CEAB

Connecticut Energy Advisory Board

October 26, 2006

The Honorable Daniel F. Caruso
Chairman
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

RE: Docket No. 317 Regarding UI Trumbull Substation Application

Dear Chairman Caruso:

On June 30, 2006, The United Illuminating Company (UI) submitted an application with the Connecticut Siting Council (CSC) seeking approval to construct a new 115kV/13.8 kV substation in the Town of Trumbull. Pursuant to Conn. Gen. Stat. Sec. 16a-7c(b), the Connecticut Energy Advisory Board (CEAB) issued a Request for Proposal (RFP) seeking alternatives to the proposed facility on July 14, 2006. No proposals were submitted in response to the RFP.

The CEAB is required to submit an evaluation to the CSC relative to the proposed project (and any proposals for alternatives), pursuant to Conn. Gen. Stat. Sec. 16a-7c(f), for conformance with the relevant infrastructure criteria guidelines (the Preferential Criteria) created pursuant to Conn. Gen. Stat. Sec. 16a-7b.

Accordingly, the CEAB submits herewith for the CSC's consideration the CEAB's evaluation of the proposal that initiated the RFP. Please let us know if you have any questions.

Sincerely,

Mary J. Healey

Donald W. Downes
Chairman
Connecticut Energy Advisory Board

Mary Healey, Esq.
Vice Chairman
Connecticut Energy Advisory Board

Attachment

The Connecticut Energy Advisory Board's

Assessment
of

The United Illuminating Company's Proposed Trumbull Substation

Prepared by La Capra Associates

CEAB
Connecticut Energy Advisory Board

The Connecticut Energy Advisory Board

October 26, 2006

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Attachment A

Questions Submitted to United Illuminating and the Responses

I. Introduction

On July 14, 2006, the Connecticut Energy Advisory Board (CEAB) issued a Request for Proposals (RFP) seeking alternatives to an application from The United Illuminated Company (UI or the Company) to the Connecticut Siting Council (CSC) to construct a new 115 kV/13.8 kV substation in the Town of Trumbull. UI's application to the CSC is the second such request filed since the enactment of Conn. Gen. Stat. Sec. 16a-7c.[1] Pursuant to Conn. Gen. Stat. Sec. 16a-7c(b), the CEAB is required to issue an RFP seeking alternatives to certain projects filed with the CSC. Proposals for alternatives to the Trumbull Substation were to be submitted no later than September 12, 2006. None were received.

The CEAB is also required, pursuant to Conn. Gen. Stat. Sec. 16a-7c(f), to submit a report to the CSC evaluating the proposed project and any proposals for alternatives to it received in response to the RFP. More specifically, Conn. Gen. Stat. Sec. 16a-7c(f) requires the CEAB to issue an evaluation of any proposal received, including the proposal that initiated the RFP, for conformance with the relevant infrastructure criteria guidelines created pursuant to Conn. Gen. Stat. Sec. 16a-7b (the Preferential Criteria). This report provides an evaluation of the proposal that initiated the RFP; it will be submitted to the CSC for its consideration.

The CEAB has concluded that the proposed Trumbull Substation project is a reasonable approach to the resolution of concerns about distribution level reliability in the Trumbull area. The following sections of the report describe how we approached the evaluation issues and how we reached our conclusions.

II. Process History

On November 28, 2005, UI made a Municipal Consultation Filing (MCF) with the Town of Trumbull (Town), proposing to construct a new 115 kV/13.8 kV substation within the Town. On January 26, 2006, representatives from La Capra Associates met with representatives of UI to discuss the proposed project and gain a better understanding of the project and any alternatives to it that UI considered.

[1] Public Act 03-140, "An Act Concerning Long-Term Planning for Energy Facilities"

On June 30, 2006, UI submitted a formal application to the CSC, seeking approval to construct the proposed substation in Trumbull. The CEAB's RFP seeking alternatives to the substation proposal (or any applicant's proposal) is required to be issued no later than 15 days after the applicant's CSC filing in accordance with Conn. Gen. Stat. Sec. 16a-7c(b). That RFP was issued on July 14, 2006.

On July 6, 2006, La Capra Associates submitted several questions to UI, seeking to confirm information discussed at the January 26^{th} meeting and to obtain additional information about the project. On July 28, 2006, UI responded to the questions submitted on July 6^{th}. These questions and the Company's responses are provided in Attachment A to this report.

On July 28, 2006, the CEAB held a bidders conference in Rocky Hill in accordance with the procedures contained in the RFP issued on July 14, 2006. No potential bidders attended this conference. Prospective bidders were requested to file a non-mandatory notice of intent to file by August 11, 2006. No such notices were filed with the CEAB. Any pre-bid questions were due to be sent to the CEAB by August 18, 2006. No pre-bid questions were submitted. Proposals in responses to the CEAB's RFP for the Trumbull substation were due by September 12, 2006 at 4 p.m. As noted above, no proposals were received.

