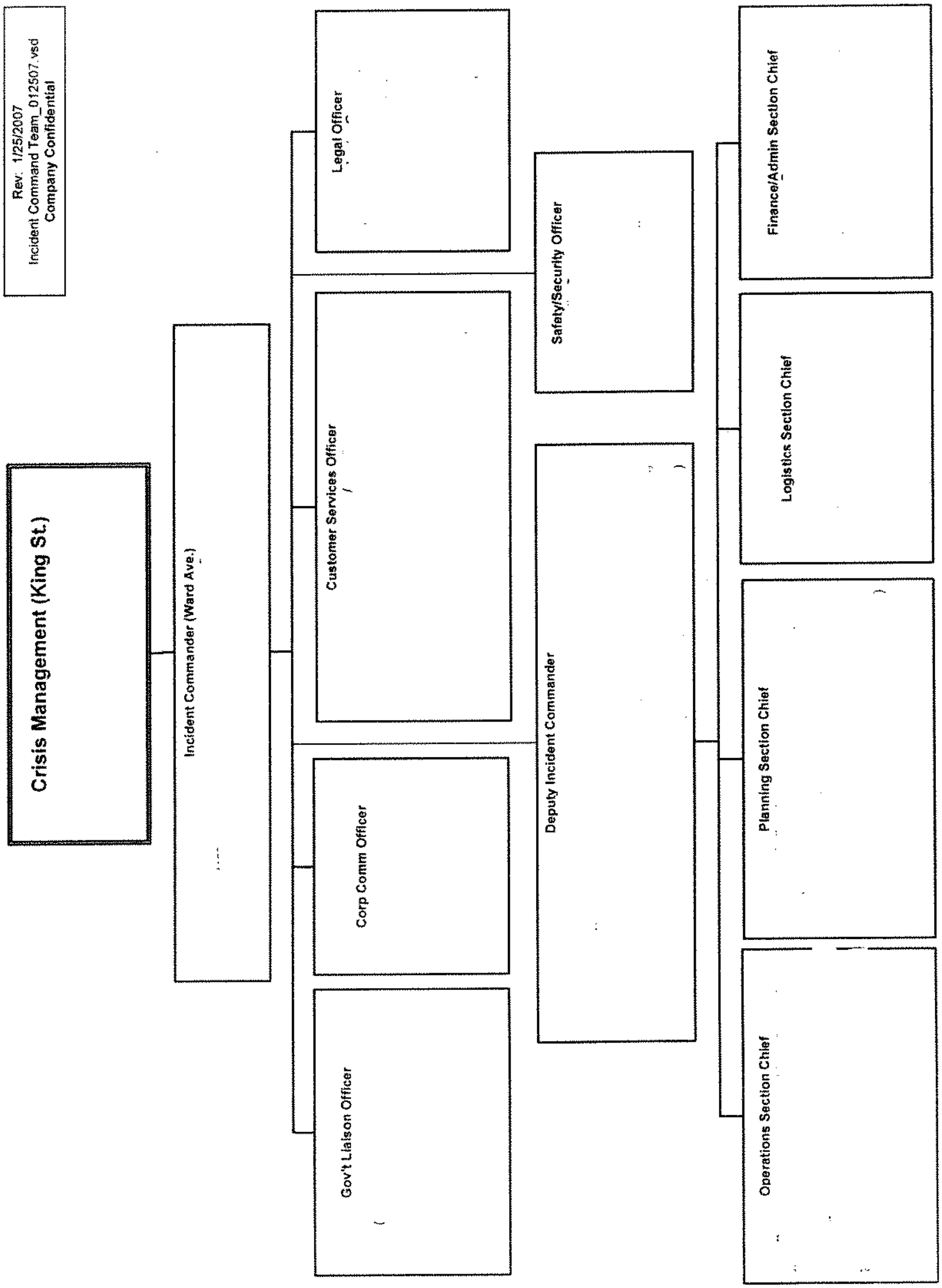
3. Incident Command is responsible for establishing the strategic objectives of the response. Once the strategic objectives were identified it was the responsibility of the section chiefs to execute the tactical responses to meet the objectives. The Incident Command Team intervenes only if circumstances or issues arise that prevents the section chiefs from accomplishing the objectives. During the October 15 incident, after the strategic objectives were defined the section chiefs were able to execute them without major problems or issues. The operational strategic objectives defined by the Incident Command Team were:

    1. Safety of employees, public, assets
    2. Restoration of generators
    3. Orderly restoration of system
    4. Verify Integrity of T&D System
    5. Verify Integrity of Substations/Switchyards
    6. Our actions shall be to operate for the long run

b. Responses to questions related to the "System Dynamics and Generation Unit Response During Normal Operation and System Disturbances" training are provided below:

1. A copy of the requested document is provided as Attachment 38 in response to CA-IR-2, subpart a, pursuant to Protective Order No. 23159.
2. The referenced training was given weekly for a period of three hours and was held from September through December 2006. The training was scheduled so that all of the operating personnel, dispatchers and control operators, and their supervisory personnel could attend and participate in the training.
3. No. Black start training is also conducted at the Waiau Station.
4. Black start training is provided to the Operating Division staff which includes Supervisory personnel and operators.
5. Prior to October 15, 2006, Kahe Station conducted annual black start training simulations by starting up a 90 MW unit using the Kahe black start generators following the completion of a scheduled overhaul. Waiau also normally conducts annual black start training on W5 or W6. However since February, 14, 2004, training was deferred due to a fuel leak on the Waiau Solar CT. Also, please see HECO's response to CA-IR-18.

HECO Incident Command Team For Critical Infrastructure Protection



CA-IR-8

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 4 of 90.

The above document states that "in a few cases there are details in which slightly different course of action could have been taken." Based on this statement please respond to the following:

a. Provide a specific list of such cases and a description of each error.

b. Were there pre-earthquake human errors such as mis-setting relays (page 27) or level transmitters which contributed to the island-wide blackout after the October 15, 2006 earthquake?

c. List and describe each human error.

HECO Response:

a. POWER Engineers does not consider the referenced statement as describing an "error."

Instead, as stated on page 4 of the report,

> The actions of the HECO staff were certainly reasonable and timely, in the best interests of the public, and amounted to a good level of performance under the circumstances. With the advantage of calm hindsight, we can see that in a few cases there are details in which slightly different courses of action could have been taken. But we are not aware of any case where actions could be described as imprudent or likely to cause injury, or damage. In our opinion, actions by HECO personnel were reasonable, responsible and conducted in a professional manner.

To assume that under the circumstances and with the information and experience available on the morning of October 15, 2006 other choices should have been made is speculative. The two cases referenced are the power plant trips due to suspected turbine vibration and the communication between the K1-2 and K3-4 control rooms at Kahe Power Plant during the black start. In the case of the power plant trips (K3 and H8 manual trips) described on page 29 and 34 of the report, we can not find fault with the operator decisions based on the circumstances under which they made their decisions as explained in the report on pages 61-64.

As discussed on pages 49-50 of the report, during the Kahe black start, the decision was made to parallel start two units at Kahe based on the unknown status of the plants as they had just experienced an earthquake, significant load swings and emergency shutdown, which stresses equipment and can lead to failures. These concerns were confirmed when K1 and K3 had equipment problems on startup. In the midst of troubleshooting the problems and varying the start attempts between units when an equipment failure was encountered the unit startup sequence status of each unit did not get clearly communicated between the K1-2 and K3-4 control rooms. This led to the trip of the black start diesel generators. Working to black start generators in parallel was attempted in this case to provide the best chance to restore a unit on-line in the shortest time.

b. The only pre-earthquake error that POWER Engineers is aware of was the setting of the Kalaeloa Steam Turbine under frequency relay by the IPP, which has been since corrected. HECO believes that the error in the relay setting was not a key factor that contributed to the island-wide blackout. The fluid level sensors were set to alarm and lockout at the proper levels per the OEM design.

c. See response to subpart b.

CA-IR-9

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 5 of 90.

The report states that operators with only one unit on line tripped the unit, thinking the disturbance was due to turbine vibration, while operators with two units on line investigated, and found no turbine vibration, and thus did not trip the units.

a. Is there a procedure that documents the steps to be taken when a vibration is felt to assure that the vibration is caused by unit vibration before tripping a unit?

b. If yes, please provide a copy of such procedure.

c. If the operators with two units could take the time to check the cause of the vibration before tripping the units, could the same not be done for the operators with only one unit running? Explain.

HECO Response:

a. Yes. A copy of the procedure is provided on pages 4-6 of this IR.

b. Please refer to a. above.

c. The control operators that had two units running (K1&2 and K5&6) had the benefit of immediately assessing that vibration problems developing simultaneously on two units is highly unlikely. Furthermore, rack-mounted instrumentation in K1&2 and K5&6 control rooms provided almost instantaneous verification that the shaking was not attributed to turbine vibration. The control operators at K3 and H8 had one unit running and did not have the benefit of comparing one unit against the other. In addition, they did not have the quick reference vibration indication instrumentation and the only single source of vibration was their respective units.

There are additional factors that impacted the actions taken by the respective Control Operators on October 15, 2006. The following summarizes additional factors which contributed to operator actions:

- Control Operators at Kahe and Honolulu had not experienced an earthquake of the magnitude experienced on October 15, 2006, while working at or near turbine generators. All operators initially reacted to high turbine vibration.
- Kahe 3 was at a relatively low load and in the process of increasing its output to support the normal morning system peak. The sudden and significant shaking combined with the high feedwater level alarms led the operator to assess turbine water induction and the potential for major turbine damage. Also, the unit was at a relatively low load. His decision to trip was based on this split second assessment.
- Honolulu 8 (H8) is a cycling unit. On the morning of October 15, 2006, H8 was in the process of ramping load up to its normal minimum load with some of the controls in manual when the earthquake struck. The decision to trip H8 was based on the operator's previous experience with a high vibration situation approximately 8 years prior that resulted from a LP turbine blade failure; the fact that H8 was still ramping up to its normal minimum load and would have minimal impact on the system if tripped; H8 was the only unit running (H9 was down and being prepared for an overhaul) and source for significant vibration.
- Kahe 1&2 were both on line and equipped with rack-mounted vibration indication on either end of the control room. When the shaking occurred the Control Operator was able to quickly scan both monitors and assess that the cause for the significant shaking was due to something other than turbine vibration. Also, high feedwater alarms did not activate during the earthquake.
- Kahe 5&6 were both on line and equipped with rack-mounted vibration indication. The Control Operator was able to quickly scan turbine vibration which indicated

normal and focused his attention on high feedwater level alarms which restored to normal following the earthquake. Also, both K5 and K6 increased load as expected when K3 and H8 were tripped.

OPERATING EMERGENCIES

IIIA. TURBINE VIBRATION & LOUD NOISES

Turbine vibration and/or loud noise emergencies are those conditions when vibration or operating sounds exceed or are different than those of normal operations.

CAUSES:

Turbine vibration and/or loud noises may be caused by the following:

1. Rubbing of internal parts.
2. Failure of internal parts.
3. Inherent inbalance of turbine rotor.
4. Bowing of rotor.
5. High exhaust hood temperature.
6. Boiler water carryover.
7. Thermal shock due to excessive changes in steam temperature.
8. Improper lube oil temperature, causing "oil whip."
9. Wear or loss of thrust bearing.
10. Fluctuations in lube oil pressure.
11. Improper steam or water sealing.
12. Insufficient drainage of shaft seals.
13. Passing through critical speed during unit start-up.
14. Failure of feedwater heater high level trip.
15. Improper operation of attemperator stop or control valves.

RESULTS:

The results of turbine vibration and/or loud noises are:

1. Damage to seal strips.
2. Damage to bearings.

3. Damage to lube oil lines and subsequent danger of fire.

4. Broken blading

5. Damage to steam and/or seals.

INDICATION:

Annunciation available are:

Annunciator	Set Point
Vibration	
Eccentricity	
Rotor position	
Casing expansion	
Differential expansion	
Turbine thrust bearing trouble.	

If one vibration point alarms while the other points read normal, examine the vibration pickup for any abnormal condition. Confirm the vibration with a portable IRD.

Rapid changes in loading and/or temperature will change the rotor position/casing expansion/differential expansion and must be observed carefully especially during unit start-up due to the dange of an internal rub.

CORRECTIVE ACTION:

Corrective action is based upon the severity of the vibration and/or loud noise:

1. Start-Up (less than 600 rpm). If the shaft excentricity rises above 1 mil, return to 200 rpm until eccentricity decays to 1 mil. If necessary return to turning gear.

2. Start-Up (above 600 rpm). If vibration rises above 5 mils, reduce turbine speed until vibration decays to below 3 mils.

If at a critical speed, accelerate to pass through the critical speed quickly.

3. Minor Vibration (Unit Loaded)

   a. If one or more vibration pick-ups indicate an increase in vibration up to 4-1/2 mils:

      (1) Check the vibration pick up with a portable IRD.

   b. If one or more vibration pick-ups indicate an increase in vibration of more than 4-1/2 but less than 8 mils:

      (1) Transfer ADS to manual.

      (2) Reduce unit load to determine if vibration returns to normal.

      (3) Ascertain cause of vibration, if possible, and restore load after correction.

      (4) If time permits, check vibration with an IRD.

      (5) If vibration remains and cannot be reduced, prepare to take unit off the line.

4. Major Vibration (unit loaded)

   a. If vibration increases 8 mils or above:

      (1) Verify that vibration exists audially or visually.

      (2) Trip the unit.

   b. After trip:

      (1) Observe roll down to determine if vibration returns to normal.

      (2) Inspect for damage due to vibration, e.g., broken oil lines, hot bearings, fires, hydrogen leaks, etc.

CA-IR-10

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 5 and 7-8 of 90.

a. The report concludes that HECO operated reasonably in its approach to add customer load while bringing the system back up after the blackout.

1. Is there any type of plan already developed, prior to an incident specifying which loads to add, in what sequence, etc? If yes, please provide a copy of such plan.

2. Does this plan provide specific steps to be taken, but allow for variations required by specific situations?

HECO Response:

a.

1. See the responses to CA-IR-6, subparts c.1 and c.2.

2. See the responses to CA-IR-6, subparts c.1 and c.2.

CA-IR-11

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 7 of 90.

The report discusses the restoration efforts and problems in the configuration of the black start generators and plant auxiliary systems at the Kahe Station.

a. Why did it take over three hours and 45 minutes for these black-start units to come up?

b. What were the black start generator configuration problems at Kahe Station?

c. What were the problems with auxiliary systems at the Kahe Station?

d. Please describe in detail the responses to parts (a) through (c) of this information request.

HECO Response:

a. With respect to the black start process of October 15, 2006, please note that referenced section of the report, page 7, provides an executive summary of that process. A more detailed discussion of the black start process is presented in pages 73-75, Section 3.3.1 Black Start.

As discussed in response to CA-IR-42, subpart a, on October 15th, HECO decided to black start the units at both the Kahe and Waiau Power Plants in parallel. The black start process at Kahe encountered several delays (see answer to subpart b below) and the Waiau Power Plant (Waiau 6) successfully completed the black start process first and energized the grid (in approximately three hours and 45 minutes from start to energizing to the grid). As described in the response to CA-IR-42, subpart a, once the Waiau Power Plant energized to the grid, HECO had to back off completing the black start process at Kahe as the next system restoration step was to establish a transmission system tie from the Waiau Power Plant to the Kahe Power Plant (the transmission system tie from Waiau to Kahe was successfully completed at approximately 2:17pm). It was necessary to back off the black start at Kahe Power Plant to avoid having two separate electric systems. Kahe 2 synchronized to the energized transmission system at 2:39pm, 12 minutes after the tie was completed.

It is important to note that while HECO had to back off the black start Kahe 2 due to the successful completion of the black start process of Waiau 6, the Kahe 2 startup process nevertheless continued on an orderly basis. The startup process included the major steps of firing the boiler to build steam pressure, pulling vacuum on the condenser, and rolling the turbine to 3600 RPM. The last step of synchronizing the Kahe 2 turbine-generator to the grid was put on hold until the transmission tie from Waiau Power Plant to Kahe Power Plant was completed.

b. On October 15, 2006, at Kahe Power Plant there were two configuration issues that affected the black start process. The first issue was noted on Page 73 of the subject report: "Initial setbacks were encountered by the UO [Utility Operator] and Shift Supervisor getting the black start configured properly to supply power to only the required auxiliaries." This initial configuration setback of the black start system breakers and the unit auxiliaries to the startup bus resulted in a delay of approximately 30 minutes. The second issue was also noted on Page 73 of the subject report: "The progressing modifications of the plan to meet changing circumstances resulted in the inadvertent configuration of the auxiliary bus leading to a trip of the black start diesels that resulted in further delay." Kahe Power Plant is equipped with two black start diesel engines with a combined generating capacity of 5 MW, sufficient for black starting of two steam-electric units in parallel (i.e., Kahe 1 or 2 and Kahe 3 or 4). At approximately 8:30am, the first configuration matter had been resolved and it was decided to black start Kahe 1 and Kahe 3 in parallel. At approximately 10:40am (as steam pressure was building), a condensate leak was observed at the air ejector condenser cover gasket and the startup of the Kahe 1 had to be aborted for safety reasons. Accordingly, efforts were switched to initiate a black start of Kahe 2 in parallel with Kahe 3. At 11:19am the black start diesel engines tripped due to excess load (i.e., the plant auxiliaries were drawing power in excess of the capacity of the two diesel engines). The excess load was attributed to prematurely connecting the Kahe 2 auxiliaries before disconnecting all the Kahe 1 auxiliaries. This configuration error resulted in a shutdown and restart of the black start processes at Kahe Power Plant and a delay of more than one hour.

c. In general, the issues with the auxiliary systems at Kahe Power Plant were those described above in the context of "configuration" issues. In addition, however, the following specific problems with auxiliaries were experienced at Kahe Power Plant during the black start process:

- Kahe 1 had problems with a condensate leak of the air ejector condenser gasket. For safety reasons the black start of Kahe 1 was aborted and efforts switched to black start of Kahe 2.
- Kahe 3 had problems with the automated boiler purge system and purge time relay. Boiler purge is a safety permissive that must be satisfied before lighting the first burner, and its purpose is to prevent a boiler explosion. Resolution of the purge system problems delayed startup.
- Kahe 5 had a problem starting the "Onan" emergency generator (DC system backup power source) which is necessary to sustain the operation of critical auxiliaries such as turbine lube oil pumps, turbine turning gear, and generator hydrogen seal oil

pumps. Until the Onan emergency generators are started, critical auxiliaries operate off a dc battery system that cannot sustain critical auxiliary operation for extended periods. This problem did not factor into the black start process of Kahe 1, 2, or 3, and did not impact system restoration efforts.

d. See the responses to subparts a, b, and c.

CA-IR-12

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Paragraph 3 discussed on pages 8-9 of 90.

The report does not provide a direct answer to this question: "Could the island-wide power outages on Oahu and Maui have been avoided?" See Commission Order No. 23155, Docket No. 2006-0431 at 2. Please provide a "yes" or "no" response with a detailed, specific, factual explanation to support the response. Where opinions are given or conclusions are made, please provide the specific facts upon which such statements are based.

HECO Response:

Given the facts and circumstances of October 15, 2006, no, an island-wide power outage on Oahu could not have been avoided. As concluded in the POWER Engineer's Report, the main underlying cause of the island-wide outage was the earthquake tripping the Low-Low Electro-Hydraulic Fluid Level switches, which resulted in the K5 and K6 E.H. systems locking out the operation of the hydraulic pumps. The OEM control schemes for the K5 and K6 turbine steam valve actuation included lockout provisions which inhibited the pumps from re-starting, even after the low-low fluid level indications cleared after the earthquake. The E.H. lockouts resulted in the eventual loss of K5 and K6, and the spinning reserve and quick load pickup capability of the remaining units was exceeded despite the Kicker Block load shed. Loss of K5 and K6 was the primary cause of the system frequency decay to below 58 Hz. At that point, the automatic underfrequency load shed Blocks 1 and 2 operated, immediately followed by the operation of the remaining automatic underfrequency load shed Blocks 3, 4, and 5 and the near simultaneous underfrequency protective relay trip of the H-Power, Kalaeloa, and AES generating units, ultimately resulting in a severe frequency drop and leading to further automatic and manual load shedding, and, eventually the island-wide blackout. (see POWER Engineer's Report at 81-82.)

CA-IR-13

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Paragraph 7, page 10 of 90.

The report recommends:

> "Assess the system restoration process following an island-wide blackout to determine the best order for generation startup that would allow load to be added in a safe and expeditious manner while carefully retaining frequency and voltage stability."

a. Is this process contained within the "Production Department Operating Division Policy Manual" or ODPM (see page 16 of POWER)?

b. Explain why or why not?

c. Is this process contained in the "Incident Response Manual" or IRM (see page 37 of POWER)?

d. Explain why or why not.

HECO Response:

a. No.

b. See the responses to CA-IR-6, subparts c.1 and c.2. The POWER Engineers' recommendation is to assess the restoration process based on HECO's experience from the earthquake event and to take into consideration use of the planned Campbell Industrial Park CT and a possible connection to a Kalaeloa CT if the protection is revised to allow connection to a dead bus.

c. No.

d. See the response to subpart b.

CA-IR-14

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Paragraph 7, page 10 of 90.</u>

The report recommends consideration of the use of "the planned Campbell Industrial Park combustion turbine (which will have black start capability). . . ." Please cite the Building Codes and Seismic Design Codes that will be the basis of design and construction of the planned combustion turbine installation at the Campbell Industrial Park.

<u>HECO Response:</u>

The Honolulu City & County Department of Planning and Permitting has instructed HECO to design the planned Campbell Industrial Park combustion turbine ("CIP1") in accordance with the 2003 edition of the International Building Code ("IBC"). HECO will be using the following seismic design parameters:

Seismic Use Group: III
Category: D
Seismic Factor (I_E): 1.50
Site (Soil) Class: D
Spectral Response Acceleration: short-period (S_s) = 0.58g
1-second period (S_1) = 0.16g

CA-IR-15

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 15-16 of 90.

a. There are six blocks of automatic Under Frequency Load Shedding referred to, starting at 58.5 Hz, going down to 57.0 Hz. The total approximate load shed under these settings is about 413 MW "based on morning peak." Load at the time of the event was approximately 836 MW.

   1. What is the morning peak load that the 413 MW of load shed is based on?

   2. What percent of that 836 MW would have been expected to be shed utilizing the automatic under frequency load shedding?

b. The report states, at page 16, that the "Undervoltage Load Shedding Scheme consists of four blocks with 27 – 46 kV breakers that shed approximately 35% of the system load." Based on this statement please respond to the following:

   1. Explain how the Undervoltage Load Shedding Scheme interacts with the Under Frequency Load Shedding Scheme.

   2. Do both of these load shedding schemes control any common breakers?

   3. Please explain and list the breakers.

   4. For this event when frequency dipped to 51.2 Hz, should all under frequency and under voltage load shed schemes have operated? Explain.

c. How much load of the 836 MW was expected to be shed under both automatic schemes for this event?

d. How much load was actually shed under both schemes?

e. Explain what caused the differences between the response to parts (a) and (b) above.

HECO Response:

a.

   1. The 413.7 MW of load shed referred to was based on the recorded 2002 day peak of 1,227 MW.

   2. The expected percentage of load to be shed is about 35%.

b.

1. The Undervoltage Load Shedding (UVLS) scheme utilizes its own set of relays that measure local voltage and trips should the voltage drop below the relays' voltage set point and remains there for the duration of the relays' time delay setting.

   The Under Frequency Load Shedding (UFLS) scheme also utilizes its own set of relays that measure frequency and trips should the frequency drop below the relays' frequency set point and remains there for the duration of the relays' time delay setting.

   Both schemes are designed and implemented such that they operate independently from each other. However, during conditions where the system experiences a sufficient drop in both voltage AND frequency, both schemes will operate independently.

2. Yes, the undervoltage and underfrequency load shedding schemes do trip some common circuit breakers.

3. As stated in the above response for item b2, the UVLS and UFLS schemes are designed and implemented such that they operate independently from each other. They are also designed to coordinate with each other such that sufficient load is tripped during system conditions where sufficient drops in both voltage and frequency are experienced.

   The following lists the circuit breakers that are designed to trip for both the UVLS and UFLS schemes:

Breaker	Circuit Name
4464	Koolau-Kahuku 46 kV circuit
4465	Koolau-Aikahi 46 kV circuit
4466	Koolau-Kaneohe 46 kV circuit
4467	Koolau-Wailupe No.1 46 kV circuit
4477	Koolau-Wailupe No.2 46 kV circuit
4484	Koolau-Nuuanu 46 kV circuit

4817	Pukele No. 6 46 kV circuit
4818	Pukele No. 7 46 kV circuit
4820	Pukele No. 5 46 kV circuit
4863	Halawa No. 3 46 kV circuit
4864	Halawa No. 2 46 kV circuit

4. By the time system frequency reached 51.2 Hz, all of the UFLS blocks should have operated since the lowest frequency set point is 57.0 Hz.

   Blocks 1 through 3 of the UVLS scheme utilize voltage set points of 121-122 kV. EMS recorded voltages for these substations show a minimum of 124.7 kV during the frequency dip to 51.2 Hz and as such, operation of UVLS Block 1 through 3 were not expected.

   Block 4 of the UVLS scheme utilizes voltage set points of 125-126 kV. EMS recorded voltages for these substations ranged from 127.4 kV to 124.7 kV during the frequency dip to 51.2 Hz and as such, a portion of UVLS Block 4 would have been expected to have tripped. Please note that the actual recorded voltages and the UVLS Block 4 voltage set points are very close (within 0.1% to 0.2%) and inherent tolerances of the measuring/sensing equipment and the UVLS relays make it difficult to determine with full certainty what should have tripped or not.

c. The UFLS scheme and UVLS scheme Block 4 combined was expected to automatically shed approximately 340 MW.

d. It is very difficult to determine the exact amount of load that was shed due to only the UFLS and UVLS schemes. However, based on the recorded system load at the time that the frequency dipped to 51.2 Hz, about 430 MW of load was shed through automatic load shedding schemes, manual load shed by HECO SLD, and tripping of some customer loads due to the system conditions.

e. HECO assumes that this question asks for a comparison of the difference between (c) and (d). Three of the four blocks of the UVLS scheme tripped due to limitations in the UVLS scheme relays' ability to accurately measure trip voltage at the low frequencies that occurred (one block – Block 4 – tripped as expected). The additional UVLS tripping, the manual load shedding efforts of the HECO SLD, and the tripping of some customer loads due to the system conditions account for the differences between the expected load shedding and actual load shedding.

CA-IR-16

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 16-17 of 90.

The reports states that "[a] new Dispatch Center was recently constructed and began full operation at the end of March 2006."

a. Was a new EMS system put in service with the new Dispatch Center?

b. If so, describe the new EMS system and state the date it became operational.

c. If it became operational in phases, please describe including all dates.

d. Were new procedures implemented at that time with respect to the system restoration plan?

 1. If yes, please provide a copy of such new procedures.

 2. If no, please explain why not.

e. Were new procedures integrated into the training program with respect to the system restoration plan?

 1. If yes, please describe such training program and provide a copy of the training program.

 2. If no, please explain why not.

f. What Building Codes and Seismic Codes were used for the design and construction of the new Dispatch Center?

HECO Response:

a. Yes.

b. The new Energy Management System (EMS) was purchased from Siemens and is the Siemens Power TG system. Please refer to Docket No. 03-0360 for additional information about the EMS. The EMS became operational in several phases with the final phase in service on April 13, 2006.

c. All generating units (i.e., HECO and independent power producers) were cutover on Monday March 27, 2006. One half of the transmission substations were cutover to the new EMS on

Tuesday March 28, 2006. The remaining transmission substations were cutover to the new EMS on Wednesday March 29, 2006. The distribution substations that are on supervisory control and data acquisition (SCADA) were cutover from Monday April 10 through Thursday April 13, 2006.

d.

1. No new procedures were implemented with respect to the system restoration plan.
2. The new EMS provides similar restoration functionality to the old EMS, therefore new restoration procedures were not implemented. For example, the distribution substations with Supervisory and Data Acquisition (SCADA) remained the same between the new and old EMS, thus providing the same control over distribution substation breakers. Another example includes displays for the automatic and manual load shedding displays. Both the old and new EMS contained the same amount of information on their respective displays. The new EMS provides additional operational functionality such as a faster scan rate, improved maintainability, the ability to provide real-time contingency analysis, and availability of dispatch information at power plant control rooms. Please refer to Docket No. 03-0360.

e. There were no new procedures added to the training program specifically with respect to the system restoration plan as explained in subpart d. However, additional training was provided with the completion of the new dispatch center in other areas not related to system restoration such as the building fire alarm system, the control room bio reader and the on-site monitoring system.

f. The building code that was used for the new dispatch center is the Uniform Building Code 1997 as amended by Building Code of the City and County of Honolulu (July 2000). The details are included below:

Design Seismic Load: Occupancy Catergory: 1 (essential)

Seismic Importance Factor: Ip = 1.50

Soil Profile Type: SE

Seismic Zone: 2A

Seismic Coefficients: Ca = 0.30; Cv = 0.50

CA-IR-17

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 17 of 90.

The report states that the "Waiau 7-8 control room also remotely operates the Waiau 9-10 combustion turbines." Based on this statement, please provide information regarding the remote operation of the W9 and 10 combustion turbines:

a. Under normal conditions; and

b. Under emergency conditions.

HECO Response:

Remote or local start of W9 and W10 is a selected feature located in the control cabin at the unit site. Under normal conditions, the remote/local switch is left in the "remote" position to allow either normal or emergency start of W9 and W10 from the W7&8 control room located several hundred feet away from W9 and W10. Both W9 and W10 combustion turbines are capable of normal or emergency startups from either remote (W7&8 control room) or local (control cab at the unit). Based on experience the startup duration, from the time a start signal is initiated to the time the CT is synchronized to the bus, are identical for both normal and emergency operation.

a. Under normal conditions and upon synchronization to the system, load is automatically ramped at 2MW/min to the minimum load point ("Spinning Reserve") of 5 MW. From this initial load point, a 2nd start signal may be initiated by the Control Operator to ramp the unit to a "Pre-select" load of 44 MW. The unit can also be dispatched by EMS or control to an exhaust temperature setpoint (Base, Peak, or Peak Reserve).

b. As mentioned above, the duration of a startup to the point of synchronization is similar for both normal and emergency starts. After synchronization the CT will ramp to the Pre-select load of 44 MW at a rate of 18 MW/min. Simultaneously, any change in system frequency caused by instability will impact generator output based on droop control.

CA-IR-18

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 18 of 90.

The report states that black start procedures for Kahe are identified in the "Power Supply Operation and Maintenance Department, Operating Division Procedure, Black Plant Startup Operations for the Kahe generating plants Units 1 through 4. Waiau plant uses Waiau Station 'Simulated Black Plant' checklists for the various operating procedures." Based on the above statement please respond to the following:

a. Provide a complete, up-to-date copy of the referenced documents for each of these units, including legible diagrams and drawings.

b. What training, certification, exercising, and/or testing of these procedures are performed and which HECO staff members are required to participate in such activities?

c. Provide the names, positions, and dates of all persons conducting and receiving such training and exercises for each unit for the last five years.

HECO Response:

a. A copy of the requested documents is provided as Attachments 27 and 28 in response to CA-IR-2, subpart a, pursuant to Protective Order No. 23159.

b. Please refer to HECO's response in CA-IR-65, part d. In addition, Kahe Utility operators perform the weekly test run of the black start diesel generators in which each unit is started and synchronized to the grid. Testing of black plant start up procedure is conducted once per year on one of the Kahe 1 thru Kahe 4 steam units depending on unit outage opportunities such as planned maintenance outages (overhauls). When this occurs, two operating crews at the unit to be started and two utility operators are scheduled to participate, as well as at least one Shift Supervisor and the Sr. Supervisor. Waiau also normally conducts annual black start training on W5 or W6. However since February, 14, 2004, training was deferred due to a fuel leak on the Waiau Solar CT. Since then, annual black start simulations have been suspended and HECO has have relied on equipment walk downs, procedure reviews and dry-runs. Periodic Waiau black start test runs and annual simulations will resume as soon as the new fuel valve and matching control system is installed (see CA-IR-19, part c).

c. See Attachment 45 in response to CA-IR-2, subpart a, pursuant to Protective Order 23159, for documentation of the last Kahe simulated black start training exercise. Specific records of the type requested in this subpart c for Kahe and Waiau black start training over the past 5 years were not created.

CA-IR-19

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 19 of 90.

The report states that "Waiau normally runs a simulated black plant startup once a year. The last time this was performed was February 14, 2004 on W6." Based on this statement please respond to the following:

a. Why were repairs not made to the fuel system that prevented a simulated black plant startup on August 21, 2005, 14 months prior to the October 15, 2006 earthquake?

b. Provide the dates and descriptions of all "simulated" or actual black plant startups on each of the Waiau units for each of the past five years.

c. Has the "intermittent fuel control valve leak" been repaired since the October 15, 2006 island-wide outage?

d. If not, explain why not.

HECO Response:

a. The Solar black start generator was installed at Waiau Power Plant in 1968. The OEM (Solar) for the Waiau black start generator notified HECO back in 2004 that the fuel control valve was not repairable and the original replacement was not available due to obsolescence. This valve controls speed and load response and is matched to the control system such that an "off-the-shelf" valve cannot be used. Therefore, replacement of the valve also requires replacement of the fuel system controls. On October 15, 2006, the critical need to black start Waiau 6 led to the decision to initiate a black start with appropriate precautions in place.

b. The last simulated black start at Waiau was conducted on W6 on February 14, 2004. Since then, annual black start simulations have been suspended and HECO has relied on equipment walk downs, procedure reviews and dry-runs.

c. No. The original equipment manufacturer (OEM) was non-responsive. An alternate provider was selected and a purchase order was issued on February 2, 2007 to provide a replacement valve and compatible controls.

d. An explanation is provided in subpart c above.

CA-IR-20

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 19 of 90.

The report states that "HECO performed a hands-on black start training exercise on July 20, 2006 when Kahe Unit 3 returned to service from a maintenance outage." Based on this statement, please respond to the following.

a. Does HECO consider the five-hour black start training scenario an acceptable result?

b. Given that only Kahe and Waiau units have black start capability according to this report, does HECO consider five hours an acceptable startup time for an island-wide blackout?

HECO Response:

a. Yes, HECO considers the five-hour black start training conducted in July, 2006, as an acceptable result. Training exercises of this type are not intended to be timed drills, but opportunities to learn in the event of a real situation. HECO agrees with Recommendation #8 on page 89 of 90 in the report, and have taken steps to improve black start restoration knowledge and awareness. Increasing the frequency and complexity of training exercises, and involving more O&M and Load Dispatch personnel for first-time and refresher training on black start procedures should translate into more efficient restoration of the system in the event of an island-wide black.

b. HECO employees worked hard to complete the black start process as quickly and safely as possible and took the prudent step to try the black start process in parallel at the Kahe and Waiau Power Plants. Given the circumstances surrounding the island wide blackout on October 15, 2006, the time required to black start the grid using Waiau Unit 6, approximately four and one half hours, was reasonable.

CA-IR-21

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 20 of 90.

The data presented on Table 1 indicates that the system load at the time of the event was 836.7 MW. For the years 2004, 2005 and 2006, please provide the following:

a. Annual peak load;

b. Annual energy usage;

c. Definition of "seasons" typical on HECO system (i.e. winter, spring, summer, fall) of the years, peak usage for each season; and

d. The 24 hourly loads for a typical weekday and weekend day in each season.

HECO Response:

a. The recorded system peaks (in Gross MW) and the recorded sales (in GWH) for 2004-2006 are provided in the table below.

	Peaks (Gross MW)	Sales (GWH)
2004	1,327	7,733
2005	1,273	7,721
2006	1,315	7,701

b. See response to (a) above.

c. Unlike many jurisdictions on the mainland, Hawaii typically does not experience four sharply-defined and distinct seasons (winter, spring, summer, and fall). However, patterns of electricity usage do vary during the year, in part due to weather. HECO typically uses two categories to classify its load shape: Evening Peaking and the less-frequent Day Peaking. Day Peaking occurs during portions of the summer. Evening Peaking is more common, and is typical at all other times of the year. The tabular data provided in response to (d) provides illustrative weekday and weekend hourly data for 2004-2006, for Evening Peak and Day Peak periods.

d. Illustrative Hourly Load Profiles for 2004-2006 Weekdays And Weekends (Gross MW)

	2004				2005				2006			
	Day Peak		Evening Peak		Day Peak		Evening Peak		Day Peak		Evening Peak	
	Wkend	Wkdy	Wkend	Wkdy	Wkend	Wkdy	Wkend	Wkdy	Wkend	Wkdy	Wkend	Wkdy
	7/18	7/19	10/10	10/11	7/17	7/18	10/9	10/10	7/16	7/17	10/8	10/9
1:00	763	748	770	787	767	744	730	717	738	728	796	772
2:00	721	710	727	754	726	706	694	688	690	693	752	735
3:00	696	690	701	732	700	688	674	673	668	675	725	715
4:00	690	701	692	738	694	695	667	677	664	686	716	717
5:00	699	747	707	778	707	742	681	721	678	735	728	761
6:00	732	853	749	871	735	856	719	817	705	835	763	850
7:00	777	968	796	959	788	954	768	904	762	941	802	941
8:00	869	1071	901	1065	871	1050	865	994	853	1033	905	1028
9:00	962	1142	993	1157	950	1117	944	1073	942	1108	1000	1129
10:00	1018	1186	1055	1205	1012	1162	992	1118	1001	1151	1061	1189
11:00	1044	1217	1084	1235	1034	1190	1026	1152	1018	1175	1090	1220
12:00	1054	1228	1103	1250	1044	1198	1032	1160	1028	1188	1110	1229
13:00	1058	1235	1106	1256	1045	1198	1038	1160	1029	1194	1117	1225
14:00	1056	1236	1108	1262	1047	1197	1037	1153	1031	1200	1124	1217
15:00	1063	1235	1113	1261	1050	1191	1037	1152	1038	1204	1124	1198
16:00	1074	1225	1121	1262	1062	1187	1047	1150	1050	1196	1132	1187
17:00	1081	1207	1125	1252	1070	1176	1054	1148	1058	1182	1132	1179
18:00	1087	1188	1146	1263	1071	1160	1073	1163	1061	1161	1141	1196
19:00	1083	1167	1204	1314	1070	1143	1120	1217	1059	1143	1195	1236
20:00	1127	1198	1158	1261	1119	1175	1073	1162	1105	1184	1148	1181
21:00	1089	1144	1102	1185	1084	1125	1020	1089	1076	1124	1091	1111
22:00	1022	1051	1044	1071	1013	1032	960	986	1006	1036	1016	1003
23:00	914	930	945	951	907	913	875	883	899	917	922	899
24:00	808	821	850	847	805	812	778	788	792	812	830	802

CA-IR-22

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 21 of 90.