III. Description of the Proposed Substation

UI proposes to construct a new 115KV / 13.8-KV substation in Trumbull, CT, on land already owned by the Company. The preferred parcel is located on Wildflower Lane, immediately west of the Connecticut State Route 8 / Nichols Avenue (State Route 108) interchange. This site is located in close proximity to Trumbull Junction, a place where UI's 115KV transmission lines numbered 1730 and 1710 connect to the transmission system of the Connecticut Light & Power Company (CL&P). No new Right of Way (ROW) will be required to complete this project. The new substation is positioned between two existing UI substations at Trap Falls and Old Town. The new substation will have two 24/32/40 MVA transformers that will have an estimated combined firm capacity rating of 58 MVA. The design of this new station is in accordance with

UI standard practices. The following is a summary of the equipment proposed to be installed at the new Trumbull Substation.

- Two 24/32/40 MVA, 115/13.8-KV transformers with load tap changers.
- One 13.8-KV bus duct system connected to the transformers.
- Low profile 115-KV bus work supported by station post insulators.
- Three 115-KV SF6 gas insulated circuit breakers.
- Five vertical break disconnect switches.
- Six center break disconnect switches.
- Three H-Frame takeoff structures.
- Four shielding masts for lightning protection.
- Two single pole dead-end structures.
- One control / switchgear building.

Loads currently served by the Trap Falls and Old Town substations will be transferred to the new Trumbull Substation once it is operational. The estimated cost of this new substation is $17.3 million, and the projected service life is 40 years or more.

IV. Evaluation of the Project

A. Evaluation Approach

The approach to the evaluation of any project is to examine its conformance with the state's Preferential Criteria, which include need and reliability. The Preferential Criteria also cover a wide range of potential environmental and quality of life impacts that may, to varying degrees, result from the development and operation of significant infrastructure projects.

Where there are a number of proposals to evaluate and to compare with one another, the Preferential Criteria allow for a balancing of the various factors.   By way of a simple hypothetical example, one generation project may have lower emissions levels than another but have a more problematic location for other reasons. With respect to the Trumbull Substation, had there been alternative proposals, the CEAB's evaluation would have compared and contrasted them with respect to the various Preferential Criteria. However, in the absence of proposed Trumbull Substation alternatives the CEAB's evaluation is, inevitably, more streamlined.

In the absence of alternative proposals, the task at hand is twofold. First, it is to determine whether we agree with UI's representations that the proposed project meets identified energy needs and would enhance system reliability consistent with the Preferential Criteria. Second, the CEAB assesses whether the proposal gives rise to such material concerns regarding other Preferential Criteria, such as environmental or quality of life issues, that it warrants special consideration by the CSC or other downstream agencies that will apply their own applicable standards. The general point, in other words, is that an applicant's project may, for example, have significant economic value to the state, but be particularly problematic relative to other important Preferential Criteria, such as environmental degradation.

Because the types of projects that trigger a CEAB RFP, as well as any proposed alternatives to it, will range in scale and scope from the large and complex to the small and relatively simple, so too will CEAB's analysis. In this case, the proposed substation is in the latter category. Moreover, the nature of the proposed project and the potential alternatives to it, such as its size, cost, likely environmental and quality of life implications, influence the type and depth of the CEAB's analysis and evaluation. In this case, the proposed substation is a relatively small scale energy project and the most relevant Preferential Criteria pertain to need and enhanced reliability.

As for the CEAB's conclusion in this case, it is our view that reliability in the Trumbull area is indeed a concern and that the proposed substation is a reasonable way to address the need and enhance reliability. In addition, particularly in the absence of alternative proposals via the RFP process, there do not appear to be elements of the proposed project that would cause such material concerns that should be given special consideration by the CSC or other downstream agencies. In sum, the CEAB considers UI's proposal to be a favorable resolution to the stated need. The CSC has the statutory responsibility to perform the need assessment and to determine whether to grant a certificate of need.

The next section of the report describes how the CEAB reached its conclusion with respect to the need for the project for local reliability enhancement.

B. The Evaluation

In evaluating the need for this project, La Capra Associates has relied upon data and information provided by the Company. We have asked for additional material and have examined what was provided for accuracy and consistency. We believe that we have performed a satisfactory amount of due diligence to support our evaluation to the CSC.

In its application, UI has stated that the proposed Trumbull substation is needed to improve electric distribution system reliability and increase the transformer capacity that supplies the 13.8 kV primary distribution feeders in the area.

1. The Present Situation

In planning its bulk power supply system and substations, UI utilizes a reliability criterion called "N-1". This is a common planning criterion utilized by most if not all electric utilities in the country. The intent of adopting this standard is to design the system to withstand the worst single event or contingency and still supply customer loads. The firm capacity of a substation is the load that can be supplied even with the failure of the largest piece of equipment, which in this case is one of the two transformers located at that substation. In determining the firm capacity of a substation, UI considers not only the loads carried by the equipment remaining in service, but also the performance of the system, such as its ability to maintain proper voltages in the event of a contingency or equipment failure.

In its June 30, 2006 filing with the CSC, UI has provided load projections and the existing firm capacity of the Old Town and Trap Falls substations. According to UI, the firm capacity at Old

Town is 85.5 MVA[2]. Actual load at Old Town in 2005 was 83.3 MVA in 2005, and is forecasted by UI to increase to 87.7 MVA by 2010, or a growth rate of approximately 1.0% per year. At Trap Falls, the firm capacity is 76.6 MVA. Actual load in 2005 was 77.3 MVA, and is forecast by UI to increase to 93.5 MVA, or a growth rate of 3.8% per year. The 3.8% per year forecasted growth rate is based upon new customer increases that have been identified by the Company.