The report mentions the staffing at the Dispatch Center at the time of the event. Please provide the following.

a. Please provide a shift schedule that shows who is scheduled to work during typical weeks.

b. How many people are scheduled at each of the 3 positions (SLD, LD, TD) at each time?

c. Is there a process for "qualifying" these personnel to assure they are capable to perform the duties & requirements of the job?

d. If so, please provide the criteria considered to determine such qualification.

e. Are any of the North American Electric Reliability Council (NERC) processes for certifying System Operators used?

f. Explain why or why not?

g. If NERC is not used for certification, provide the requirements that are utilized for certification and testing.

HECO Response:

a. In general, the normal contingent of dispatchers on a Sunday include 1 – Supervising Load Dispatcher (SLD), 1-Load Dispatcher (LD) and 1 – Trouble Dispatcher (TD). The SLD work in 12 hour shifts, for instance on a typical day, one SLD works from 10am – 10pm and the 2nd SLD works from 10pm to 10am. The LD and the TD work in 8 hours shifts, for instance on a typical day, the shifts are from 6:00am – 2:00pm, the 2nd shift is from 2:00pm – 10:00pm and the 3rd shift from 10:00pm- 6:00am.

b. At least one person in each position is scheduled for each shift.

c. Please refer to the response provided in CA-IR-6, subpart b.

d. Please refer to the response provided in CA-IR-6, subpart b.

e. HECO is not required to comply with NERC and is not a member of NERC. NERC's mission is to improve the reliability and security of the bulk power system in North America. The bulk power system in North America is significantly different from HECO's in that the North America power system is a grid of interconnected utilities. This interconnected system enables bulk power transfer from one region to another and the dispatcher or plant operator's action during an emergency can greatly influence the reliability of the neighboring utilities. HECO is an isolated island utility without interconnections. HECO would not have the same operating issues that the North American utilities have. For this reason HECO does not use the NERC processes for qualifying dispatchers.

f. NERC's certification processes provide for the operating requirements between interconnected utilities. Our review of their operator training indicates that the focus is on responding to situations involving interconnected transmission lines, bulk power transfer and system frequency upsets. Thus the certification process for a NERC reliability area may cover some topics that apply to HECO but the majority of the topics do not apply because HECO is an isolated island utility. HECO's dispatchers are trained in the area of monitoring transmission lines current carrying capabilities, system voltage requirements, and response to frequency changes among other things. As noted before the difference is that NERC is concerned about the operation and response of interconnected utilities and the impact of the actions of one utility might also affect the neighboring utilities.

g. Please refer to the response provided in CA-IR-6, subpart b.

CA-IR-23

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 22 of 90.

The report states that "[s]ome of the events did not generate an alarm. . . ."

a. Why did this happen?

b. Was it a failure, or was it designed that these certain events would not be alarmed?

HECO Response:

a. POWER Engineers would like to clarify that in this instance a better choice of words would have been "Some events do not generate a time stamped record..." Events such as the E.H. system low fluid level and low-low fluid level lockout provide alarms on the operator annunciator panels (visual and audible) but do not log a time stamp for the alarm on the DCS. There are a number of such alarms in the power plants. The indication from the plant operators is that these alarms did operate, along with a multitude of other alarms.

b. This is directly related to the plant and DCS design.

CA-IR-24

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 26 of 90.

The report describes the 8:09:06 trip on the Koolau-Village 46 kV #1 line, which was later determined to be due to an insulator failure. What seismic design basis is needed for design and construction of HECO electric transmission lines?

HECO Response:

Please note that the report on page 26 describes the 7:09:06 trip on the Koolau-Wailupe 46 kV #1 line, and not "the 8:09:06 trip on the Koolau-Village 46 kV #1 line". Because wind loads are typically greater than seismic loads on poles and lines, seismic loads are implicitly addressed in the design and construction of HECO overhead electric transmission lines. HECO's overhead electric transmission lines are designed, at a minimum, in accordance with wind loads conforming to the Commission's General Order No. 6 (Rules For Overhead Electric Line Construction).

CA-IR-25

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 26 of 90.

The sequence of events discusses the start up of Waiau CTs and mentions that "CTs take approximately 15 minutes from initiation of start to synchronization to the grid." Based on this statement, please respond to the following.

a. Provide the manufacturer's starting curve and specific starting sequence and timing.

b. Describe any emergency start provisions that would result in synchronizing times quicker than 15 minutes.

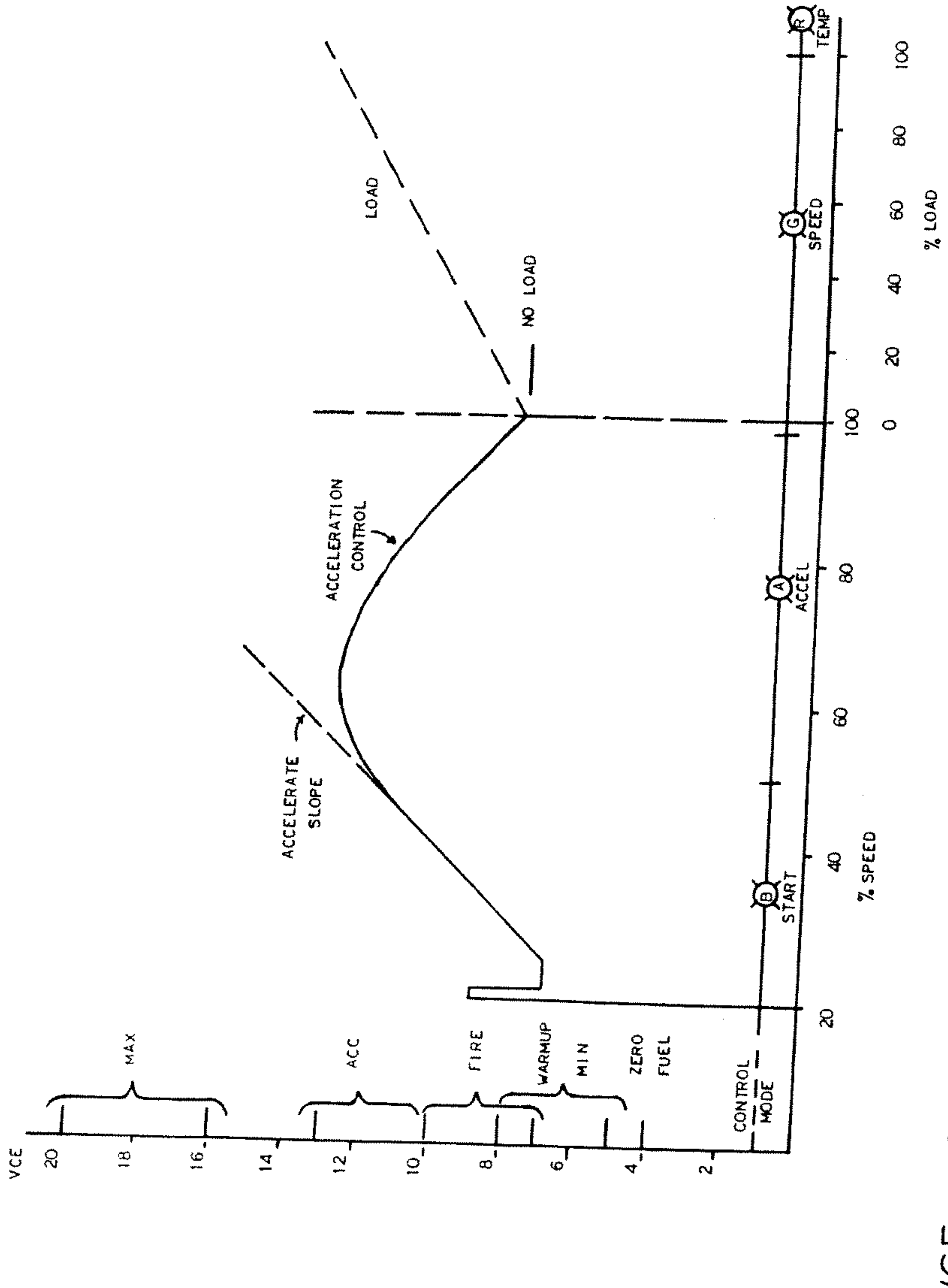
HECO Response:

a. Please see attached page 3 for a CT fuel supply (VCE) vs. speed/load graph.

b. On October 15, 2006, when the LD called for the startup of the first CT at 7:09+ the W7 and W8 CO took the initiative to startup up both CTs. By 7:14.30 (approximately 5 minutes after the call for the first CT) the IPP generators had tripped and the system began to collapse. There was insufficient time for either CT to complete its startup process and successfully synchronize to the grid. On page 26 of the POWER Engineers report it states that it takes approximately 15 minutes from initiation of a start to synchronization. The 15 minute time period actually represents the time from initiation of start to the minimum load of 11 MW (previous covered source permit requirement). The initiation of start to synchronization time ranges from approximately 8-10 minutes in both a normal and emergency starts, which is longer than the 5 minutes that the CTs had on October 15th. There are no emergency start provisions which allow an initiation of start to synchronization time faster than the 8-10 minute range.

In addition, the time between a start command and synchronization to the grid is determined by various factors including ambient conditions, turbine conditions (cold or hot start), turbine acceleration rate, turbine exhaust temperature, and unit efficiency.

Acceleration rate and exhaust temperature are operational constraints to minimize stress to the machine during startup. Please see response to CA-IR-17.



VCE vs SPEED - LOAD

CA-IR-26

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 27 of 90.

The report states that "[n}ine of the relays did not show a target of the event log had been overwritten" so it could not be determined with certainty whether the relays operated. Based on this statement, please respond to the following.

a. Was this a failure of a system, or due to design? Please explain.

b. With a very new EMS system, it is expected that provisions would be in place to capture all pertinent data for later analysis. Is this the case? Please describe.

HECO Response:

a. POWER Engineers is not certain why a number of the electromechanical relays failed to show a target. Most of the load shed breakers opened as there were no indications from the Primary Troublemen or the Load Dispatchers that they had to be manually opened during the restoration, so the lack of relay targets would be a failure of that component of the relay but not necessarily a failure of the relay to trip. Microprocessor frequency relays picked up numerous events of frequency swings during the restoration, which ended up overwriting the history records for the blackout event. Event recording function of these microprocessor relays are designed to capture short-term events such as faults and limited duration transients and therefore have a limited memory buffer size.

b. Modern relays collect and store sub-second data useful for a forensic review of an event. Typical EMS telemetry at the substation level is limited to breaker status (open or closed) and frequency and voltage scans at the seconds level and are not designed to collect and record relay information. The SCADA system links the transmission status to the EMS status and alarm screens and logs in the Dispatch Center. HECO's SCADA system currently provides breaker status of all 138kV and 46kV breakers. HECO's SCADA system is not presently connected to provide breaker status and control for a majority of the 12.5 kV breakers on the system. HECO EMS is not able to determine the breaker status for most 12.5 kV breakers on the Kicker Block, Block 1, and Block 2 of the Underfrequency Load Shed Scheme.

CA-IR-27

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 27 of 90.

The report states that at "7:13:19 – The LD initiated remote startup of distributed generators (DGs), but the DGs were unable to complete the startup sequence and connect to the grid." What were the problems encountered during the startup sequence and connecting to the grid?

HECO Response:

No problems were encountered. The DGs were unable to come on-line because by the time that the DGs were ready to synchronize, system frequency was already below the design range of the DG automatic synchronizer, therefore, the DG units were unable to synchronize to the grid.

CA-IR-28

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 30 of 90.</u>

The report states that the "frequency dropped to about 51.2 Hz and then recovered over about 20 seconds to about 55.5 Hz . . . ."

a. Was all automatic under Frequency Load Shedding initiated by this time?

b. How many MW were shed by automatic action?

HECO Response:

a. Yes, with the exception of two relays that may have failed to operate to trip two 12.5 kV and one 4 kV circuit breakers.

b. See the response to CA-IR-15, subpart d.

CA-IR-29

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 31 of 90.

The report states that the frequency had been as low as 51.2 Hz, but "the system frequency recovered to about 56.7 Hz. At this time, after operating at a low frequency for several minutes, the K1-2 CO and Station Superintendent made the decision to separate the K1-2 units from the system to try to island to the local load with its auxiliaries due to the severe underfrequency situation . . . ."

a. Was the decision to separate conveyed to the SLD or LD? Please explain.

b. The report states that the SLD and LD were "inundated by the number of alarms logging on the EMS (over 3600 in the course of 20 minutes) . . . ." Based on this statement, please respond to the following.

   1. Describe how the alarms are prioritized.

   2. Describe how the prioritization is presented to the SLD and LD.

   3. Are the alarms grouped to indicate a single event causing multiple alarms? Please explain and describe.

c. Provide copies of EMS screens that are examples of the response to parts (b)1-3 above.

HECO Response:

a. K2 was the first of the K1&K2 pair to be separated. With system frequency below 57Hz for 2 minutes or more, the attempted separation of K2 was not conveyed over the system Hotline. The Control Operator then went over to K1 to initiate separation of that unit. At the time of separating K1, the Station Superintendent announced the intent to separate K1 over the system Hotline.

b. An explanation based on the statement in the report is provided below:

   1. The EMS alarms are configured over nine priorities with P1 alarms being the highest. Typical EMS alarms in the P1 category include generating unit trips, breaker trips and closures and critical hardware system status alarms for the EMS. In addition, EMS alarms can be grouped by area of responsibility (AOR). There are 13 AORs that are set

up to display in the EMS.

2. The default EMS alarm screen is set to display all alarms for all priorities, all areas of responsibilities (AOR), both acknowledged and unacknowledged alarm states, and from all stations. However, each individual dispatcher is able to filter out different EMS alarm priorities, AORs, alarm states and stations at his dispatcher console. There is no set guideline on what types of EMS alarms they are required to have on their display screen on the dispatcher console or on the wallboard but at a minimum dispatchers will be watching for the high priority EMS alarms.
3. No. The EMS alarms are displayed as they occur. An event may have several different alarms, and if the alarms are all time stamped with the same time, they will appear together. The new EMS has the capability to group alarms in a master to slave relationship. When a master alarm occurs, the slave alarms' (up to 8 slaves) priority could be temporarily changed for a short period of time, however, HECO has not configured the new EMS to use this feature at this time.

c. In response to this information request, HECO will provide a screen shot from the EMS in order to show what an Alarms Summary display looks like. The Alarms Summary display is shown on page 4 of this IR response. In order to demonstrate how alarm can be filtered, information from the alarms and events historical archive will be used instead of EMS screen shots.[1] HECO will attach historical archives with examples of the types of filtering that can be done. The EMS alarm screen and the historical archive are able to utilize the same filters.

[1] The on-line EMS alarm screen will only contain alarms as they occur on the system. As a normal business practice, the dispatcher will acknowledge and delete alarms on this screen when they are no longer needed in order to keep the alarms screen clear so that new alarms can easily be identified. Therefore, providing screen shots on the real-time system demonstrating the different alarms showing various priorities, AOR's, alarm states and stations is difficult because the dispatcher will need to allow the alarm screen to retain alarms for an extended period and this will impact the daily operation.

For instance page 5 of this IR response shows a sample of the alarms and events with priorities ranging from P1 through P7 and AORs "GEN", "DSTATION", "STATION", "DISTR", "UNIT", and "EMS." Page 6 of this IR response shows a sample of how the EMS alarm screen and the historical archives are able to filter the alarms to only show the P1 alarms. Page 7 of this IR response shows a sample of how the EMS alarm screen and the historical archives are able to filter the alarm to only show the AOR "UNIT."

02/20/07 22:36:03 SIEMENS
Spectrum Power TG

Alarms Summary

Filters: All AORs, All Priorities, BOTH, All Stations & Non-Station Alarms

UNIT P1	02/20 22:35:07	138KV OCB 104 (WAIRTU)		TRIP
UNIT P1	02/20 22:35:07	138KV OCB 105 (WAIRTU)		TRIP
GEN P1	02/20 22:35:10	WAIAU_6	TRIPPED OFF CONTROL	BREAKER IS OPEN

Example of Alarms Priorities and AORs

Priorities

AORs

32	10/15/06 7:05:56	K2 LOW LIMIT (KGRTU1)	NORMAL		3	NORMAL				GEN
33	10/15/06 7:06:02	K2 LOW LIMIT (KGRTU1)	ALARM		3	ALARM				GEN
34	10/15/06 7:06:06	K2 LOW LIMIT (KGRTU1)	NORMAL		3	NORMAL				GEN
35	10/15/06 7:06:11	K2 LOW LIMIT (KGRTU1)	ALARM		3	ALARM				GEN
36	10/15/06 7:06:14	K2 LOW LIMIT (KGRTU1)	NORMAL		3	NORMAL				GEN
37	10/15/06 7:06:17	K2 LOW LIMIT (KGRTU1)	ALARM-NORM		3	ALARM-NORM				GEN
38	10/15/06 7:06:25	K2 LOW LIMIT (KGRTU1)	ALARM		3	ALARM				GEN
39	10/15/06 7:06:30	W7 RATE LIMIT (WGRTU3)	ALARM		3	ALARM				GEN
40	10/15/06 7:06:32	W7 RATE LIMIT (WGRTU3)	NORMAL		3	NORMAL				GEN
41	10/15/06 7:06:33	W7 RATE LIMIT (WGRTU3)	ALARM		3	ALARM				GEN
42	10/15/06 7:06:34	W7 RATE LIMIT (WGRTU3)	NORMAL		3	NORMAL				GEN
43	10/15/06 7:06:40	W7 RATE LIMIT (WGRTU3)	ALARM		3	ALARM				GEN
44	10/15/06 7:06:41	W7 RATE LIMIT (WGRTU3)	NORMAL		3	NORMAL				GEN
45	10/15/06 7:06:43	W7 RATE LIMIT (WGRTU3)	ALARM		3	ALARM				GEN
46	10/15/06 7:06:44	W7 RATE LIMIT (WGRTU3)	NORMAL		3	NORMAL				GEN
47	10/15/06 7:06:45	W7 RATE LIMIT (WGRTU3)	ALARM		3	ALARM				GEN
48	10/15/06 7:06:52	W7 RATE LIMIT (WGRTU3)	NORMAL		3	NORMAL				GEN
49	10/15/06 7:08:16	HRRV BASE POINT	OVER ALARM LIM	46	2	OVER ALARM LIM		46.09	46	GEN
50	10/15/06 7:08:34	FLUID PRESS PLANT #2 EVI OPEN (ARC1)	ALARM		3	ALARM				DSTATION
51	10/15/06 7:08:51	TSF A MINOR ALARM (ARC1)	ALARM		5	ALARM				DSTATION
52	10/15/06 7:08:53	OIL CONTAINMENT SYS TROUBLE (ARC1)	ALARM		7	ALARM				DSTATION
53	10/15/06 7:08:53	138KV TSF TR3 LTC/MAIN LO OIL (IWI)	ALARM-NORM		5	ALARM-NORM				DSTATION
54	10/15/06 7:08:53	138KV TSF TR3 LTC/MAIN LO OIL (IWI)	ALARM		5	ALARM				DSTATION
55	10/15/06 7:08:54	MINOR ALARM UNIT SUB TSF #1 (ARC2)	ALARM		7	ALARM				DSTATION
56	10/15/06 7:08:55	138KV GAS BUS LOW SF6 (SCH)	ALARM-NORM		3	ALARM-NORM				STATION
57	10/15/06 7:08:55	138KV TSF TR3 LTC/MAIN LO OIL (IWI)	NORM-ALARM-N		5	NORM-ALARM-NORM				DSTATION
58	10/15/06 7:08:56	W7 RATE LIMIT (WGRTU3)	ALARM		3	ALARM				GEN
59	10/15/06 7:08:57	K2 LOW LIMIT (KGRTU1)	NORMAL		3	NORMAL				GEN
60	10/15/06 7:08:57	138KV GAS BUS LOW SF6 (SCH)	ALARM-NORM		3	ALARM-NORM				STATION
61	10/15/06 7:08:57	138KV TSF TR3 LTC/MAIN LO OIL (IWI)	ALARM-NORM		5	ALARM-NORM				DSTATION
62	10/15/06 7:08:57	EQUIP_CS:RTU.KAHUKU1D	FAILED		2	FAILED				DISTR
63	10/15/06 7:08:57	'LINE 91 KAHUKU1D'	FAILED		2	FAILED				COMM
64	10/15/06 7:08:57	138KV GAS BUS LOW SF6 (SCH)	ALARM-NORM		3	ALARM-NORM				STATION
65	10/15/06 7:08:57	138KV GAS BUS LOW SF6 (SCH)	ALARM-NORM		3	ALARM-NORM				STATION
66	10/15/06 7:08:58	138KV OCB 169 (KAHRTU)	TRIP		1	TRIP				UNIT
67	10/15/06 7:08:58	138KV GAS BUS LOW SF6 (SCH)	ALARM-NORM		3	ALARM-NORM				STATION
68	10/15/06 7:08:59	138KV TSF TR3 LTC/MAIN LO OIL (IWI)	ALARM-NORM		5	ALARM-NORM				DSTATION
69	10/15/06 7:09:00	'LINE 91 KAHUKU1D' switched to RTUCS 2 (B)			2					EMS

Example of Filtering Only P1 Alarms

D1 Priority

A	B	C	D	E	F	G	H	J
Time Stamp	Ms	MESSAGES_TXT	Priority	Status	Comment	Value	Limit	AOR
10/15/06 7:08:58		138KV OCB 169 (KAHRTU) TRIP	1	TRIP				UNIT
10/15/06 7:09:06		KAHE_3 TRIPPED OFF CONTROL BREAKER IS O	1	BREAKER IS OPEN				GEN
10/15/06 7:09:06		46KV OCB 4467 (KOO1) TRIP	1	TRIP				TRANSLOG
10/15/06 7:09:07		46KV OCB 4467 (KOO1) CLOSE	1	CLOSE				TRANSLOG
10/15/06 7:09:07		46KV OCB 4467 (KOO1) TRIP	1	TRIP				TRANSLOG
10/15/06 7:09:08		46KV CB 4552 (HONRTU) TRIP	1	TRIP				UNIT
10/15/06 7:09:08		H 8 TRIP CLOSE	1	CLOSE				PAGE
10/15/06 7:09:12		HONO_8 TRIPPED OFF CONTROL BREAKER IS O	1	BREAKER IS OPEN				GEN
10/15/06 7:09:30		H 8 TRIP TRIP	1	TRIP				PAGE
10/15/06 7:11:15		W8 GROSS MEGAVOLTAMP (WGRTU1) OUT-REAS	1	OUT-REASON-HIGH		85.57	90	GEN
10/15/06 7:11:30		LFC CONTROL TRIPPED-LRG ACE	1	TRIPPED-LRG ACE				GEN
10/15/06 7:11:30		LFC CONTROL Ptyp 067 Alm 02	1	Ptyp 067 Alm 02				GEN
10/15/06 7:12:43		138KV OCB 246 (KAH2) TRIP	1	TRIP				UNIT
10/15/06 7:12:43		138KV OCB 247 (KAH2) TRIP	1	TRIP				UNIT
10/15/06 7:13:55		W8 GROSS MEGAVOLTAMP (WGRTU1) OUT-REAS	1	OUT-REASON-HIGH		89.22	90	GEN
10/15/06 7:14:02		12KV CB 1120 (WAIHEE) TRIP	1	TRIP				DISTR
10/15/06 7:14:02		12KV CB 1788 (WAIHEE) TRIP	1	TRIP				DISTR
10/15/06 7:14:02		11.5KV CB 1768 (AIEA) TRIP	1	TRIP				DISTR
10/15/06 7:14:02		11.5KV CB 1769 (AIEA) TRIP	1	TRIP				DISTR
10/15/06 7:14:02		11.5KV CB 2450 (AIEA) TRIP	1	TRIP				DISTR
10/15/06 7:14:02		11.5KV CB 3164 (MAKALAD) TRIP	1	TRIP				DISTR
10/15/06 7:14:02		11.5KV CB 3165 (MAKALAD) TRIP	1	TRIP				DISTR
10/15/06 7:14:03		ST GEN BKR STATUS (KAL) TRIP	1	TRIP				GEN
10/15/06 7:14:03		138KV GCB 312 RECLOSER (KAL) ERROR	1	ERROR				TRANSLOG
10/15/06 7:14:03		KST TRIP CLOSE	1	CLOSE				PAGE
10/15/06 7:14:04		Load Shed - BLOCK1 UNDR OPER LIM 58.0	1	UNDR OPER LIM		57.96	58	PAGE
10/15/06 7:14:13		12KV CB 1166 (WAIALUA) TRIP	1	TRIP				DISTR
10/15/06 7:14:13		12KV CB 1615 (WAIALUA) TRIP	1	TRIP				DISTR
10/15/06 7:14:13		138KV CS 374 (WAH3) OPEN	1	OPEN				TRANSLOG
10/15/06 7:14:18		46KV MOS 4954 (MAKAHA) IN - TRANSIT	1	IN - TRANSIT				TRANSLOG
10/15/06 7:14:20		STATUS:PAGING.KST_HIS_MODE TRIP	1	TRIP				UNASGNED
10/15/06 7:14:20		KST TRIP TRIP	1	TRIP				PAGE
10/15/06 7:14:20		46KV MOS 4954 (MAKAHA) OPEN	1	OPEN				TRANSLOG
10/15/06 7:14:21		138KV CB 327 (HRRV) TRIP	1	TRIP				UNIT
10/15/06 7:14:21		138KV CB 326 (HRRV) TRIP	1	TRIP				UNIT
10/15/06 7:14:21		46KV MOS 4955 (MAKAHA) IN - TRANSIT	1	IN - TRANSIT				TRANSLOG
10/15/06 7:14:22		HRR TRIP CLOSE	1	CLOSE				PAGE
10/15/06 7:14:22		11.5KV CB 1299 (HAUULA) TRIP	1	TRIP				DISTR
10/15/06 7:14:22		11.5KV CB 1592 (HAUULA) TRIP	1	TRIP				DISTR
10/15/06 7:14:23		CB 310 (KAL) TRIP	1	TRIP				UNIT
10/15/06 7:14:23		CB 311 (KAL) TRIP	1	TRIP				UNIT

Example of Filtering On AOR "UNIT"

Time Stamp	Ms	MESSAGES_TXT	Priority	Status	Comment	Value	Limit	AOR
10/15/06 7:08:58		138KV OCB 169 (KAHRTU) TRIP	1	TRIP				UNIT
10/15/06 7:09:08		46KV CB 4552 (HONRTU) TRIP	1	TRIP				UNIT
10/15/06 7:12:43		138KV OCB 246 (KAH2) TRIP	1	TRIP				UNIT
10/15/06 7:12:43		138KV OCB 247 (KAH2) TRIP	1	TRIP				UNIT
10/15/06 7:14:21		138KV CB 327 (HRRV) TRIP	1	TRIP				UNIT
10/15/06 7:14:21		138KV CB 326 (HRRV) TRIP	1	TRIP				UNIT
10/15/06 7:14:23		CB 310 (KAL) TRIP	1	TRIP				UNIT
10/15/06 7:14:23		CB 311 (KAL) TRIP	1	TRIP				UNIT
10/15/06 7:14:23		CB 323 (AES) TRIP	1	TRIP				UNIT
10/15/06 7:14:23		CB 324 (AES) TRIP	1	TRIP				UNIT
10/15/06 7:14:28		138KV OCB 249 (KAH2) TRIP	1	TRIP				UNIT
10/15/06 7:14:28		138KV OCB 250 (KAH2) TRIP	1	TRIP				UNIT
10/15/06 7:17:22		138KV OCB 129 (KAHRTU) TRIP	1	TRIP				UNIT
10/15/06 7:17:28		138KV OCB 132 (KAHRTU) TRIP	1	TRIP				UNIT
10/15/06 7:17:56		138KV OCB 133 (KAHRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:09		138KV OCB 104 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:09		138KV OCB 105 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:13		138KV OCB 101 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:13		138KV OCB 102 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:23		138KV OCB 110 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:23		138KV OCB 111 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:18:25		46KV CB 4552 (HONRTU) CLOSE	999	CLOSE				UNIT
10/15/06 7:18:26		138KV OCB 169 (KAHRTU) TRIP	999	TRIP				UNIT
10/15/06 7:18:27		46KV CB 4552 (HONRTU) TRIP	999	TRIP				UNIT
10/15/06 7:18:34		138KV OCB 246 (KAH2) TRIP	999	TRIP				UNIT
10/15/06 7:18:34		138KV OCB 247 (KAH2) TRIP	999	TRIP				UNIT
10/15/06 7:19:02		138KV CB 327 (HRRV) TRIP	999	TRIP				UNIT
10/15/06 7:19:04		138KV CB 326 (HRRV) TRIP	999	TRIP				UNIT
10/15/06 7:19:05		138KV OCB 107 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:19:05		138KV OCB 108 (WAIRTU) TRIP	1	TRIP				UNIT
10/15/06 7:19:17		CB 310 (KAL) TRIP CC	999	TRIP				UNIT
10/15/06 7:19:17		CB 311 (KAL) TRIP CC	999	TRIP				UNIT
10/15/06 7:19:35		CB 323 (AES) TRIP CC	999	TRIP				UNIT
10/15/06 7:19:36		CB 324 (AES) TRIP CC	999	TRIP				UNIT
10/15/06 7:27:20		138KV OCB 130 (KAH3) TRIP	1	TRIP				UNIT

CA-IR-30

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 33 of 90.</u>

The report states that "[o]thers were not aware this had been an earthquake until it was announced on the Hotline." Based on this statement please respond to the following:

a. Are there any devices at sites away from the power plants to detect seismic activity?

b. If so, is this information made available to the Control Center on an immediate basis?

c. If not, can this be done?

<u>HECO Response:</u>

a. Yes.

b. No.

c. In theory, yes. However, we are not aware of any such seismic alarm devices being used in other generating units.

CA-IR-31

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 33 of 90.</u>

The report states that the Kahe 1 "Master Fuel Trip" tripped on low fuel pressure and shut off fuel to the burners.

a. Provide the fuel operating range and turn-down ratio for each of the generating units.

b. Provide a copy of the fuel supply operating procedures and distribution schematics.

HECO Response:

a.

UNIT	NORMAL OPERATING PRESSURE RANGE	TRIP POINT
K1	1080-700 PSIG	400 PSIG
K2	1080-700 PSIG	400 PSIG
K3	1080-700 PSIG	550 PSIG
K4	1080-700 PSIG	550 PSIG
K5	250-70 PSIG	35 PSIG
K6	270-70 PSIG	40 PSIG
W3	550-380 PSIG	175 PSIG
W4	550-380 PSIG	175 PSIG
W5	750-450 PSIG	225 PSIG
W6	750-450 PSIG	225 PSIG
W7	1000 PSIG	400 PSIG
W8	1000 PSIG	400 PSIG
H8	120-40 PSIG	30 PSIG
H9	900-350 PSIG	300 PSIG

UNIT	TURN DOWN RATIO
K1	2.5:1
K2	2.5:1
K3	2.6:1
K4	2.6:1
K5	2.6:1
K6	2.6:1
W3	2:1
W4	2:1
W5	2.4:1
W6	2.3:1
W7	2.5:1
W8	2.6:1
H8	2.3:1
H9	2.4:1

b. Boiler fuel supply operating procedures and Piping & Instrument Diagrams (P&IDs) for Kahe 1 are being provided for reference pursuant to Protective Order No. 23159 as attached pages 3-19 and 20-22, respectively.

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CA-IR-32

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 36 of 90.

The report states that the "automatic Under Frequency Load Shed (UFLS) and Under Voltage Load Shed (UVLS) schemes activated and assisted in shedding load as designed." Based on this statement, please respond to the following.

a. Did these two schemes shed all the load that was expected?

b. Please explain and describe the response to part (a) of this information request.

c. Describe the process to manually shed load?

d. How much time does it take to shed one circuit?

e. Can groups of circuits be shed with one step or sequence of steps? Please describe.

f. Provide copies of EMS screens that give load shedding capabilities to the SLD and LD, and describe the steps that must be taken.

g. Explain the circumstances concerning the "two breakers that apparently did not operate"

HECO Response:

a. Yes, please see the response to CA-IR-15c through CA-IR-15e and CA-IR-28a.

b. See the response to CA-IR-15 and CA-IR-28.

c. Manual load shed requires the load dispatcher to first navigate to the Manual Load Shed Screen on the EMS. Then, the load dispatcher selects the 46kV breaker to open which opens a window in which the dispatcher has the option to "open" or "close" the selected breaker. After selecting the "open" button, a confirmation screen opens in response to which the operator must confirm his selection to execute the opening of the breaker.

d. The time to select, trip and get confirmation to execute a breaker open is about 3 seconds.

e. Manual load shed is performed at the 46 kV level, which sheds distribution substations with several 12.5 kV circuits at a time.

f. Screen prints of the Manual Load Shed Screens found on the EMS are shown in attached pages

3-4. The steps to locate the Manual Load Shed Screens is as follows,1) from the Operations Index display the dispatcher selects Loadshed System Control 2) on the next screen the dispatcher selects the System Protection button and then 3) selects manual Load shed. The process for selecting the circuits and opening the breakers are described in part c above.

g. See the response to CA-IR-59, subpart c.

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CA-IR-33

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 37 of 90.

The report states that the "vast majority of customers were restored, at about 0155 hours on October 16, 2006."

a. How many customers and how much load were still out at this time?

b. Were there any major or critical customers still out, like hospitals, airports, etc.?

c. If the response to part (b) of this information request is yes, please identify the affected customers.

HECO Response:

a. At 0155 hours on October 16, 2006, approximately 291,000 customers were restored. This represents almost 99% of the system load. At 0155 hours, less than 1% of the system load was impacted.

b. No major or critical customers were out of power at 0155 hours.

c. Not applicable.

CA-IR-34

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 37 of 90

The report states refers [sic] to HECO's "confidential Incident Response Manual (IRM)." Please provide a complete copy of this document.

HECO Response:

A copy of the Incident Response Manual is provided as Attachment 1 in response to CA-IR-2, subpart a, pursuant to Protective Order No. 23159.

CA-IR-35

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 38 of 90.

The report refers to the "Incident Command Team."

a. Who are the individuals on the "Incident Command Team?" Identify each individual and indicate the person in charge ("Incident Commander", page 49).

b. Is this team in place before an event occurs?

c. What is the process for keeping the members of this team current, and trained in their duties?

HECO Response:

a. Attached as page 3 is the Incident Command Team on duty on October 15th and 16th, 2006 and is provided pursuant to Protective Order No. 23159.

b. The Incident Command Team (ICT) structure is in place prior to any event. Mobilization of the ICT can take place in anticipation (if advance warning can be obtained) or in response to an event. The Operations area has the fundamental responsibility to respond immediately to the system events. *It is not practical to have the team in place before an earthquake or other* disasters for which there is little or no warning. In other situations where HECO has an advance notice, for example, the threat of a hurricane, the ICT would be assembled and in place as HECO prepared for the possibility of a hurricane impacting its system.

c. Training is provided in the form of a drill that is usually conducted in May of each year where a simulated disaster exercise is conducted. A consultant specializing in this training is brought in to conduct this training and to observe and critique the exercise. In addition, the Incident Command Team is activated to various levels whenever an event that has or may create a significant level of system risk or an expectation of a possible system risk. For example, most recently the Incident Command Team was activated on March 31 - February 2 in response to weather conditions (such as high winds and sea grass infiltration) and other system equipment issues which significantly reduced available generation reserves. Copies of the Incident Response Manual are provided to all Incident Command Team members.

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CA-IR-36

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 38 of 90.</u>

The report states a number of times that HECO's Incident Command was developing a restoration plan.

a. What was the restoration plan before October 15, 2006?

b. What was the black start plan before October 15, 2006?

c. Were these plans ready to be implemented at all locations? Explain.

<u>HECO Response:</u>

a. See response to CA-IR-6, subpart c.

b. See response to CA-IR-42, subpart b.

c. An incident specific response plan is developed and implemented as part of the response by the operations staff and Incident Command Team for each incident. HECO personnel responding to the event immediately initiates actions to develop incident specific black start and restoration plans. HECO employees were in place at the Power Plants, the Dispatch Center and T&D facilities to effectively implement the specific black start and restoration plans.

CA-IR-37

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 40 of 90.

Please provide a copy of the 1991 Blackout Report.

HECO Response:

The Company assumes that the Consumer Advocate is referring to the Power Technologies, Inc. "Investigation of 1991 Oahu Island-Wide Outage for Hawaiian Electric Company" report, PTI Report #R6-93, dated August 26, 1993 ("PTI Report"). Copies of the PTI report were provided to the Commission and the Consumer Advocate by letter dated August 31, 1993 in Docket No. 6281.

CA-IR-38

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 40 of 90

The report states that "unstable unit operations could result in exceeding environmental operating limits, thus requiring a forced shutdown of the unit." Based on this statement, please respond to the following.

a. Is it HECO's position that during an island-wide blackout, the environmental agencies that have jurisdiction over air emissions would not have excused a short-term emissions excursion in order to restore power to the island more quickly? Explain.

b. Provide a copy of the Operating Air Permit in effect for the unit(s) in question on October 15, 2006.

HECO Response:

a. Although CA-IR-38, subpart a, asks about "short-term emissions excursion," given the complexity of restoring the units under the conditions on October 15, 2006, the duration of any period of emissions excursion could be extensive. The rules of the State Department of Health do not allow units to be operated in violation of their permits in the event of an emergency. Rather, the Department of Health's rules afford an affirmative defense to noncompliance when the operator can demonstrate that "during the period of the emergency [the operator] took all reasonable steps to minimize emission levels that exceeded the emission limitations or other requirements [of the permit]" (Hawaii Administrative Rule, HAR 11-60.1-16.5(a)(3)). As HECO's units have permit limitations applicable during start-up, HECO's operators were required to take "all reasonable steps" to meet those requirements and minimize emission levels during start-up.