With all equipment in service, Old Town and Trap Falls can service the existing loads. Under an "N-1" criterion, where the system must withstand the loss or failure of the largest piece of equipment, these stations need additional capacity, or need to have some of their loads transferred to other stations. By 2010, the combined projected loads for Trap Falls and Old Town substations will exceed their ratings by approximately 19 MVA, even with all equipment in service. Based upon this discussion, we concur that there are reliability issues in the Trumbull area.

2. UI's Proposed Solution

UI proposes to install a new substation located in Trumbull between the existing Trap Falls and Old Town substations. When the new Trumbull substation is operational, approximately 35 MVA of existing load will be transferred to it; 18 MVA from Old Town and 17 MVA from Trap Falls. These transfers will reduce loads at those existing substations to a level that will comport with the "N-1" planning criterion until after 2015, according to UI.

According to UI, there will be additional benefits to constructing the new Trumbull Substation. UI is required to maintain system reliability at their 1998 levels. Construction of the new substation and accompanying load transfers will facilitate achieving that objective. Furthermore, the existing substations at Old Town and Trap Falls are connected to transmission lines owned by CL&P, while the new Trumbull substation will connect to lines owned by UI. The load transfers from Old Town and Trap Falls to the new Trumbull Substation could reduce payments by UI to CL&P for the use of the CL&P transmission system.

[2] With one transformer out of service, this rating is reduced to 65 MVA to guard against voltage collapse.

3. The CEAB's Conclusion

We concur with the Company's conclusion that the supply situation for the existing Trumbull substation is undesirable and in need of relief. Without some form of remediation, the existing system will not be able to reliably serve load in three to five years.

As an alternative to constructing a new substation, the Company considered the option of transferring loads to neighboring existing substations. Therefore, we examined the data provided by UI for loadings on substations in the five neighboring towns, which is summarized in the following table.

Substation	2005 Load (MVA)	2010 Load (MVA)	Capacity (MVA)
Barnum	48.6	51.4	54.1
Congress I	67.7	80.3	96.0
Congress II	24.0	31.4	48.0
Hawthorne	67.3	72.0	96.0
Indian Well	64.2	75.9	73.8
subtotal	271.8	311.0	367.9
Old Town	83.3	87.7	65.0
Trap Falls	77.3	93.5	76.6
subtotal	160.6	181.2	141.6
Total	432.4	492.2	509.5

Without any additional substation capacity, the loads on Old Town and Trap Falls plus the five neighboring substations will nearly equal the total firm capacity by 2010. Furthermore, the transfer of loads to neighboring substations would increase the length of the primary distribution circuits that deliver electricity from the substations to the customers, and expose the reconfigured distribution system to outages and poor reliability. Based upon the above discussion, we concur with the Company's assessment that achieving transformer capacity relief by transferring loads to neighboring substations is not a feasible solution.

Other alternatives considered by the Company include (a) the installation of a 40 MVA modular substation at Trumbull, (b) replacing existing transformers at Old Town and Trap Falls with larger transformers, (c) feeder enhancement through distribution automation, (d) distribution generation, and (e) demand side management including conservation and load management. According to in the Company's application to the Connecticut Siting Council, none of these alternatives, either alone or in combinations, were deemed to be superior to the new substation at Trumbull.

After review, we believe that the Company's assessment of these alternatives is reasonably accurate and appropriate. This means, in our view, that the proposed substation is a reasonable approach to reversing the decline in local area reliability. Moreover, in the absence of any proposed alternatives, it appears to be the only realistic way forward.

We believe that the Company's proposed solution comports favorably with the Preferential Criteria. As we stated previously, the two most important aspects of the Preferential Criteria that are applicable to the proposed project are need and reliability. We concur with the Company's assessment that there is a need to address reliability in the Trumbull area, and that the proposed substation will address that need. We note that the proposed substation will capitalize on the use of existing infrastructure, as the Company already owns the land and no new ROW will be required. It provides a long term solution, as substations have a service life well in excess of 40 years and the load relief provided appears to extend out to 2015 or beyond.

V. Conclusion

Based upon the data received from UI and our analysis of it, we conclude that the Company has made a compelling case that the proposed new substation conforms to the most relevant of the

Preferential Criteria for this project which is enhanced reliability. Additionally, our analysis, the depth and scope of which was tailored to the proposed project and influenced by the absence of alternatives, does not reveal that there are elements that cause material concerns relative to the other Preferential Criteria. Consequently, the CEAB views the proposal Trumbull Substation favorably.

Attachment A

Questions Submitted to United Illuminating and the Response

July 28, 2006

CEAB
Attn: Gretchen Deans
c/o CERC
805 Brook Street, Bldg. 4
Rocky Hill, CT 06067

Re: **United Illuminating – Proposed Trumbull Substation Questions from the Connecticut Energy Advisory Board**

Dear Ms. Deans:

Enclosed is a copy of The United Illuminating Company's responses to Interrogatories CEAB 1 – CEAB 13 in the above docket. Enclosed are three (3) copies and a CD-ROM.