It is important to understand that environmental considerations cannot be separated from the context of overall operations. During recovery from a system-wide outage, this context becomes even more important. Under the abnormal and extreme conditions of

October 15, 2006, environmental compliance is but one of many critical operational factors considered in restoration. Additional critical factors including personnel, public and equipment safety, impact of surges on equipment operation, etc., are constantly being addressed to lower the risk of a forced outage which would result in a restart from square one. To mitigate and manage the dynamics of restoration activities and risks, a conscious decision was made to initially add load in small increments, within the capabilities of the first generating units. Even with adding small increments, system dynamics were extreme.

b. The "Operating Air Permits" (i.e., Covered Source Permits) in effect for the Kahe and Waiau Generating Stations on October 15th are voluminous. Copies will be provided to the Commission and the Consumer Advocate under a separate transmittal. (See Attachments 201 and 202.)

CA-IR-39

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 42 of 90.

The report states that "[w]ith the assistance of the dispatchers and the Test Engineer, the PTMs were directed on how to troubleshoot the problem with the breakers." Based on this statement, please respond to the following.

a. Is training provided to PTMs on troubleshooting breakers? Explain.

b. Was this something that was not covered in the training?

HECO Response:

a. The Technical Services Division, which consists of a group of Test Engineers and Substation Electricians, is responsible for the maintenance and troubleshooting of problems on substation equipment, including circuit breakers. If a breaker does not operate properly, Substation Electricians are typically tasked to assess the cause of the problem and fix the breaker. PTMs are provided training on operating substation breakers and relays. The responsibility of the PTM's is to assist the dispatchers with the operation of the system, and is directed toward finding problems on the system that have caused outages to HECO's customers. In addition to this responsibility, the PTMs are trained, in their primary function, to operate the equipment to perform switching operations, which includes substation equipment such as circuit breakers.

b. In the case of the October 15th outage restoration activities referred to on page 42 of the report, some restoration time was saved because a Test Engineer was able to utilize the radio in the dispatch center to direct the PTM on what could be done to remedy the breaker problem and eventually restore the 46kV or 12kV circuit instead of waiting for a Substation Electrician or Test Engineer to travel out to the specific breaker site to troubleshoot the problem himself.

CA-IR-40

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 45 of 90.

The report states that "HECO's fuel supply is transported from holding tanks to the power plants primarily via pipelines." Based on this statement please respond to the following:

a. Provide diagrams of HECO's entire fuel unloading storage and transport systems. Include maps indicating locations of pipelines pumping stations and storage tanks.

b. Provide a description of fuel storage and forwarding facilities at each of HECO's black start units.

c. Are back-up diesel generating units provided for fuel pipeline pumping stations?

d. If not, why not?

HECO Response:

a. HECO will make available for confidential inspection, documents responsive to this request pursuant to Protective Order 23159. However, HECO objects to the copying and dissemination of such documents on the ground that it seeks information afforded protection by the Homeland Security Act of 2002.

b. The Waiau Solar turbine is served by one 1600-gallon vertical cylindrical diesel storage tank. This provides approximately 17 hours of fuel if the Solar turbine operates continuously at 100% output. Fuel is forwarded to the unit by gravity feed. The tank is refilled by a tanker truck.

The two Kahe black start EMDs are served by a single 12,000-gallon horizontal cylindrical diesel storage tank. Each EMD is equipped with a 130-gallon day tank which is kept filled from the bulk tank through automatic level controls. There is sufficient diesel storage to run the two EMDs continuously at 100% rated load for about 32 hours. The bulk storage tank at Kahe is refilled by a tanker truck.

c. The Barbers Point Tank Farm (BPTF) support systems incorporates a diesel fueled emergency generator which is capable of providing sufficient electric generation to operate the pipeline control system satellite control room located at BPTF, pipeline leak detection system and pumping system to maintain fuel flow through the Kahe Pipeline and Waiau Pipeline simultaneously. The Iwilei Tank Farm (ITF) support systems do not incorporate a backup diesel generator.

d. The ITF receives fuel from BPTF via tanker trucks. If due to a failure of the local electric distribution circuit, ITF is unable to operate the pumping system to transfer fuel through the Iwilei Pipeline from the ITF to Honolulu Power Plant, then tanker trucks inbound to ITF would be diverted to the Honolulu Power Plant which is capable of receiving fuel directly from such tanker trucks. Thus, fuel for Honolulu Power Plant may effectively bypass transit through the Iwilei Pipeline in an emergency situation.

CA-IR-41

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 47 of 90.

The report states that there was communication with outside agencies "whose input was considered in the restoration prioritization."

a. Has there been discussion and input from these agencies prior to any events to get that input ahead of time?

b. If yes, please describe.

c. Mention was made of the desire to restore power to critical customers first, but that such desire was "tempered by the prudence and efficiency of restoring loads along the way . . . ."

1. What are the specific instructions on restoring power to these critical customers?

2. Who are the critical customers? Please provide a list.

3. Who has the authority to restore other load "along the way" before moving directly to critical customers?

HECO Response:

a. There have been discussions with various local and federal agencies regarding emergency response issues, and some of those agencies have been invited and included in HECO incident response drills and in past actual events.

b. See the response to subpart a. The input that HECO received from those agencies was primarily focused on what they observed during the drill or related to how they would like to interact with HECO during actual emergencies (process related).

c.

1. There are no specific instructions on the order in which to restore power to critical customers. The order of critical customer restoration is dependent on the order in which generation and T&D facilities are restored, and cannot be done in a sequence that would risk destabilization of the electric grid, which could result in again tripping generators

offline and/or damage to equipment which might result in an even longer outage. For example, on October 15th, generation and transmission began with the restoration of areas surrounding Waiau Power Plant. This allowed restoration of critical customers in the immediate area in the early afternoon timeframe.

2. A list of HECO's critical customers was previously provided to the Commission and the Consumer Advocate by letter dated January 9, 2007 pursuant to Protective Order No. 23159.

3. The authority to restore other loads "along the way" is directed by the On Scene Commander in the Dispatch Center. In this case, the Superintendent of the Operating Division was the On Scene Commander.

CA-IR-42

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 49 of 90.

The report states that the "decision to simultaneously attempt black start at both Kahe and Waiau was made early by the Manager of System Operation and Manager of Power Supply Operations and Maintenance in consultation with the Incident Commander and the Vice President of Power Supply . . . ." Based on this statement, please respond to the following.

a. Explain the decision to simultaneously start both of these Plants.

b. Provide the predetermined plan for black start.

HECO Response:

a. At approximately 7:45am on October 15, the Manager of System Operations (SO) and the Manager of Power Supply Operation & Maintenance (PSO&M) arrived at the EMS Dispatch Center and realized they were facing an island-wide blackout situation. While various options were being considered at the Dispatch Center, on-scene staff at Kahe and Waiau began the process of securing all units that tripped and prepared their respective stations for black start. At the Dispatch Center, options considered included the following:

   (1) Black start one or two steam units at Kahe Power Plant (KPP), build the transmission line from KPP to Waiau Power Plant (WPP) to provide station power to WPP, and startup other units at KPP and WPP in parallel;

   (2) Black start either W5 or W6 at WPP, build the transmission line from WPP to KPP to provide station power to KPP, and startup other units at KPP and WPP in parallel;

   (3) Black start WPP and KPP in parallel. Should an unexpected problem develop, i. e., breaker failure, that would prevent synchronization of both stations, both stations would continue to black start in parallel and close in on their respective dead buses. If black starting in parallel results in two separate islands, a synchronization plan would be

developed based on the situation to tie the two islands into one grid;

(4) Black start WPP and KPP in parallel. If the timing of the startup of black start units at Kahe and Waiau are in close proximity, rather than create two islands the first unit/station (e.g., W6 on October 15th) would close on the dead bus and the other unit/station (e.g., K2 on October 15th) would suspend their startup until the transmission system connection between the two stations can be established to allow the second unit (K2) to synchronize to the system that was energized by the first unit (W6). Please refer to the discussion in CA-IR-11, part a. for a detailed breakdown on the sequence of events on October 15th.

Option 4 was recommended and by 8:00 a.m., executives of the operating departments were notified and concurred with the restoration plan. This decision was communicated to on-scene supervisory staff at Waiau and Kahe. Likewise, System Operation supervisory personnel initiated plans for connecting initial loads at the 12kV level.

b. There is no predetermined plan for black starting the grid because the course of action depends on the particulars of the incident and consideration of circumstances such as the physical conditions of the generating units that are black-start capable, the physical condition of the transmission system; the availability of operating and supervisory personnel at Waiau Power Plant and Kahe Power Plant, and the status of the communications and control systems between the EMS Dispatch Center and the power plants.

CA-IR-43

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 49 of 90.

The report states that the "UO reported that his previous experience had been to start the black start units and synchronize them with the grid." What black start training had that UO received?

HECO Response:

The quoted section refers to the fact that the UO routinely operates the black start diesel generators to exercise the engine and ensure proper equipment operation under normal conditions on a weekly basis. This routine procedure is performed by initiating a start, synchronizing the unit, and loading the unit up to its rated capacity of 2.5MW. This task is not considered black start training although it helps to familiarize the UO with the operation of the diesel generators. The UO that operated the black start diesels on October 15th was not present during the most recent black start exercise conducted. HECO agrees with Recommendation #8 regarding improvements in training and procedures across the Company where appropriate to reduce the possibility for operator error and to ensure coordination activities.

CA-IR-44

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 52 of 90.</u>

The report describes the Waiau Station restart problems. Based on this discussion, please respond to the following.

a. What is the expected life of the batteries on W 9 and 10?

b. Were these batteries part of the original installation?

c. If so, were they replaced and when?

d. If not, when were they installed?

e. Provide a copy of the battery preventive maintenance procedures.

f. Provide a copy of the instrument air and nitrogen supply piping schematics.

g. Are alarm points provided for the following:

   1. Low batteries on the DCS?

   2. Local alarm?

   3. Control room alarm?

   4. Low instrument air and/or nitrogen pressure?

   5. Local alarm?

   6. Control room alarm?

<u>HECO Response:</u>

a. The type of battery used in both W9 and W10 has a life expectancy of 84 months.

b. The batteries in place on October 15, 2006 were not the original batteries that were installed back in 1973 when the units were commissioned for operation.

c. The battery bank in W9 was last replaced in June, 2002, and W10 batteries were replaced in December, 2002. Prior to 10/15/06, a PM inspection revealed small cracks and weeping on some of the battery casings. Rather than replace affected batteries, a decision was made to replace the bank because it was determined that the cracking and weeping could be symptomatic of a broader problem with the rest of the batteries. Since then replacement batteries (84 month service life) were installed in January, 2007 on W9. Replacement batteries for W10 arrived on island and are scheduled for installation during the upcoming planned outage in March, 2007.

d. See response to part c above.

e. The PM procedure for W9 is provided as page 4 attached to this IR response. The procedures for W10 are identical.

f. The requested piping and instrument diagrams are provided as page 5-6 attached to this IR response pursuant to Protective Order 23159.

g. Originally many of the critical local alarms were consolidated into a few alarms at the remote location (W7&8 control room). The intent was to alert the operator situated at the remote location and dispatch a Utility Operator to the CT to investigate. The DCS control upgrades installed since the mid 1990's allowed the local annunciator alarms at each CT to be transmitted and displayed at the remote location. The following responses are based on the configuration of the CT alarm systems on October 15th which reflect recent upgrades.

1. Yes. When the controls were upgraded from the original control systems to distributed control systems (DCS), back up power to the DCS was tied into the existing battery bank. Low battery voltage alarm capability exists at both the local and remote sites.
2. Yes. Please refer to response provided in 1 above.
3. Yes. Please refer to response provided in 1 above.
4. The source of instrument air used at the CT comes from the instrument air header

located at W7&8. Thus low instrument air pressure is detected and alarmed in the W7&8 control room. The backup nitrogen system does not have a low pressure alarm because it was designed as a manual backup system that requires the Utility Operator to inspect the fuel forwarding area before manually transferring to the backup nitrogen system. A local pressure gage is provided for pressure indication.

5. Instrument air for the CT's are supplied from air compressors at W7&8. Associated low pressure alarms on the instrument air system are located at the W7&8 units.
6. Please refer to response provided in 5 above.

Custom Maintenance Basis

Waiau 9
125 VDC Battery Bank

Time Directed

Task Description & Comments	Frequency	Status	Go
Battery Capacity Discharge Test Comments: This tasks is for the testing of Lead Acid and NICAD Batteries. Perform Infrared Thermography in association with testing and recharge.	5 Years	New Task	
Clean and Inspect Batteries Comments: Inspect Electrolyte levels and signs of leakage. Inspect cell vents / flame arrestors. Inspect battery posts, post seals. Inspect for discoloration due to arcing or heating. Check tightness of connections. Ensure cleanliness of battery rack and battery room. Charge batteries after adding water. Inform PDM to perform IR thermography during charge.	1 Month	CMMS/CP Task	
Take Battery Readings and Trend Comments: Take specific gravity, internal ac impedance, dc terminal voltage, and interconnection resistance readings. Measure and record pilot cell temperatures.	1 Month	CMMS/CP Task	

Original Maintenance Program

Task Description & Comments	Frequency	Status	Go
Clean and Inspect Batteries	1 Month	Existing	
Take Battery Readings and Trend	1 Month	Existing	

Notes

There are currently no Notes associated with this Custom Template.

Attachments

Title	Description	Date	Size	View	Go
WPP Battery Test Equipment	AVO / Biddle BITE 2 and BITE 2P	01/25/2005	59K		

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CA-IR-45

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 57-58 of 90.

The report discusses the Waiau units 9 and 10 lack of black start capability. Based on this discussion, please respond to the following.

a. Has HECO considered using a DG unit or diesel to give black start capability to these units? Please explain.

b. What is the projected cost to give black start capability to these units?

c. Page 58 states that "W9 and W10 must operate with a minimum of 5 MW of load for each machine to prevent violating the air quality permit." Based on this statement, please respond to the following.

   1. Provide a copy of the air quality permits for W9-10.

   2. Are there provisions for operations in violation of normal levels of permitting for emergency conditions?

HECO Response:

a. Yes. In the past, HECO has considered upgraded black start capability for the Waiau power plant through the addition of black start generators, including installing generators to operate in parallel with the existing Solar CT. Following the 1983 island-wide outage, HECO elected to add black start capability to Kahe Power Plant instead of upgrading the existing black start capability at Waiau Power Plant. Construction of two 2.5MW EMD black start generators at Kahe began in 1985 and were placed into service in 1986. At that point and time (and up until the October 15, 2006 island-wide outage) all previous island-wide outages were transmission related. HECO felt that because future outages may result in the unavailability of critical transmission circuits (say as the result of a storm or hurricane), partial or full restoration of the system with some transmission circuits out of service could be accomplished more reliably if both of HECO's major power plants had black start capability. Furthermore, the addition of the southern transmission corridor in 1994 provided a significant increase in the reliability of HECO's transmission system such that the likelihood of a transmission system event (again, the cause of all previous island-wide outages) leading to an island-wide outage reduced the benefit of an upgraded black start system for Waiau Power Plant.

As discussed in page 58 of the POWER Engineers report, due to the interconnection of the DG units with the distribution system the HECO DG units are not capable of back feeding power to the Waiau Power Plant.

b. We do not have a current estimate to provide black start capability for W9 or W10.

c. The minimum load following synchronization on startup was originally set at 5 MW, which is what the air quality permit was and is based on. Therefore if W9 and W10 were modified with black start capability, the minimum initial load applied to W9 or W10 in an actual black start situation should match the designed minimum load of 5 MW.

   1. The air quality permits submitted in response to CA-IR-38, subpart b, includes the permits for W9 and W10.

   2. There are no permit provisions for operating W9 or W10 in violation of CSP permit limits. See HECO's response to CA-IR-38, subpart a.

CA-IR-46

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 58 of 90.

The report discusses "[t]he distributed generation (DG) diesel units at three HECO substations" as being "available on October 15 and are designed to provide peaking power." Based on this statement, please respond to the following.

a. What is the reason for siting the DG units where they are located?

b. Describe what would be required to move the "distributed generation (DG) units at three HECO substations" to power plant sites to provide black start capability?

HECO Response:

a. The HECO DG units available on October 15, 2006 were installed in 2005 at HECO's Ewa Nui Substation, Helemano Substation, and Iwilei Tank Farm. The substation DGs were part of a broader capacity shortfall mitigation plan discussed in the 2005 and 2006 Adequacy of Supply report filed with the PUC. The DGs are intended to be temporary installations until the reserve capacity shortfall is resolved. HECO considered all substations and other properties owned by HECO on the island of Oahu for DG installations, and selected these three sites based primarily on the criteria of physical space availability, appropriate zoning, utility land ownership, and suitability as a distributed generation resource. Other criteria considered were compatibility with surrounding activities, ease of fuel delivery, site security, and ease of installing remote communications. HECO provided documentation relating to its 2005 DG site selection evaluation in its response to CA-IR-441, in Docket No. 04-0113.

b. It is impractical to relocate on a temporary basis individual generators identified in response to part (a) in an attempt to provide emergency black start capability at one or more of

HECO's power plant sites in response to an island-wide blackout. Although these DG units are trailer mounted, the controls, protection and power connection is hard wired. Relocating these DG units and connecting at Waiau for black start would take longer than the time it would take to start up W5 or W6.

CA-IR-47

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 59 of 90.

The report states "the black-out of the system was not connected with any shortcomings in the HECO processes for the long-term planning of generating capacity . . . ." Based on this statement, please respond to the following.

a. Given that HECO's black start training exercises required five hours to complete black startup of the Kahe and Waiau steam units, would it not have been prudent of HECO to have installed one or more aeroderivative combustion turbine generator sets with black start capability that could attain full load in less than 10 minutes?

b. If no, explain in detail why not.

c. Why are there no combustion turbine generator sets of significant capacity in the HECO fleet that have diesel engine starting means and are interconnected to start and pull up a dead bus? Please explain since such units are commonly available.

d. HELCO and MECO utilize quick starting aeroderivative combustion turbine generating sets (GE LM2500 models). Why does/did HECO not use these or other similar generating sets on Oahu? Explain in detail.

HECO Response:

a. The question asked in subpart (a) contemplates the selection of generating unit types on the basis of optimizing blackout restoration. However, the basis for the quoted section of the report was to provide an assessment of whether or not long term planning decisions contributed to the October 15th outage (i.e., did HECO have sufficient generating capacity to reliably serve load that day). Although the addition of an aero-derivative combustion turbine (available in a maximum size of approximately 40MW on liquid fuels) may be of benefit during an island-wide blackout situation, from a capacity planning perspective, it is not the preferred size unit for the HECO system to reliably serve load in a cost effective manner. HECO identified that a nominal 100MW peaking unit is the preferred generation size and type to add to the HECO system. As a result, HECO plans to add a frame based simple-cycle combustion turbine to the generation fleet in 2009 to meet peaking duty needs. While it will have black start capability, that was not the basis for selecting this unit type and size. The time it takes to black start an aero-derivative combustion turbine and a frame based simple-cycle combustion turbine are similar, differentiated by minutes as opposed to hours.

b. See response to part (a) above.

c. When the majority of the HECO fleet was designed and built (1950s), liquid fired combustion turbines were not common in the size preferred for the system. In the 1960s when the last of the HECO generating fleet was designed, HECO identified the need for baseload generation of appropriate size (90-140 MW+) capable of efficiently burning residual fuel oils. Additional factors considered in the selection of generation type include having sufficient inertia to provide system stability and consideration of the spinning reserve and quick-load pickup operating requirements. As a result, the HECO system is comprised mostly of high pressure/high temperature steam generating units. More recently, HECO has added combustion turbines to the system with the addition of the Kalaeloa combined-cycle IPP and HECO's planned simple-cycle combustion turbine at the Campbell Industrial Park.

d. HELCO and MECO–Maui Division are much smaller systems compared to HECO. HELCO's and the Maui Division's recorded peak demand in 2006 were 201 MW-net and 206 MW-net, respectively. This is in contrast to HECO's recorded peak demand in 2006 of 1,266 MW-net. HECO's all-time peak of 1,284 MW-net occurred in 2004.