Sincerely,

Charles Eves
Director Strategic
Planning – Electric System

Enclosure

Interrogatory CEAB-1

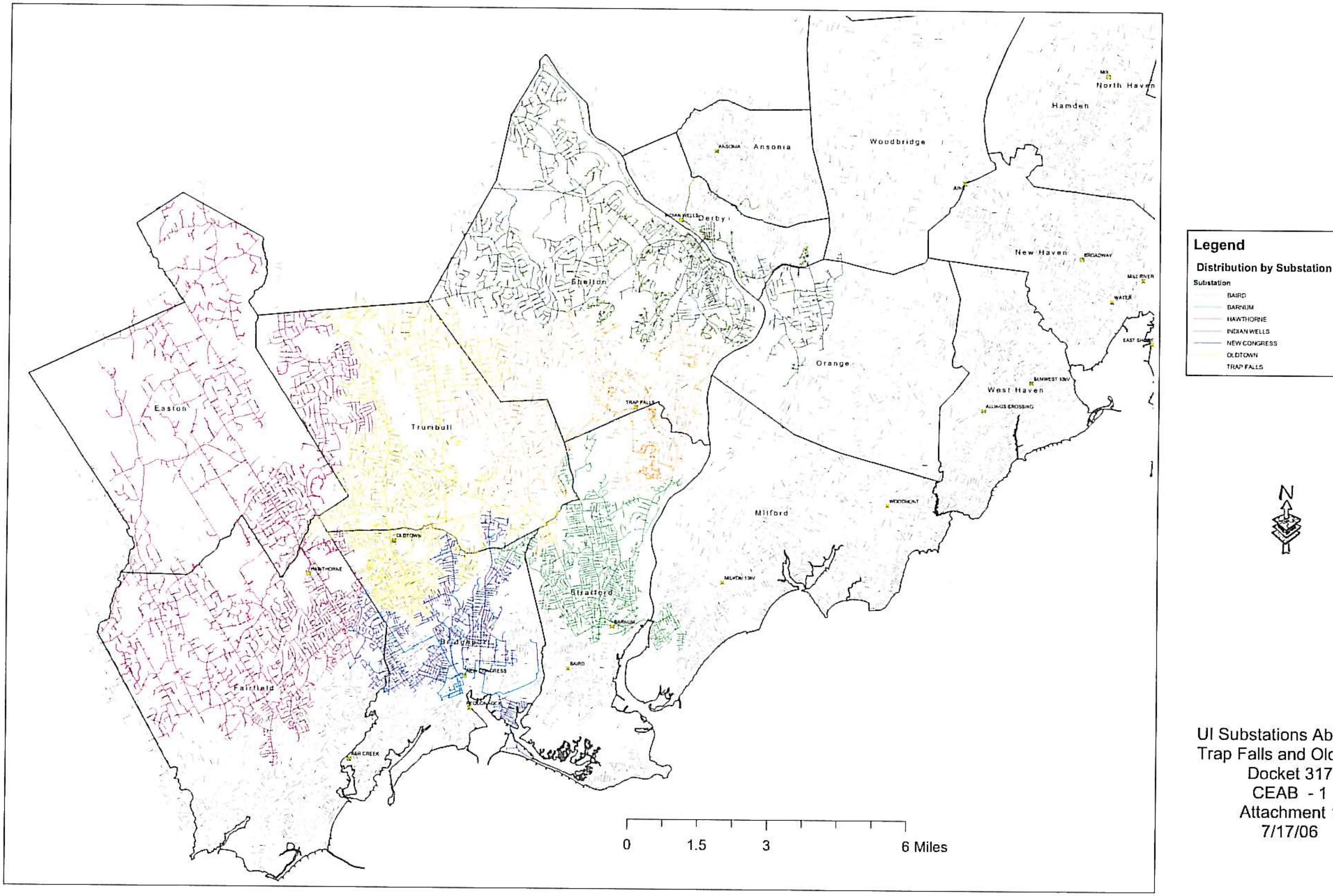
The United Illuminating Company
CSC Docket 317

Witness: Charles Eves

Q-CEAB-1: Please provide a list of all existing substations that serve areas that abut the area served by the Old Town and Trap Falls substations. For each substation listed above, please provide a street map showing the area served, the number and size of transformers located there, the MVA rating of the station, and the 2005 actual load in MVA. Also provide a graph similar to figure 4 and 5 on page 7 of Volume I.

A-CEAB-1: A map illustrating the areas served by substations adjacent to Trap Falls and Old Town have been included as Attachment 1

Each of UI's bulk substations is equipped with 2 transformers, the rating supplied is the firm rating of one transformer. Graphs of the abutting substation actual loads, forecasts and ratings are included as Attachment 2.



UI Substations Abbutting
Trap Falls and Old Town
Docket 317
CEAB - 1
Attachment 1
7/17/06

BULK SUBSTATION NEPOOL COINCIDENT PEAK MVA GROWTH (2006-2016) For 5 Year Plan (2006-08 Identified Loads)

Revised 03/24/06

Chart Source Data

INDIAN WELL

Year	MVA	Rating
2001	58.51	73.80
2002	61.96	73.80
2003	59.82	73.80
2004	56.68	73.80
2005	64.16	73.80
2006	67.09	73.80
2007	70.77	73.80
2008	74.36	73.80
2009	75.10	73.80
2010	75.85	73.80

BARNUM

Year	MVA	Rating
2001	48.40	54.10
2002	46.30	54.10
2003	43.56	54.10
2004	40.42	54.10
2005	48.62	54.10
2006	49.05	54.10
2007	49.90	54.10
2008	50.39	54.10
2009	50.89	54.10
2010	51.40	54.10

CONGRESS I

Year	MVA	Rating
2001	64.98	96.00
2002	65.74	96.00
2003	63.52	96.00
2004	60.29	96.00
2005	67.74	96.00
2006	69.58	96.00
2007	73.76	96.00
2008	78.76	96.00
2009	79.55	96.00
2010	80.35	96.00

HAWTHORNE

Year	MVA	Rating
2001	65.50	96.00
2002	68.77	96.00
2003	64.98	96.00
2004	58.57	96.00
2005	67.25	96.00
2006	68.90	96.00
2007	69.61	96.00
2008	70.55	96.00
2009	71.26	96.00
2010	71.97	96.00

TRUMBULL

Year	MVA	Rating
2001		
2002		
2003		
2004		
2005		
2006		
2007		
2008	32.65	58.00
2009	32.98	58.00
2010	36.21	58.00

CONGRESS II

Year	MVA	Rating
2001	23.86	48.00
2002	23.29	48.00
2003	24.87	48.00
2004	22.58	48.00
2005	23.97	48.00
2006	24.44	48.00
2007	26.33	48.00
2008	30.77	48.00
2009	31.07	48.00
2010	31.38	48.00

Load growth figures are identified load increases for 2006, 2007, and 2008 only.
Load growth beyond 2008 is 1.0% per year, per the "System Peak Load Forecast", taken from the UI CSC Report, 3/31/06, for extreme weather.

Trumbull Sub initial load = 18.2 MVA (Old Town Fdr 2620, 2627) + 17.2 MVA (Trap Falls Fdr 3545, 3547) x 1.085 Load Growth x 0.85 Diversity = 32.65 MVA

Interrogatory CEAB-2

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves
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Q-CEAB-2: Regarding figure 4 on page 7 of Volume I, please explain the reduction in load at the Old Town substation from 84.05 MVA in 2002 to 78.69 MVA in 2003 to 74.08 MVA in 2004, and the increase to 83.31 MVA in 2005.

A-CEAB-2: The load at Old Town Substation decreased 5.36 MVA, from 84.05 MVA in 2002 to 78.69 MVA in 2003, for two reasons. First, there was a load transfer of 1.75 MVA from Old Town Substation to Congress Street I Substation. The remaining reduction of 3.61 MVA was due to the less extreme weather during the summer of 2003 than in 2002. Also, this load reduction was only offset by approximately 0.2 MVA of expected new customer load additions from the 2002 peak to the 2003 peak.

The load at Old Town Substation went down 4.66 MVA, from 78.69 MVA in 2003 to 74.08 MVA in 2004, due to the cooler, less humid weather during the summer of 2004 than in 2003. This reduction occurred in spite of approximately 1.9 MVA of expected new customer load additions from the 2003 peak to the 2004 peak.

The load at Old Town Substation went up 9.23 MVA, from 74.08 MVA in 2004 to 83.31 MVA in 2005, due to both the more extreme weather during the summer of 2005 as compared to the weather in 2004, as well as approximately 3.12 MVA of expected new customer load additions from the 2004 peak to the 2005 peak. This load increase occurred in spite of two load transfers from Old Town Substation, a 1.01 MVA to Hawthorne Substation, and a 1.23 MVA transfer to Congress Street II Substation, during the year.

Interrogatory CEAB-3

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves
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Q-CEAB-3- Regarding figure 4 on page 7 of Volume I, load increases at Old Town to 87.68 MVA in 2010 from 83.31 MVA in 2005, for a compound annual growth rate of approximately 1.0%. Please explain the basis for the forecasted load growth.

A-CEAB-3 The basis of the forecast substation load is the actual metered substation coincident peak load of 83.31 MVA in 2005. Known estimated new customer load increases are then added to this value to arrive at the forecast.

New customer increases have been identified from various internal company sources, including the UI's "Economic Development Quarterly Major Forecast", Customer Engineers, and Key Account Managers. These identified load increases, when used in the forecast, have been adjusted to account for their probability of being energized as proposed, as well as their load coincidence. Identified customer load increases are only included for the first three years of the forecast due to uncertainty in subsequent years.

For Old Town Substation these totals are 0.52 MVA, 1.28 MVA, and 0.85 MVA for 2006, 2007, and 2008 respectively. For the years 2009 and 2010 a load growth figure of 1% is used. This is the UI "System Peak Load Forecast" taken from the UI Forecast Report to the Siting Council dated 3/15/06, for extreme weather conditions.

<u>Interrogatory CEAB-4</u>

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves
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Q-CEAB-4- Regarding figure 5 on page 7 of Volume I, load increases at Trap Falls to 93.48 MVA in 2010 from 77.30 MVA in 2005, for a compound annual growth rate of approximately 3.8%. Please explain the basis for the forecasted load growth.

A-CEAB-4 The basis of the forecast substation load is the actual metered substation coincident peak load of 77.3 MVA in 2005. Known estimated new customer load increases are then added to this value to arrive at the forecast.