Given their smaller system size, suitably sized reciprocating diesel and combustion turbine engines are alternatives for their respective systems. The firm capacity generating units on HELCO's system range from 1 MW-net diesel engines to a 30 MW-net geothermal unit.

The firm capacity generating units on Maui range in size from 2.5 MW-net diesel engines to 2-on-1 combined cycle units with a total rating of 56.8 MW-net each (although for capacity planning purposes, the combined cycle is counted as two 28.4 MW-net halves since each combustion turbine can operate independently of the other and can provide sufficient energy to generate one-half of the steam turbine output). Based on the factors described in part a. above, a GE LM2500 simple cycle combustion turbine or similar generating sets (such as an LM6000) are not the preferred type or size to meet Oahu's firm capacity needs.

CA-IR-48

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 62 of 90.

The report describes HECO's Turbine Vibration Detection Systems. Based on this discussion, please respond to the following.

a. Provide the type and model of vibration detection systems that are installed on each generating unit.

b. What type of vibration displays are provided in the control room for each generating unit?

c. Does the Turbine Supervisory system have vibration tripping capabilities?

d. What is the normal mode of operation for the generating units? (manual or automatic)

e. How often are the Boiler/Turbine/Generator control and protection systems re-calibrated and tuned for accuracy, response time, and repeatability?

f. Does the Boiler/Turbine/Generator control system have automatic runback capabilities on all of the generating units?

g. If so, what is the runback sequence for each of the generating units?

HECO Response:

a. All of the generating units have vibration detection systems from Bently-Nevada except as noted for K3 below.

Unit	Vibration Detection System
Kahe 1	8mm proximity probes and Model 3300 monitor rack
Kahe 2	8mm proximity probes and Model 3300 monitor rack
Kahe 3	ABB Electronic Technology Systems Inc. (ETSI) system
Kahe 4	8mm proximity probes and Model 3300 monitor rack
Kahe 5	8mm proximity probes and Model 3300 monitor rack
Kahe 6	8mm proximity probes and Model 3300 monitor rack

Unit	Vibration Detection System
Honolulu 8	8mm proximity probes and Trendmaster 2000
Honolulu 9	8mm proximity probes and Model 3300 monitor rack
Waiau 3	8mm proximity probes and Model 3300 monitor rack
Waiau 4	8mm proximity probes and Model 3500 monitor rack
Waiau 5	8mm proximity probes and Model 3300 monitor rack
Waiau 6	8mm proximity probes and Model 3300 monitor rack
Waiau 7	8mm proximity probes and Model 3500 monitor rack
Waiau 8	8mm proximity probes and Model 3500 monitor rack
Waiau 9	8mm proximity probes and Model 3500 monitor rack
Waiau 10	8mm proximity probes and Model 3500 monitor rack

b. The vibration displays for each generating unit is as follows:

Unit	Vibration Display
Kahe 1	Operator's console & Bently-Nevada rack
Kahe 2	Bently-Nevada rack
Kahe 3	Operator's console
Kahe 4	Operator's console & Bently-Nevada rack
Kahe 5	Operator's console & Bently-Nevada rack
Kahe 6	Operator's console & Bently-Nevada rack
Honolulu 8	Graphics display on the LCD Monitor
Honolulu 9	Bently-Nevada rack
Waiau 3	Graphics display on the Operator's console
Waiau 4	Graphics display on the Operator's console

Unit	Vibration Display
Waiau 5	Bently-Nevada rack
Waiau 6	Bently-Nevada rack
Waiau 7	Bently-Nevada LCD display
Waiau 8	Bently-Nevada LCD display
Waiau 9	Graphics display on the Operator's console
Waiau 10	Graphics display on the Operator's console

c. On October 15th, only Waiau 9, Waiau 10, and Honolulu 8, had vibration detection and trip functions (all other units have vibration detection only). W9 and W10 originally had vibration detection and trip functions that were upgraded prior to October 15, 2006, from the original GE units to the existing Bentley Nevada units. H8 was also upgraded prior to October 15, 2006, with a Bentley Nevada Turbine Supervisory system that trips the turbine due to abnormal thrust bearing detection. All steam units in the HECO fleet except for H8 are equipped with mechanical thrust bearing trips.

d. The normal mode of operation for steam units is all burners in service and all controls in automatic.

e. The Boiler/Turbine/Generator protection systems are tested at the end of an overhaul. Boilers overhauls are scheduled every 3 years to comply with boiler inspection and permit requirements.

f. Yes. Runback schemes vary between units based on the vintage of the unit, capability of upgraded controls, etc. Over the years steam units have been upgraded with more advanced distributed control systems (DCS). While original (standard) runback schemes based on boiler "follow mode" of operation (i.e., automatic throttle pressure regulation) have been preserved, additional runback capability has been added as described in (g) below.

g. Runback enhancements included in recent control upgrade projects, and existing on October 15, 2006, include:

Unit	Runback	Description
Kahe 1	Yes	Runback is initiated on loss of a Boiler Feed Pump or the high speed FD fan motor. The Turbine load will be reduced to 50 MW.
Kahe 2	Yes	Runback is initiated on loss of a Boiler Feed Pump or the high speed FD fan motor. The Turbine load will be reduced to 50 MW.
Kahe 3	Yes	Standard runback with original equipment.
Kahe 4	Yes	Runback is initiated on loss of a Boiler Feed. The Turbine load will be reduced to 50 MW.
Kahe 5	Yes	Runback is initiated on loss of a Boiler Feed Pump or a FD fan. The Turbine load will be reduced to 110 MW on the loss of one fan. The Turbine load will be reduced to 85 MW on the loss of one BFP.
Kahe 6	Yes	Runback is initiated on loss of a Boiler Feed Pump or a FD fan. The Turbine load will be reduced to 110 MW on the loss of one fan. The Turbine load will be reduced to 85 MW on the loss of one BFP.
Honolulu 8	Yes	Standard runback with original equipment.
Honolulu 9	Yes	Standard runback with original equipment.
Waiau 3	Yes	Standard runback with original equipment.
Waiau 4	Yes	Runback is initiated on loss of a Boiler Feed Pump. The boiler capacity will be limited to 29.75 MW. The CO will manually reduce the unit load to match.
Waiau 5	Yes	Runback is initiated on loss of a Boiler Feed Pump. The boiler capacity will be limited to 33.5 MW. The CO will manually reduce the unit load to match.
Waiau 6	Yes	Runback is initiated on loss of a Boiler Feed Pump. The boiler capacity will be limited to 33.5 MW. The CO will manually reduce the unit load to match.
Waiau 7	Yes	Standard runback with original equipment.
Waiau 8	Yes	Standard runback with original equipment.

CA-IR-49

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 64 of 90 Paragraph 3.

Section 3.2.2. of the report discusses the EH low fluid lockout trip of the Kahe 5 and 6 units. Based on this discussion, please respond to the following.

a. Did the operator receive a "Low Fluid Level Alarm?"

b. Was the 86 LFT "Low Fluid Level Lockout" relay part of the original installation?

c. If not, when was this relay added to the system and why?

d. What is the E.H. system pressure decay rate on K5 and K6 at the low-pressure reservoir? (pump off to pump on)?

HECO Response:

a. Yes.

b. Yes.

c. Not applicable.

d. Under normal operating conditions, pressure decay from pump unloading to pump loading is approximately one minute.

CA-IR-50

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 65 of 90.

Once the 86 LFT relay is locked out and the operator takes the appropriate corrective action please respond to the following.

a. Under normal operating conditions how much time will elapse?

b. What is the appropriate action for the operator to take to correct a "Low Fluid Level Lockout?"

c. Have there been problems in the past with K5 and K6 E.H.?

   1. If so, what were the problems?

   2. When did the problems occur?

   3. What was done to correct these problems?

d. What were the low EH fluid level alarms settings on each of the generating units?

e. What were the low low EH fluid level trip settings on each of the generating units?

HECO Response:

a. Response to the alarm would be to send the Equipment Operator to the reservoir to verify the level, then for the Control Operator to reset the lockout and restart the pump. Unlike the events on October 15th, in a situation in which no other events are occurring at the same time which requires an operators' attention, it would take approximately 2 minutes for the Equipment Operator to reach the EH reservoir from most locations in the assigned area. After checking the level, it would take another minute and a half to communicate the level information to the Control Operator and have the Control Operator reset the lock out relay and restart the EH pump. However, Equipment Operators, Junior Control Operators, and Control Operators perform other operating duties, which may result in a response time longer than the three and a half minutes.

b. As stated on page 67 of the report, "Inspection of the E.H. system requires that the JCO or the EO go to the second story (one flight of stairs for each), walk about 70 feet and inspect the E.H. reservoir, check fluid level, inspect the system integrity to the turbine, and determine the cause for the alarm. In the case of October 15, 2006, with both K5 and K6 "Low Fluid Level Lockout" alarms tripped, this activity was required for both units in addition to activities to control boiler operation to maintain the increased load level."

c. None.

d. K5 and K6 EH fluid low level alarms are set as follows:

   Low Level Alarm: 17.25" in reservoir

   Low-Low Level Alarm: 11.625" in reservoir

e. K5 and K6 EH low level lockout is set at 7.625" in reservoir

CA-IR-51

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 67 of 90.

a. What are the alarm priorities on K5 and K6?

b. How are the alarm priorities differentiated?

c. What is the experience level of the operational staff on duty on October 15, 2006?

HECO Response:

a. All HECO units have physical annunciator panels (see Slide 25 of HECO outage presentation provided in response to IR-77) to communicate alarm conditions to operators. Priorities are differentiated by alarm placement, color, and resetting capability. Alarms are arranged on an annunciator panel in groups indicating which part of the system they affect: Turbine, Generator/Electrical, Boiler, Fuel oil, Condensate/Feedwater, Miscellaneous. This arrangement gives first level of prioritization. High priority alarms are also colored red when they alarm vs. white coloring for lower priority alarms. Finally, high priority alarms which require notice and potential action even if cleared will not automatically reset requiring operator action to clear alarm indication once condition clears.

b. See response to part a. above.

c. On October 15, 2006, the Control Operator in K5 and K6 control room has 28 years of operating experience at Kahe power plant. The Junior Control Operator at K5 and K6 has 13 year of operating experience at Kahe power plant. The Utility Operator at Kahe Power Plant has 5 years of operating experience at Kahe power plant. The Equipment Operator at K5 and K6 has 2 years of operating experience at Kahe power plant.

CA-IR-52

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 68 of 90.

The report states that "[a]fter the initial tremor, it was clear to the Dispatch Center personnel that the system had experienced an earthquake." How soon did the Dispatch Center announce the earthquake to the Power Plants on the hotline?

HECO Response:

The dispatcher announced over the hotline that there was an earthquake after control room operator at Kahe 3 announced that he had tripped Kahe 3 and before Honolulu 8 control room operator announced that he had tripped Honolulu 8.

CA-IR-53

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 69 of 90

The report references the "HECO Operations Manual – Section IV, Severe System Frequency Depression."

a. Is this part of the "approved operating procedures" referenced on page 4 of the report?

b. If not, please provide a copy of the referenced document.

HECO Response:

a. Yes. This is a section from the Production Department Operating Division Policy Manual (ODPM).

b. Not applicable. See response to subpart a. above.

CA-IR-54

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 70 of 90.

The report that "[o]ver the Hotline, power plant operators were asked by the LD to try to hold on to the system." Describe the sequence and timing of this request and the interaction with the separation of K1-2.

HECO Response:

Upon K1 and K2's separation from the grid, system frequency abruptly dropped even further as W5, W7 and W8 were the only units left to support the system. The W5 and W6 Control Operator notified the LD over the Hotline of his intentions to trip W5 and the W7 and W8 Control Operator also contemplated tripping his units due to the low system frequency condition. At this point the LD announced over the Hotline for units to "hold on" to the system.

CA-IR-55

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 70 of 90.

The report provides the Low frequency operation background. Based on this discussion, please respond to the following.

a. What are the low frequency capabilities of the HECO steam turbine generation units?

b. Provide OEM low frequency limits for each of the generating units.

HECO Response:

a. The basis of the discussion on page 70 of the report regarding low frequency operation is intended to ensure the long-term integrity of turbine-generator units after operating at low frequencies. POWER Engineers has concluded that it would be prudent to assess the low frequency capabilities of HECO's steam turbine generation units (see Conclusion No. 5 at page 83, Recommendations Nos. 4 and 5 at pages 88-89), and HECO will be following through on those recommendations. Operating limitations have been guided by the Operating Department Policy Manual (ODPM).

b. See response to subpart a. above.

CA-IR-56

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 71 of 90.

The report references the HECO steam generating unit critical limitations. Based on this discussion, please respond to the following.

a. What are the critical RPM, frequency, and loads for the HECO steam generating units?

b. What is the testing and calibration procedure for the under frequency relays for each generating unit?

HECO Response:

a. The basis of the discussion on page 71 of the report is a discussion on the general mechanics of possible blade damage and failure resulting from low frequency operation. POWER Engineers has concluded that it would be prudent to assess the low frequency capabilities of HECO's steam turbine generation units (see Conclusion No. 5 at page 83, Recommendations Nos. 4 and 5 at pages 88-89), and HECO will be following through on those recommendations.

b. Not applicable. There are no frequency relays for HECO Steam Generation Units.

CA-IR-57

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 71 of 90.

The report states "[t]he indications are that the automatic load shed schemes operated mostly as planned." Based on this assertion, please respond to the following.

a. Did this apply to both frequency and voltage schemes?

b. How did these schemes NOT operate as planned?

c. What was the cause of this not operating as planned?

d. Please describe.

HECO Response:

a. Yes, this applies to both the Underfrequency Load Shedding ("UFLS") and Undervoltage Load Shedding ("UVLS").

b. Please see the response to CA-IR-28a.

c. Please see the response to CA-IR-28 and CA-IR-15.

d. Please see the response to CA-IR-28 and CA-IR-15.

CA-IR-58

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 72 of 90.

a. Provide under frequency trip settings for each of the HECO generating units and the IPP's.

b. Why are the under frequency trip settings for the IPP higher than the trip settings of the load shedding blocks 1 through 5?

HECO Response:

a. A copy of the requested document is provided as Attachment 93 in response to CA-IR-2, subpart a, pursuant to Protective Order No. 23159.

b. The IPP generators may not necessarily trip before the UFLS blocks based upon the IPP and load shed respective trip settings as relay trip settings are a function of both frequency setpoint and a time delay. AES Hawaii (AES), and HPOWER have under frequency set points within the range of HECO's UFLS scheme (58.5Hz to 57Hz). The Kalaeloa combined cycle unit has frequency setpoints at or below the underfrequency load shed scheme. After the October 15th outage, it was discovered by Kalaeloa staff that the underfrequency relay for the Kalaeloa Steam Turbine was incorrectly set by an OEM technician to 58Hz in a prior protection system upgrade project in April 2006. The underfrequency relay has since been reset at the PPA setting. However, each of these IPP under frequency set points has a corresponding time delay which means that frequency must remain at or below the under frequency set point for the duration of the time delay before a trip would occur. HPOWER utilizes two under frequency set points with time delays of 20 seconds and 6 seconds. AES utilizes a time delay having a variable inverse characteristic, which means that the time delay is dependent upon how low the frequency is relative to the under frequency set point. For example, AES relay test results (7/14/2006) show that the relay will trip in about 65.68 seconds with frequency at 58.2 Hz and 11.5 seconds with frequency at 57.0 Hz. These time delays provide adequate margin in generation loss scenarios in which the scheme is designed to address to allow the HECO UFLS scheme to restore frequency above the IPPs' frequency set points before unit tripping can occur.

In other words, the HECO UFLS scheme coordinates load shed set points with the IPP under frequency set points and their associated time delays such that under frequency tripping of the IPPs do not occur for those conditions that the HECO UFLS scheme was designed to accommodate.

CA-IR-59

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 72 of 90.</u>

The report mentions that "[t]wo breakers were noted to not have tripped during the automatic load shed sequence." Based on this representation, please respond to the following.

a. What is the total number of breakers in the "automatic load shed" schemes?

b. How many breakers operated properly?

c. How many breakers did not operate properly?

    1. Explain why the breakers were believed to have not operated properly.

    2. Please describe.

d. Are these the same breakers referred to on page 27?

<u>HECO Response:</u>

a. There are a total of 97 breakers in the automatic load shed schemes.

b. 94 of the 97 breakers are believed to have operated automatically.

c. POWER Engineers clarifies that two relays (as opposed to breakers) failed to operate to trip three breakers (two 12.5 kV and one 4 kV circuit breaker). One relay in Block 2 was found to have no target and a blown fuse on the sensing circuit (one 12.5 kV and the 4 kV breaker) and if this was pre-event, the relay would not operate. The other 12.5 kV breaker (in Block 3) was manually opened by SCADA and the relay did not show a target.

d. HECO is unsure of which breakers on page 27 the CA is referring to as the only reference to breakers on page 27 are breakers for the Kicker Block and Block 1 of the UFLS.

CA-IR-60

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 73 of 90.</u>

The report describes situations that "can allow the two IPPs to trip before the majority of the automatic load shed occurs." Based on this statement, please respond to the following.

a. Is there a reason to operate and have these trip points set like this?

b. Have there been discussions with the IPPs about coordination during emergency operations?

c. Are the IPPs willing to make changes to help during these times?

d. Has consideration been given to close back in to a dead bus?

e. Please explain.

<u>HECO Response:</u>

a. The IPP underfrequency relay settings were required by the IPPs to protect their equipment from damage. The final settings were reviewed and accepted by HECO after consideration of their coordination with HECO's underfrequency load shed scheme. A discussion related to coordination between IPP frequency and time delay set points and the HECO UFLS scheme was included in the response to CA-IR-58, subpart b.

b. Relay settings are set to provide automatic protection of equipment and would not be adjusted during an event for emergency operations.

There have been discussions with Kalaeloa over several years with regard to the CT trip setting of 56.8 Hz and 0.07 seconds. This was lowered from 57.0 Hz following further internal study in 2004 by Alstom Power (the CT manufacturer and Kalaeloa plant designer) in conjunction with installation of the M Upgrade that facilitated the increase in plant Capacity from 180 MW to the 208 MW level (Docket No. 04-0320).

c. In many cases the change in relays settings would require a plant shutdown, so quick changes in the settings are not practical during an emergency event. Further, the relay settings are already set based on protection of equipment and HECO acceptance of the settings had previously been obtained. See also response to subpart b. above.

d. The option to close on a dead bus is being considered by an internal team and will include discussion with Kalaeloa as needed to examine this option. This was included as Recommendation #3 in the Power Engineers report.

e. See the response to subpart d.

CA-IR-61

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 74 of 90.

The report describes the black start process at Kahe and Waiau Generating Stations on October 15, 2006. Based on this discussion, please respond to the following.

a. What is the procedure for reducing the drum pressure when striving for a hot start as experienced October 15, 2006?

b. What is the experience level of the operating and maintenance staff on duty during the system troubleshooting function?

c. What is the training requirement for those employees performing system-troubleshooting function?

d. What is the normal mode of operation for the generating units and associated systems (i.e., automatic or manual)?

e. Provide the nameplate information on the black start Solar Combustion Turbines at the Kahe and Waiau generating stations.