New customer increases have been identified from various internal company sources, including the UI's "Economic Development Quarterly Major Forecast", Customer Engineers, and Key Account Managers. These identified load increases, when used in the forecast, have been adjusted to account for their probability of being energized as proposed, as well as their load coincidence. Identified customer load increases are only included for the first three years of the forecast due to uncertainty in subsequent years. For Trap Falls Substation these totals are 1.03 MVA, 6.50 MVA, and 4.88 MVA for 2006, 2007, and 2008 respectively. For the years 2009 and 2010 a general load growth figure of 1% is used. This is the UI "System Peak Load Forecast" taken from the UI CSC Report of 3/31/06, for extreme weather conditions.

In addition to this general load growth there are major identified new customer load increases in the Constitution Blvd/Waterview Dr. area that have been included for this 2009-2010 period.

<u>Interrogatory CEAB-5</u>

Q-CEAB-5: Regarding page 9 of Volume I, it states that the new Trumbull Substation will be designed with sufficient short circuit margin to enable it to accept the additional short circuit current contributions from customer owned generation. Does this refer to existing or potentially future customer owned generation? Please discuss how much additional customer-owned generation can be accommodated with the installation of this new substation, and where it can be located.

A-CEAB-5: There is currently no distributed generation operating in parallel on the feeders proposed to be fed from Trumbull Substation

The exact amount of generation that could be connected to the substation cannot be determined by the margin of fault current alone. Size, type (synchronous machine, induction machine or inverter based) and location of DG on the distribution system will determine the feasibility of DG interconnection to the electric system. Special studies may be required even when the fault current limits are not exceeded. UI screens all proposed generator installations for conflicts with voltage regulation, harmonic contribution and the impact on over-current protection by performing specific studies, based on criteria identified in UI's Interconnection Guidelines for Distributed Generation.

There are two types of fault current ratings for electric system equipment that must be considered when introducing DG to the electric system.

- Momentary rating
- Interrupting rating

When a fault occurs on the electric system the resulting fault current consists of a steady state component and a decaying exponential component. This decaying exponential component typically decays from thousands of amps to several hundred amps in a matter of cycles depending on the reactance of the electric system. This decaying component is superimposed on the steady state fault current to produce a decaying sinusoidal waveform that represents the fault current the device must withstand or interrupt.

The momentary rating represents the ability of the device to withstand the mechanical forces inherent in both the steady state and exponential fault current at the moment the fault occurs.

The interrupting rating represents the amount of fault current that the device can safely interrupt. Typically the breakers will interrupt the fault current 5 to 7 cycles after the initiation of the fault, by this time the majority of the exponential component of the fault current has decayed.

In the past UI has operated it's substations with the bus ties closed, thereby paralleling two transformers and reducing the apparent system impedance as seen at the 13.8 kV bus. This results in fault currents that are relatively close to the rating of UI's switchgear and limits the amount of generation that the system can safely support.

Trumbull substation will be designed with two 24/32/40MVA, 12%, X/R=45 transformers and will operate with the bus ties normally open. On rare occasions, however, certain operating conditions will require the bus ties to be closed and will result in the transformers being paralleled. The feeder protection schemes will be designed with a fault limiting scheme to open the bus ties instantaneously, prior to the feeder breakers opening. Therefore the limiting rating to use in assessing the amount of generation that can be safely added is the momentary interrupting rating of the switchgear.

Paralleled Transformers (Occasional Configuration)
Momentary Duty: 76% or 22,937 amps
Breaker Momentary Rating – 30,000 Amps
Breaker Interrupting Duty: 88% or 16,416 amps
Breaker Breaker Interrupting Rating: 18,750 amps

Split Bus (Normal Configuration)
Breaker Duty: 46% or 8,644 amps
Breaker Rating: 18,750 amps

This analysis indicates that the proposed design of Trumbull Substation could accommodate an additional 7,063amps of momentary fault current or an additional 10,106 amps of interrupting fault current from distributed generation. The amount of DG that could be installed and remain under these constraints would depend on the types of generators installed and their fault current contributions. These contributions would be governed by the type of generator, the impedance of the interconnection and the system impedance between the substation and the generator location.

<u>Interrogatory CEAB-6</u>

The United Illuminating Company CSC Docket 317	Witness: Charles Eves Page 1 of 1

Q-CEAB-6: Regarding page 21 of Volume I, does the cost estimate include any work to re-configure the distribution system to accommodate the new substation?

A-CEAB-6: The cost estimate includes the engineering, materials and construction to reconnect two distribution feeders from Trap Falls Substation and two distribution feeders from Old Town Substation to the new substation.

Interrogatory CEAB-7

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves
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Q-CEAB-7 Regarding page 26 of Volume I, please provide a copy of UI's Economic Development Quarterly Major Forecast that served as the basis for the load forecast.

A-CEAB-7 A copy of the report dated 3/10/06 is attached. Note that customer account numbers and names have been protected.