HECO Response:

a. For clarification, only the Waiau Generating Station has a drum pressure constraint for the black start process based on the design of the black start system which uses a low pressure emergency boiler feedwater pump to fill the boiler in preparation for startup. If the unit selected for black start was operating at full drum pressure prior to an island-wide outage, drum pressure must be reduced to match the capability of the smaller emergency boiler feedwater pump powered by the Solar black start CT. Drum pressure is reduced by opening the drain valves to the Primary Superheat Inlet Header and the Secondary Superheat Outlet Header. At the time of the earthquake and system collapse on October 15th, W5 was on line at full drum pressure and W6 was in the process of starting fires in the boiler with low drum pressure. During the disturbance, fires were pulled on W6 to concentrate on stabilizing W5. W6 was selected as the black start unit at Waiau because it had a lower drum pressure and did not require the operator to reduce drum pressure.

b. The Operators that were on shift at Kahe when the earthquake hit had an average of 13 years experience, with Control Operators averaging 30 years experience. The majority of the troubleshooting at Kahe during the restoration period was done by the Station Superintendent, Sr. Supervisors, Shift Supervisors, Control Operators, Junior Control Operators, Working Foremen, Technicians and support personnel with an average experience level of 16 years. The Operators that were on shift at Waiau when the earthquake hit had an average of 12 years experience, with Control Operators averaging 22 years experience. The majority of the troubleshooting at Waiau during the restoration period was done by Superintendents, Sr. Supervisors, Shift Supervisors, Control Operators, Junior Control Operators, and Working Foremen with an average experience level of 16 years.

c. Refer to HECO response to CA-IR-65, subpart a.

d. The normal mode of operation for the generating units and associated systems is "Automatic".

e. Clarification note: Solar Combustion Turbine is only at Waiau,

Waiau Solar Turbine
Gas Turbine T-1020S-33
Generator Nameplate
EM BEMACII
Brushless
SerNo 167940111
KVA 938 RPM 1200
KW 750 Cycles 60
Volts 4160/2400
Amperes 130/225
Phases 3 PF 0.8
Frame 732 Inst Book 141

Continuous Rating
Arm 75deg C Rise by Thermometer
Field 95 deg C Rise by Resistance
Rotation CCW
Exciter Rotor Part No 148B929G01
Exciter Stator Part No 148B933G01
3176-55065-BSW

Kahe Black Start Diesels
See attached page 4 of this IR response.

GENERAL DATA

SPECIFICATIONS	TYPE OF UNIT 60 ∿ Peaking 8 Pole Gen.	 60 ∿ Base Load 8 Pole Gen.	 50 ∿ Base Load 8 Pole Gen.
Engine			
Model	20-645E4		
Type	2-Cycle, Turbocharged, "V"		
Number Of Cylinders	20		
Bore And Stroke	9-1/16 × 10 Inches		
Total Displacement, Cu. In.	12,900		
Compression Ratio	14.5:1		
Rating, BHP, Nominal	3600**	3600*	3050*
Operating Speed, RPM	900	900	750
Lubricating System	Full Pressure		
Governor (Woodward)	EGB-10		
Weight, Pounds (Engine Only)	Approximately 42,885		
Synchronous Generator			
Model	A20	A20	A20
KW	2750	2500	2100
KVA	3440	3125	2625
Phase	Three		
Volts	4160 Wye/2400 Delta		
Amperes	477/826	434/751	365/632
Power Factor %	Eighty		
Field Excitation			
No Load Amperes	39.2	39.2	55.0
Rated Load Amperes	105.1	97.67	120.79
Weight (Approximate)	18,100	18,100	18,100
Air Intake And Exhaust System			
Air Intake	Exhaust Driven Turbocharger		
Air Intake Filter-Carbody	Inertial Air Filter		
Air Intake Filter-Engine	Oil Bath		

*10% overload permissible for any 2 hours out of 24.
**Minimum load restricted to 20% of full load rating.

CA-IR-62

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Page 75 of 90.

The report states that the "CIP CT planned for 2009 will have black start capability and should be able to be on the bus within an hour." Based on this representation, please respond to the following.

a. What is the location and electrical connectivity to the High Voltage system?

b. Identify the make, model number, and nameplate data for this unit.

c. Provide the start up sequence and times given by the manufacturer that causes the one hour start time.

d. Are there provisions that can be made to decrease this black start time?

e. If the response to part (d) of this information request is yes, please describe such provisions.

f. Is there an emergency start capability for this model that would result in a time less than one hour?

g. Will it be able to start an island against a dead bus?

h. In air permitting for this unit, is consideration being given to secure exceptions during emergency conditions?

i. If not, why not.

j. Provide a copy of the construction air permit for this unit.

HECO Response:

a. The CIP CT planned for 2009 ("CIP1") will be connected to the 138 kV transmission system at the AES Substation.

b. The make and model of CIP1 will be the Siemens SGT6-3000E. This combustion turbine was formerly known as the Westinghouse 501D5A.

c. Blackstart of CIP1 would likely fall under one of the following scenarios (times are best case):

   1. Normal Start – CIP1 was not running at time of power loss: 35.5 minutes

- o Startup of blackstart unit and auxiliary equipment: ~15 minutes
- o Start CIP1 and synchronize to bus: 20.5 minutes*

2. Restart (normal) – CIP1 was running and tripped at time of power loss: 44 minutes*
   - o Unit trips and coasts down below 300 rpm: 23.5 minutes
   - o Startup of blackstart unit and auxiliary equipment: ~15 minutes (done while CIP1 coasts down)
   - o Start CIP1 and synchronize to bus: 20.5 minutes
3. Restart (quick start) – CIP1 was running and tripped at time of power loss: 36 minutes*
   - o Unit trips and coasts down below 300 rpm: 23.5 minutes
   - o Startup of blackstart unit and auxiliary equipment: ~15 minutes (done while CIP1 coasts down)
   - o Start CIP1 and synchronize to bus: 12.5 minutes

* per Siemens

d. No, there are no provisions that can be made to shorten the scenarios listed in the answer to part (c). The times listed in those scenarios are considered "best case".

e. Not applicable

f. See responses to part (c).

g. Yes, CIP1 will have the ability to operate in an isochronous mode that will allow it to energize a dead bus.

h. No.

i. See HECO's response to CA-IR-38a.

j. HECO has not yet obtained the final Covered Source Permit for this unit.

CA-IR-63

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 78 of 90.

The report states that "[s]tarting diesel engines, on Maui and the island of Hawaii, could be characterized as needing only minutes for each engine." Based on this representation, please respond to the following.

a. Is it possible to install these type engines on Oahu?

b. Please explain.

c. Could small diesel units be installed to provide black start capability to existing combustion turbine units?

d. Please explain and provides [sic] cost estimates.

HECO Response:

a. Yes.

b. Although possible, it is not the appropriate size and type of generation for a system as large as HECO's. In fact, HECO does have diesel generating units of the size and type on the MECO and HELCO system. These units are used as black start units only because Oahu's system is so much larger than the MECO or HELCO systems.

c. See the response to CA-IR-45.

d. See the response to CA-IR-45.

CA-IR-64

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 82 of 90.

The report states that "[t]he Kalaeloa Combustion Turbine 2 tripeed [sic] on underfrequency but remained on line, supply local auxiliary or 'house' load for some time, until it had to be shut down for operational reasons." Base [sic] on this representation, please respond to the following.

a. What were the operational reasons?

b. What type of training is required to become a Control Operator (i.e., on-the-job, classroom and/or simulator)?

HECO Response:

a. The existing design for the Kalaeloa/HECO interconnection is such that Kalaeloa can only synchronize to the HECO system through their generator breaker. This breaker must be open prior to the synchronizing process. Opening the generator breaker trips the CT (CT2 in this case) and also shuts down all plant auxiliaries.

b. See response to CA-IR-65 for HECO's training requirements.

CA-IR-65

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage –Page 83 of 90.</u>

Regarding HECO's operating staff at all of the generating stations, please respond to the following.

a. What type of training is provided by HECO (i.e., on-the-job, classroom and/or simulator)?

b. What is the control operator's qualification process?

c. Are the operators required to re-qualify after a given period of time?

d. Is the black start sequence part of the control operators' qualification and requalification?

e. What generating unit control system upgrades have been made to-date?

f. Have these upgrades improved reliability and response time during emergency conditions?

g. What systems or generating units do the present simulators emulate?

<u>HECO Response:</u>

HECO's operator training and development is based on a closed line of progression at each power plant. The closed line refers to operators progressing to higher levels of responsibility within each station. Transfers between stations are allowed if operators are willing to start at the bottom of the progression. The line of progression (LOP) is designed to provide sufficient working experience and knowledge of every position as operators work their way to higher levels of responsibility. The lowest level is the Equipment Operator position and the highest level is the Control Operator.

a. A more detailed breakdown of Operator training is provided below.

- Prior to entering the line of progression discussed above all operating personnel are required to complete a 13 week training program which consists of 5 weeks of classroom training and 8 weeks of on-the-job training before assuming the watch as a qualified Equipment Operator. During the 8 weeks of on-the-job training, Equipment Operator Trainees are required to complete the following:

- A series of practical tests (demonstrations);
- Minimum Training Objectives for a particular unit
- System check outs
- Walk-throughs

- When computer based training materials became available, all incumbents in the Operating Division were required to complete the program as a self-study program within one year. New operators are expected to complete the CBT program within one year after joining the Operating Division.
- Line of progression advancement training is required for Equipment Operators (EO), Utility Operators(UO), Jr. Control Operators (JCO), and Control Operators (CO).

  EO, UO, and JCO line of progression training is comprised of the following:

  - 3 weeks of on-the-job training at a particular unit overseen by an Operator qualified at the particular position. The Sr. Supervisor and the Shift Supervisor also assist in the training process. Additional weeks of on-the-job training are granted to the Operators at their request.
  - Completion of the Minimum Training Objectives for a particular unit.
  - Completion of 4 weeks of Watch Standing duties without the supervision of a qualified Operator. During this 4 week time period, the Operator must demonstrate his or her ability to direct all aspects of operations at the

particular unit.

The Control Operator position is the most senior position in the Operations line of progression. It takes about 15 years to advance through the line of progression to the Control Operator position. Training requirements to become a Control Operator are as follows:

- o Completion of a minimum of 4 weeks of on-the-job training at a particular unit. A Control Operator qualified at that unit oversees the on-the-job training. The Sr. Supervisor and the Shift Supervisor also assist in the training process. Additional weeks of on-the-job training are granted to the Operators at their request.
- o Completion of the Minimum Training Objectives for a particular unit.
- o Completion of 4 weeks of Watch Standing duties without the supervision of a qualified Control Operator. During this 4-week time period, the Operator must demonstrated his/her ability to direct all aspects of operations at this unit.

b. Please see the training requirements for CO in a. above.

c. Operators are provided refresher training once every six months that include training for positions one above, and one below their primary position in the LOP. In addition an operator may request refresher training after returning from extended leave, i.e., vacation, sick leave, etc.

d. The black start sequence and procedures are included in the LOP to the UO position but is limited to classroom training and a walk-through of the system until opportunities arise during the annual black start simulation at Kahe and Waiau. HECO agrees with

Recommendation #8 on page 89 in the report to enhance the black start training program.

e. To date, various levels of control upgrades have been applied to all Kahe and Waiau units. Attachment 29 in response to CA-IR-2, subpart provides details on the extent of control upgrades for each unit.

f. HECO has experienced relative improvement from the original pneumatic combustion controls. The new DCS systems have diagnostic capabilities that allow faster troubleshooting of control and system problems. The new system enables remote monitoring and analysis from Engineer's desk tops. Also, enhanced capability such as providing additional runback capability discussed in CA-IR-48, helps the Control Operator minimize safety and equipment risks in the event of an unanticipated equipment malfunction. Also, the enhanced graphics on the more advanced upgrades significantly improves the man-machine interface.

g. With regard to Power Supply, the reference to simulations that begin on page 83 through 85 refers to actual black start simulations where designated units are started up with the black start generator(s). As discussed in d. above, HECO agrees with Recommendation #8 to improve the black start training program which will also include more opportunities for black start simulations.

CA-IR-66

Ref: Document Operating Manual, Section III, Part E, Page 2 of 7, Paragraph D.

The manual states that Combustion Turbines, W9 and W10, can load up at 18 MW/Min up to 44 MW.

a. Is this from a cold start?

b. If not, what is the total time from cold start to 44 MW?

   1. Under normal conditions?

   2. Under emergency conditions?

HECO Response:

a. In either a cold or warm start, the W9 and W10 CTs are able to ramp at 18MW/minute up to 44 MW once synchronized to the grid. See response to CA-IR-17.

b.

   1. The 18MW/minute up to 44 MW refers to an emergency start.

   2. Typically, from the initiation of a startup to 44 MW will take approximately 10-1/2 to 12-1/2 minutes under an emergency startup sequence. See response to subpart (a) above.

CA-IR-67

<u>Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page 17 of 19.</u>

The above document states that HECO is presently "redesigning its land line connectivity to provide backup carrier circuits . . . ."

a. Based on this statement, please describe in detail the changes and additions that are being done.

b. Are additional lines being added?

c. If so, how many?

d. Are additional switches being added to permit change over to backup lines?

e. Will this be fully redundant?

<u>HECO Response:</u>

a. After investigating multiple options, HECO has elected to substitute existing "Type I" Time Warner Telecom (TWTC) circuits with "Type II" circuits that will traverse Hawaiian Telecom (HT) facilities. Under this "Type II" scheme, HECO's landline phone service circuits will continue to be contracted through TWTC, however, TWTC diversifies the "last mile" with HT facilities that are served with power from HT's Central Office rather than TWTC's facilities, which do not have Central Office-based power. The TWTC landline circuit failure during the earthquake/power outage was because TWTC's "Type I" delivery system experienced power failures. TWTC's main communication site never failed, rather only the "last mile" landline transport to HECO. By transitioning part of its landline circuits to Type II service, HECO can still maintain the same inbound and outbound phone service, there will be no need for a large-scale conversion and HECO can retain its current public phone numbers. TWTC will route HECO calls via either the TWTC "last mile" circuits or the HT "last mile" circuits, whichever circuits are available, to HECO's Avaya phone system. The key to backup diversity is that the HT connection is powered by the Central Office, which continued to function during the October power outage.

b. HECO is not adding lines, rather it is reallocating existing TWTC contracted circuits to the new Type II services as described above.

c. Not applicable/none.

d. As described above, this new solution does not require new switching equipment, only a change in circuit type (i.e., diversity).

e. HECO is essentially introducing some redundancy by substituting new Type II circuit facilities from a second vendor (HT). The Type II circuit diversity would have prevented loss of landline connectivity during the October 15, 2006 outage.

CA-IR-68

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu - Page 3 of 19.

The Company's report states that the October 15, 2006 earthquake "was a rare and significant event."

a. How many island wide outages have there been in the last 30 years. Please list dates, durations and causes.

b. Given this history, what is HECO's expectation of the frequency of this type event?

c. Explain in detail HECO's plans to assure communication capability during this type event?

HECO Response:

a. As far as can be determined, no island-wide outages on Oahu have occurred as a result of an earthquake in the history of the company. The following are the island-wide outages that have occurred in the last 30 years due to other causes:

- **7/13/83** – Cause: Transmission-related. A combination of several events, occurring together:
  - o Two major 138-kV lines were out of service for repairs (one had been damaged during Hurricane Iwa)
  - o A three-phase fault on the Kahe-CEIP 138-kV line was caused by a sugar cane fire
  - o Relays mis-operated to trip three additional 138-kV lines
  - o During the system instability that occurred due to the first three conditions above, faulty instrument readings caused more load to be picked up than the remaining generators could supply.

  Duration of outage: 4 to 12 hours, with a few customers that experienced an outage of up to 18 hours.

- **8/18/84** – Cause: Transformer ("potential" transformer) explosion at Kahe substation, concurrent with an open linear coupler switch in the Kahe station switchyard which led to the secondary protective action of busses opening to trip the Kahe generating units off line.

  Duration: approximately 2 to 11.5 hours

- **4/9/91** – Cause: Transmission-related.
  - One 138-kV line was out for maintenance, when two other 138-kV lines experienced faults and tripped offline within 10 minutes of each other. The remaining 138-kV line between Kahe and the eastern portion of the electric system became severely overloaded, leading to system collapse.
  - Duration: 7 to 12 hours.

b. The company does not have an expectation regarding the specific frequency of an island-wide outage. While the company must be prepared to respond to an island-wide outage regardless of the cause, it should be noted that all of these previous island-wide outages on Oahu were transmission related. No record has been found of a generation-related island-wide outage in the history of the company. Major steps to address the causes of the previous outages, including the building of a southern transmission corridor on the island, had been taken in the more than 15 years since the last island-wide outage.

c. With respect to external communications, many measures are now in place or are in the process of being completed to maximize communication capability during an island-wide outage. These include communications equipment solutions such as dedicated phone lines to key emergency contacts including Oahu Civil Defense (line in service), State Civil Defense (project in planning stage with SCD), and the designated Oahu emergency broadcast radio station KSSK (circuit currently being installed); plans to diversify the "last mile" of land line service into HECO's Ward Avenue facility (see response to CA-IR-67); and reviewing wireless phone resources for key company emergency responders.

Other steps include updating unpublished contact phone number lists for key media to increase the ability to reach media unimpeded by high caller traffic on the main public lines and ensuring such phone numbers are readily accessible (see response to CA-IR-74); and revising procedures to assess, in a major emergency, whether a company spokesperson should be physically present at the primary emergency broadcast station.

CA-IR-69

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu - Page 7 of 19.

a. Concerning the unavailability of landline phone service, wireless phone service, and Internet service; do any of the providers have back up emergency generation capability? Please describe in as much detail as available.

b. If not, has this been considered? Please describe.

c. Has consideration been give [sic] to locate any of the HECO DG units at the sites of these critical customers' facilities?

d. Explain why or why not.

e. Have geo satellite phones been considered? Please explain.

HECO Response:

a. HECO objects to this information request on the grounds that it seeks confidential and proprietary information of HECO's customers[1] and certain information afforded protection by the Homeland Security Act of 2002. Without waiving these objections, HECO provides the following response pursuant to Protective Order 23159: See page 3 of this IR response.

b. See objection to subpart a. Without waiving these objections, HECO provides the following response pursuant to Protective Order 23159: See page 3 of this IR response.

c. HECO has identified the possibility of locating its DG units at critical customer sites, though not specifically for telecommunication sites. At this time, HECO has not evaluated a business model or assessed the commercial and regulatory constraints or requirements to do so.

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[1] HECO is unable to disclose confidential customer information without jeopardizing those customers' business interests. For example, revealing a customer's on-site generating capabilities could highlight security vulnerabilities as well as provide competitors with information that could be used against that customer. Publicizing such capabilities or lack thereof could also subject customers to unwanted sales solicitations.

d. HECO has not fully evaluated the feasibility of such a business model, and has considered it only on a preliminary basis primarily due to the potential regulatory and contracting complexities. HECO will consider this in more detail but recommends that customers with a critical, on-going need for emergency backup power take steps to install their own emergency power systems.

e. Satellite phones are used at HECO for last resort communications only, should internal private line, landline or wireless communications become unavailable. Satellite phones have a major deficiency in that they need line of sight with the satellites and are not ideally suited for indoor use.