Town	Sub	Circuit	Description	Size (sq.ft.)	Probability (1)	Time Period (3)	Fraction of Year	kWh/Sq Ft/Yr	kWh	kW	Contact	New construction (NC) or existing vacant (EV)
ANSONIA	ANS	3677	Commercial	10,000	25%	1Q-2006	1	4.42	44,200	100	CEH	EV
ANSONIA	ANS	3677	Commercial	10,200	25%	4Q-2006	0.25	0.22	2,276	153	CEH	EV
ANSONIA	ANS	3671	Commercial	36,000	50%	3Q-2006	0.5	1.11	39,780	360	CEH	NC
ANSONIA	ANS	3677	Residential	9,000	25%	1Q-2006	1	2.21	19,890	27	CEH	EV
ANSONIA	ANS	3677	Commercial	21,000	25%	4Q-2006	0.25	0.22	4,686	84	CEH	NC
ANSONIA	ANS	3677	Commercial	91,000	100%	1Q-2006	1	8.32	757,120	1,365	CEH	NC
ANSONIA	ANS	3671	Commercial	10,000	50%	3Q-2006	0.5	4.42	44,200	100	CEH	NC
ANSONIA	ANS	3677	Commercial	28,800	25%	2Q-2006	0.75	0.67	19,278	115	CEH	NC
ANSONIA	ANS	3679	Residential	66,000	25%	4Q-2006	0.25	0.22	14,726	264	CEH	NC
ANSONIA	ANS		Commercial	100,000	25%	4Q-2006	0.25	0.55	55,250	1,500	CEH	EV
ANSONIA	ANS	3676	Commercial	50,000	25%	4Q-2006	0.25	3.67	183,500	1,500	CEH	EV
BRIDGEPORT	CONG I	2539	Commercial	250,000	25%	4Q-2006	0.25	0.52	130,000	2,500	PST	NC
BRIDGEPORT	CONG II	530	Commercial	60,000	25%	1Q-2006	1	1.56	93,557	900	PST	NC
BRIDGEPORT	PEQ		Commercial	40,000	75%	4Q-2006	0.25	2.75	110,100	400	PST	NC
BRIDGEPORT	PEQ	2516	Commercial	80,000	75%	2Q-2006	0.75	1.56	124,800	1,200	PST	EV
BRIDGEPORT	CONG I	2539	Commercial	89,000	25%	4Q-2006	0.25	0.55	49,173	890	PST	NC
BRIDGEPORT	ASH	2674	Commercial	58,000	100%	4Q-2006	0.25	7.8	452,255	2,204	PST	NC
BRIDGEPORT	BAIRD	2641	Commercial	10,000	25%	4Q-2006	0.25	1.56	15,600	100	PST	NC
BRIDGEPORT	CONG II	550	Commercial	15,000	75%	2Q-2006	0.75	4.97	74,588	150	PST	NC
BRIDGEPORT	BAIRD	2632	Commercial	100,000	50%	4Q-2006	0.25	1.84	183,500	500	PST	NC
BRIDGEPORT	PEQ	2516	Commercial	61,000	25%	4Q-2006	0.25	0.55	33,703	610	PST	NC
BRIDGEPORT	PEQ	2515	Commercial	149,000	25%	4Q-2006	0.25	0.55	82,323	1,490	PST	NC
BRIDGEPORT	PEQ		Commercial	8,000	50%	4Q-2006	0.25	1.11	8,840	120	PST	EV
BRIDGEPORT	BAIRD	2632	Commercial	12,000	50%	3Q-2006	0.5	2.21	26,520	360	PST	EV
BRIDGEPORT	BAIRD	2632	Commercial	12,000	50%	2Q-2006	0.75	1.84	22,020	300	PST	EV
BRIDGEPORT	CONG I	2547	Commercial	60,000	100%	2Q-2006	0.75	11.01	660,600	900	PST	NC
BRIDGEPORT	ASH	2675	Commercial	78,750	50%	4Q-2006	0.25	0.45	35,142	2,363	PST	NC
BRIDGEPORT	CONG I	590	Commercial	31,500	25%	4Q-2006	0.25	0.22	7,028	126	PST	EV
BRIDGEPORT	CONG I	2542	Commercial	15,000	75%	2Q-2006	0.75	14.62	219,291	10	PST	NC
BRIDGEPORT	HAWTH	2685	Commercial	10,000	75%	3Q-2006	0.5	1.34	13,388	150	PST	NC
BRIDGEPORT	PEQ		Commercial	140,000	25%	2Q-2006	0.75	0.89	124,950	1,400	PST	EV
BRIDGEPORT	ASH	2675	Commercial	73,500	25%	4Q-2006	0.25	0.22	16,415	221	PST	NC
BRIDGEPORT	ASH	2675	Commercial	65,000	25%	2Q-2006	0.75	0.22	14,503	195	PST	EV
BRIDGEPORT	CONG II	551	Commercial	16,000	25%	2Q-2006	0.75	0.64	10,170	48	PST	NC
BRIDGEPORT	CONG I	2545	Commercial	40,000	75%	3Q-2006	0.5	9.75	389,850	1,200	PST	EV
DERBY	INDW	503	Commercial	5,000	100%	1Q-2006	1	11.65	58,238	125	CEH	EV
DERBY	INDW	505	Commercial	19,800	25%	1Q-2006	1	0.89	17,672	79	CEH	EV
EAST HAVEN	ESHOR	1707	Commercial	276,000	50%	4Q-2006	0.25	1.84	506,460	2,760	PST	NC
EAST HAVEN	QUIN	1546	Commercial	39,000	25%	2Q-2006	0.75	0.67	26,106	117	PST	NC
EAST HAVEN	QUIN	1546	Commercial	30,000	50%	1Q-2006	1	1.79	53,550	90	PST	NC
EAST HAVEN	ESHORE	1707	Commercial	56,100	25%	1Q-2006	1	0.89	50,069	168	PST	NC
FAIRFIELD	ASH	2662	Commercial	100,000	50%	2Q-2006	0.75	5.82	582,375	2,500	PST	NC
FAIRFIELD	ASH	2660	Residential	100,000	100%	1Q-2006	1	3.57	357,000	400	PST	NC
FAIRFIELD	ASH	2660	Commercial	220,000	100%	1Q-2006	1	0.89	196,350	880	PST	NC
FAIRFIELD	ASH	2673	Commercial	160,000	15%	4Q-2006	0.25	0.33	53,040	1,600	PST	NC
FAIRFIELD	ASH		Commercial	10,000	10%	2Q-2006	0.75	0.62	6,240	300	PST	NC
FAIRFIELD	HAWTH	2689	Commercial	15,000	75%	1Q-2006	1	6.63	99,450	150	PST	NC
FAIRFIELD	ASH		Commercial	5,500	50%	2Q-2006	0.75	3.32	18,233	138	PST	EV
FAIRFIELD	ASH	2670	Commercial	6,500	75%	2Q-2006	0.75	4.68	30,420	65	PST	EV
FAIRFIELD	HAWTH	2683	Commercial	50,000	25%	2Q-2006	0.75	1.66	82,875	500	PST	NC
FAIRFIELD	ASH	2668	Commercial	36,000	25%	2Q-2006	0.75	1.56	56,160	360	PST	NC
FAIRFIELD	ASH	2669	Commercial	9,900	75%	1Q-2006	1	6.63	65,637	99	PST	NC
FAIRFIELD	HAWTH	2684	Commercial	110,000	25%	2Q-2006	0.75	0.67	73,631	1,100	PST	NC
FAIRFIELD	ASH		Commercial	20,500	50%	3Q-2006	0.5	0.89	18,296	205	PST	EV
HAMDEN	MIX	1696	Commercial	10,000	10%	1Q-2006	1	2.08	20,800	100	CEH	NC
HAMDEN	MIX		Commercial	50,000	25%	4Q-2006	0.25	0.55	27,625	1,250	CEH	NC
HAMDEN	MIX	1687	Commercial	60,000	25%	2Q-2006	0.75	1.66	99,450	600	CEH	NC
HAMDEN	MIX	1696	Commercial	196,000	100%	3Q-2006	0.5	4.42	866,320	1,960	CEH	NC
HAMDEN	MIX PDS	1694	Commercial	25,600	25%	1Q-2006	1	0.89	22,848	102	CEH	NC
HAMDEN	MIX	1697	Commercial	27,000	10%	2Q-2006	0.75	0.27	7,229	108	CEH	NC
HAMDEN	MIX	1693	Commercial	50,000	25%	2Q-2006	0.75	1.66	82,875	500	CEH	NC
HAMDEN	MIX	1684	Commercial	15,000	75%	1Q-2006	1	6.24	93,600	225	CEH	NC
HAMDEN	MIX	1688	Commercial	43,000	50%	3Q-2006	0.5	2.08	89,440	430	CEH	EV
HAMDEN	SACK	1642	Commercial	12,000	25%	1Q-2006	1	3.67	44,040	600	CEH	EV
HAMDEN	MIX	1687	Commercial	10,000	25%	1Q-2006	1	2.08	20,800	150	CEH	NC