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CA-IR-70

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu - Page 8 of 19.

The Company's report mentions "live TV appearances" as actions taken by the Company.

a. Which TV stations were available during the entire island wide outage?

b. Do the TV stations have emergency generation capabilities? Please describe.

c. How effective are TV broadcasts expected to be during an island wide blackout when most citizens do not have power to operate TVs?

d. The Company's report states that the DCC "began making phone calls to HECO's System Operations personnel" within three minutes of the earthquake.

   1. How did the DCC find out about the occurrence?

   2. Please describe.

HECO Response:

a. HECO's understanding is that KITV4, while not able to air normal TV broadcasts on Oahu earlier in the day when one of their Oahu transmitters was without power, was able to continue to broadcast on the neighbor islands utilizing a microwave transmitter on the top of the Archer Lane building which houses their studio. KITV4 was also able to uplink their programming via satellite, which resulted in their broadcasts being picked up by CNN, allowing news to be received on the neighbor islands and the mainland as well as by those Oahu residents with external TV antennas and TVs powered by portable generators or batteries. The station was also able to stream its broadcast on its Internet site for the duration of the outage. It was reported that the KITV4 website had 405,000 page views from the 808 area code on that day. These broadcasts provided a secondary means for Oahu residents to receive news from friends and family on the mainland and on the neighbor islands.

KFVE was also on the air, and could be viewed by those who had TVs powered by batteries or emergency generators. Its sister station, KHNL, was not on the air because its Hilton Hawaiian Village transmitter was without power.

KHON was broadcasting throughout the earthquake on the neighbor islands because those transmitters remained operational.

b. KITV, KFVE and KHON were able to broadcast during the power outage.

c. As noted in the response to subpart a, while most Oahu residents did not have power to operate their televisions during the day, in some cases, such as with KITV and KHON, the broadcasts were being picked up elsewhere, allowing the information to be relayed to local residents who were in contact with friends and family in those locations.

d.

1. The DCC, who was in Kaneohe at the time of the earthquakes, felt the quakes and saw the lights flicker and then go out. When that occurred, he immediately called in to System Operation to find out what was happening on the electric system.
2. See the response to subpart d.1.

CA-IR-71

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page 9 of 19.

The Company's report mentions the inability to contact KSSK, the primary emergency broadcast radio station, by phone and the need to send a staff member to KSSK studio in order for such contact to be established.

a. The report continues by stating that "[a]rrangements were made with the KSSK news director to provide regular phone updates to KSSK." How was this expected to be accomplished given the earlier inability to make phone contact? Please describe in detail how this would be accomplished.

b. There is discussion of HECO's attempt to access the Company's computer network which contained "emergency communications reference materials including unpublished radio station phone numbers." Getting the numbers was delayed until access to the HECO computer network was gained. Were there other methods to obtain these numbers, such as written lists, etc? Please explain.

HECO Response:

a. The early difficulties in making contact with KSSK were primarily due to an inability to get through to the station because of heavy caller volume on their main news line. When contact was made, the alternative unpublished phone number into the studio was obtained, as well as the news director's personal cell phone number. Thus, at that time, it was expected that the reason for the previous difficulty in reaching the station would likely not be an issue and that calls could be made to either of these contact numbers, as well as the main news line as a backup.

b. The unpublished studio number for KSSK was also included in the communication department's written emergency procedures, hard copies of which were located in the department's King Street offices. Access to those copies was delayed due to initial reports that the King Street building was not accessible due to the power outage. See the response to CA-IR-74, subpart a, on steps taken by HECO to have unpublished radio station phone numbers more readily available.

CA-IR-72

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page 14 of 19.

a. The report references the need to contact and restore power to the larger commercial customer accounts. Do any commercial customers have emergency generation facilities?

b. If yes, please list and describe the facilities that each customer has.

c. Does HECO have a complete list of customer owned generation? If yes, please provide a copy of the list.

HECO Response:

a. Yes.

b. HECO objects to this information request on the grounds that it seeks confidential and proprietary information of HECO's customers, invades customer privacy, and requests the disclosure of certain information afforded protection by the Homeland Security Act of 2002.[1]

Without waiving these objections, HECO provides the following response:

An earlier partial survey of larger commercial customers indicated that most of these commercial customers do not have back-up generators.

c. No.

[1] HECO objects to the production of customer-specific documentation concerning customer back-up generators on the grounds that [1] such information is confidential and has been protected from disclosure by the Commission in other proceedings, and [2] the disclosure of such information has not been consented to by the customers.

CA-IR-73

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page A2.

a. The report mentions "HECO's new Dispatch Center in 2006." What are the backup power supply facilities for this facility?

b. Please provide a detailed explanation and copies of diagrams.

c. What is the preventative maintenance and schedule of the preventive maintenance for these backup supplies?

d. Provide any test procedures and schedules for the backup power supply testing.

e. Provide a detailed explanation of which parts of the Ward Avenue facility are served by the backup supply, including the new Dispatch Center.

f. Describe the functions that were included in the backed up areas.

g. What Building Code and Seismic Design Code were used as the basis of design and construction of the new Dispatch Center?

HECO Response:

a. The new dispatch center is served by two 12kV circuits. The new dispatch center electrical equipment includes two padmount transformers, two switchgears, two UPS and battery systems, and two diesel generators. Each of two diesel generators is able to support the full load of the new dispatch center.

b. A single line diagram of the electrical system is provided with this response as attached page 3, pursuant to Protective Order 23159. The utility protective relaying senses utility voltage or frequency out of tolerance on both utility sources, which initiates an adjustable time delay of 0.5 to 10 seconds. Upon expiration of the time delay, breakers are open and a run signal is sent to the generators. Both generator turn on and synchronize. Next, breakers are closed to allow the generators to serve the building. The UPS and batteries allow the critical load such as the EMS to not be interrupted during the transition.

c. The systems are currently under warranty. Manufacture schedule for changing of fluids and filters will be followed fro the diesel generators. The batteries are monitored through the site monitoring system.

d. The diesel generators are operated for tested weekly.

e. At the time of the 10/15/06 outage only the new dispatch center was connected to the back-up system. The generators also support HECO's new call center.

f. The back-up system provided power to the new dispatch center and call center. The new dispatch center contains the Control Room where generation is dispatched to customers and the HECO's electrical grid is controlled, monitored and maintained. The new dispatch center also houses the new EMS, the EMS support staff personnel and operations personnel. The new dispatch center also houses the Gallery Room where the Incident Command Team was able to meet.

g. Please refer to the response provided in CA-IR-16 subpart f.

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CA-IR-74

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page 18 of 19.

One action item includes the need to expand the list of unpublished radio station phone numbers and including the list in multiple reference locations for ready access.

a. Provide a copy of this process, including timeframes for updating, locations for storage, etc.

b. Is this list included in HECO's emergency preparedness plan, or any document similar to that?

HECO Response:

a. Calls were made in October 2006 to the four major radio owner groups (Clear Channel Communications, Cox Radio Group, Visionary Related Entertainment, and Salem Media of Hawaii) to request additional phone numbers for their respective radio stations beyond the published studio phone lines (and in addition to any unpublished contact numbers already known on October 15). Note that not all stations have such "hotline" numbers. The media contact listings for the Corporate Communications department were then updated and copies distributed to all department personnel. The updated electronic file was also saved to a location on the company LAN shared drive accessible by all department personnel. The numbers were also programmed into department cell phones. An existing department laminated wallet card of key communications contact phone numbers will be updated to include the unpublished media hotline numbers. The procedure followed for performing this update on a semi-annual basis will be included in a revision to the incident response manual (IRM). The IRM was provided as Attachment 1 of CA-IR-2, subpart a.

b. No. The list of unpublished radio station phone number is not in the IRM. Yes, HECO does have a list of unpublished radio station phone numbers that is separate from the IRM.

CA-IR-75

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page A1.

a. At 7:20 a.m., the log indicates that "[c]alls to the media cell phone following the second quake" were made. Was there any additional outage related impact from the second quake or after shocks?

b. If yes, please describe.

c. Please provide all details, time lines, etc. on this second quake.

HECO Response:

a. Based on the review of system events performed by both HECO and POWER Engineers, the events leading to the island-wide outage were initiated by the first quake. There are no indications that the second quake led to further outage-related impacts.

b. Not applicable.

c. As described in the POWER Engineers outage report, according to the Hawaiian Volcano Observatory, a second 6.0 magnitude quake was reported approximately seven minutes after the initial quake on October 15, 2006. Per the Hawaiian Volcano Observatory, the location was 44 kilometers north of the Kona airport at a depth of 20 kilometers.

CA-IR-76

Ref: Document Investigation of 2006 Oahu Island-Wide Power Outage – Review of External Communications on the Island of Oahu – Page A2.

a. At 10:00 – 10:30 a.m., the drafting of the first press release was started. Is there a previously planned process and drafted press release for an island wide outage?

b. If yes, please provide a copy of the draft and describe the process to be followed.

HECO Response:

a. The general process is to look for relevant press release templates, obtain facts for the current situation and, utilizing this information, begin to draft the press release. The Corporate Communications department emergency plan included templates of press releases for various emergency scenarios, such as calls for conservation in anticipation of possible generation shortfalls, the announcement of plans to initiate manual load shedding in such anticipated generation shortfall situations, and oil spill emergencies. While there was not a specific press release template for a scenario immediately following an island-wide outage, Corporate Communications used existing templates, including emergency tips for food safety, protection of sensitive electronic equipment and safe use of portable generators in the drafting of the press release.

b. A copy of the templates containing emergency tips is attached as pages 2-6.

SAFETY

Q: How do you tell the difference between telephone, television cable and electrical lines? How can I tell if standing water is electrified? How can I tell if a fallen line still has electricity in it?

A: Consider all cables and wires as being energized regardless of whether they are electrical, cable television or telephone. After a storm any one of these wires can be energized if it falls and gets wrapped around an energized line whether it's a few feet away or a block away. If the line is in the water, there is even more reason to be cautious, consider the wire and the water energized.

Q: How should I hook up my electrical portable generator?

A: Connecting a portable generator to home wiring can cause safety problems if not connected properly. When using a portable generator, HECO asks that you carefully follow instructions in the manufacturer's manual, for your safety and the safety of HECO employees working to restore electricity to the HECO system. If you are using a portable generator, HECO asks that you carefully follow instructions in the manufacturer's manual, for your safety and the safety of HECO employees working to restore electricity to the HECO system.

As a general rule, don't plug the generator into your household electrical outlets. Improper use of generators can cause electricity to backflow into power lines, endangering HECO workers or possibly even neighbors served by the same power line. Instead:

- Plug your equipment or appliance directly into the generator; make sure the wattage requirements of the appliance don't exceed the capacity of your generator or extension cord.
- Provide adequate ventilation for exhaust and cooling.
- Store reserve fuel in a safe place away from the generator or any other equipment that might ignite the fuel; use containers designed for fuel storage.
- Avoid operating generators in rain, near swimming pools, sprinkler systems or with wet hands, feet or clothing.
- In rare cases, you may need to connect a generator permanently to your household wiring. Do NOT do so UNLESS the installation is done by a licensed electrician or electrical contractor.

Q: What should I do when I see lines from a utility pole down on the ground?

A: Assume the lines are energized (i.e. that they're live) and dangerous. Don't touch them. Stay away. Warn others to stay away. Call the HECO Trouble Line at 548-7961 or 911 for immediate emergency help.

Important!

Many objects, although non-metallic may conduct electricity. If unsure, don't touch it! A fence or metal guard rail touching a downed line can be energized for several thousand yards. This may be dangerous to anyone coming into contact with the fence or rail even though they are not in the immediate vicinity of the downed line. Do your best to keep people away while emergency help is on the way. If someone is touching a fallen power line, don't try to rescue them. Efforts to pull a shock victim away could make you a victim. Warn others to stay away...call 911 or the HECO Trouble Line at 548-7961 for immediate emergency help. Stay clear until you are sure the power is shut off.

Q: What should I do if a power line has fallen on the car that I am in?

A: Stay inside the car if possible and wait for help. If possible, try to break contact with the line by driving the car away from it. If you need to get out of the car right away (because of some other pending danger like fire), jump free of the car. Jump so that your body clears the vehicle before touching the ground. The purpose here is to avoid having your body become an electrical path from the car to the ground.

Q: How can I tell if a line is a power line? What about phone or cable TV lines?

A: Assume that all lines are dangerous and unsafe. Sometimes phone or cable TV lines can be dangerously energized by power lines and therefore lethal if contacted. It takes a well-trained eye to recognize the differences. There are a variety of materials and methods used on power lines and therefore a variety of descriptions and circumstances that are best understood by the trained eye. If you are unsure, stay away, warn others to stay away, and call the HECO Trouble Line at 548-7961 or 911 for immediate emergency help.

Be Prepared

The best time to plan and prepare for an emergency is before one happens. Take time out to check your house. Make sure you have: a portable radio, flashlights, batteries, canned foods, water bottles, a manual can-opener, plastic trash bags, disposable plates, forks, spoons, knives, hot and cold cups, paper napkins, a hibachi or camp stove with enough fuel for five days, matches in a waterproof container, heavy duty aluminum foil, masking tape, blue-ice packs, and ice-coolers. Remember, the best time to plan and prepare for an emergency is before it happens.

In the event of a storm, freeze some of the blue-ice packs that you use for camping or picnics. They'll help keep food cold if an outage occurs. You can also put some of the blue-ice packs in an ice-cooler --

and put your most perishable items like milk, juice, and cold-cuts in there. Then, if a power failure occurs, you won't have to open your refrigerator.

1. If there is advance warning about a storm that might cause a power failure, surge-proof your sensitive electrical appliances such as your television, VCR, and computers by shutting them off and unplugging them. If the power should go off, it's a good idea check to see that all your lights are off, and that all sensitive equipment is unplugged to prevent damage from a power surge that may occur when the power is restored.

2. If you feel you have suffered a loss due to a power outage, you can file a claim with Hawaiian Electric. A claim must be filed within thirty days of the incident by sending a letter to Hawaiian Electric. Be sure to keep all receipts or replacement estimates.

   The address for filing a claim is: Hawaiian Electric Company,
   Claims Department,
   PO Box 2750
   Honolulu, HI 96840

Kitchen Survival Tips

1. During a power outage, a fully-stocked free-standing freezer will keep most of your foods frozen for up to seventy-two hours -- if you don't open the door! Don't peek inside to see if the food is still frozen...each you open the door, cold air gets out!

2. The freezer section of a refrigerator-freezer will keep most of your foods frozen ten to twenty-four hours. Try not to open the freezer door during an outage, you'll let the cold air escape!

3. If power restoration is taking longer than anticipated, put some dry ice in the freezer. Always use gloves or tongs when handling it. Dry ice can be placed directly on top of your foods. Remember, dry ice cools foods below it.

4. After the power is restored, you can refreeze most your food items that still have ice crystals remaining, but try to consume these foods as soon as possible.

5. After the power has been restored check your foods and immediately cook foods that have thawed out, but are still cold. Dispose of any food that has an off color or odd odor, or perishable foods that have warmed to room temperature for an unknown length of time.

6. Here are some guidelines for food safety -- butter, margarine, and hard cheeses are safe unless mold or rancid odors develop. Fresh fruits and vegetables are safe as long as they aren't mushy or slimy. Eggs will be safe for several days if the shells have no cracks. Fresh meat, poultry, luncheon meats or hot-dogs should be discarded if allowed to warm to room temperature for more than two hours. Milk and cream probably will sour after eight hours without refrigeration. Vinegar and oil salad dressings, jellies, jams, mustard, pickles, and olive may be safely kept UN-refrigerated unless they have been contaminated by poultry or meat juices.

7. In stocking the cupboard for an emergency, here are some food suggestions: non-fat dry powdered milk, canned meats such as Vienna sausage and Spam, pork and beans, canned fruits and vegetables, instant hot cereal, canned or powdered fruit juices, instant coffee and tea, sugar, non-

dairy creamer, rice, cookies, jelly, and peanut butter to name a few. Store these foods in cool, dry and dark areas such as under a bed or a table covered with a long tablecloth. Store packaged foods in metal or plastic covered containers.

8. In the event of a severe storm fill-up clean water containers. Allow a minimum of two quarts of water per person per day. Don't forget the needs of your pets. Add two drops of chlorine bleach per quart of water to be stored. Use an eye dropper solely for this purpose.

9. If you're unsure about the water quality during an outage, you can purify the water by boiling it. If this is not possible, strain the water through paper or clean layers of cloth. Use any household bleach that contains five point two five hypochlorite as its only active ingredient. For every gallon of water, add eight drops to clear water and sixteen drops to cloudy water. Stir and let stand thirty minutes.

CUSTOMER ADVISORY – PORTABLE GENERATORS

TO: ALL REPORTERS, EDITORS
SUBJECT: ELECTRICAL SAFETY – PORTABLE GENERATORS

If you are using a portable generator, HECO asks that you carefully follow instructions in the manufacturer's manual, for your safety and the safety of HECO employees working to restore electricity to the HECO system. As a general rule, don't plug the generator into your household electrical outlets. Improper use of generators can cause electricity to backflow into power lines, endangering HECO workers or possibly even neighbors served by the same power line. Instead:

- Plug your equipment or appliance directly into the generator; make sure the wattage requirements of the appliance don't exceed the capacity of your generator or extension cord.
- Provide adequate ventilation for exhaust and cooling.
- Store reserve fuel in a safe place away from the generator or any other equipment that might ignite the fuel; use containers designed for fuel storage.
- Avoid operating generators in rain, near swimming pools, sprinkler systems or with wet hands, feet or clothing.
- In rare cases, you may need to connect a generator permanently to your household wiring. Do NOT do so UNLESS the installation is done by a licensed electrician or electrical contractor.

RADIO COPY

PRODUCT: STORM MESSAGE
TITLE: :60 RADIO - GENERATOR SAFETY

ANNCR: This is ____ from HECO with some things you should know about using a generator. Several important precautions are necessary to insure your safety.

First, as a general rule, don't connect the generator into your household electrical outlets. This can cause power to back flow into power lines, endangering electric workers or possibly even neighbors. Instead, plug appliances directly into your generator, using grounded extension cords. Make sure the wattage needs of the appliance don't exceed the capacity of the generator or extension cords.

Second, if you do call an electrical contractor to help you, make sure he or she is State licensed.

Third, keep your generator outdoors and away from flammable materials to minimize the risk of fire or carbon monoxide poisoning.

Thanks for your patience and cooperation. Your safety is important to us, especially during the rebuilding. Our crews will continue working around the clock until the job is done.

CA-IR-77

Ref: Document October 19, 2006 Combined HECO, HELCO, and MECO Briefing to the Commission and the Division of Consumer Advocacy November 1, 2006 Transmittal.

a. Attachment 2, HECO's PowerPoint presentation. The black and white print copy is not readable. Please provide a color, electronic PowerPoint file or pdf file of presentation.

b. Attachment 5, HELCO PowerPoint presentation. The black and white print copy is not readable. Please provide a color, electronic PowerPoint file or pdf file of presentation.

c. Attachment 6, MECO PowerPoint presentation. The black and white print copy is not readable. Please provide a color, electronic PowerPoint file or pdf file of presentation.

HECO Response:

a. Color, electronic PDF files of the HECO, HELCO and MECO PowerPoint presentations are on a CD to be provided shortly.

b. See the response to subpart a.

c. See the response to subpart a.