Town	Sub	Circuit	Description	Size (sq.ft.)	Probability (1)	Time Period (3)	Fraction of Year	kWh/Sq Ft/Yr	kWh	kW	Contact	New construction (NC) or existing vacant (EV)
HAMDEN	MIX	1685	Commercial	20,000	25%	1Q-2006	1	2.08	41,600	300	CEH	NC
HAMDEN	BRODWAY	1908	Commercial	12,000	100%	1Q-2006	1	6.63	79,560	120	CEH	NC
HAMDEN	BRODWAY	1908	Commercial	13,000	50%	1Q-2006	1	9.75	126,685	390	CEH	EV
HAMDEN	MIX PDS	1694	Commercial	280,600	50%	4Q-2006	0.25	0.45	125,218	842	CEH	NC
HAMDEN	MIX PDS	1694	Commercial	25,000	25%	1Q-2006	1	2.08	52,000	375	CEH	EV
HAMDEN	MIX	1687	Commercial	77,000	50%	1Q-2006	1	4.16	320,320	2,926	CEH	NC
HAMDEN	MIX	1688	Commercial	10,000	50%	1Q-2006	1	4.16	41,600	150	CEH	NC
HAMDEN	MIX	1689	Commercial	80,000	100%	1Q-2006	1	8.84	707,200	2,000	CEH	NC
HAMDEN	MIX	1696	Commercial	11,000	100%	2Q-2006	0.75	2.68	29,453	44	CEH	NC
HAMDEN	MIX		Commercial	35,200	100%	2Q-2006	0.75	2.68	94,248	141	CEH	NC
HAMDEN	SACK	1642	Commercial	33,000	100%	2Q-2006	0.75	2.68	88,358	132	CEH	NC
HAMDEN	MIX	1691	Commercial	20,000	50%	3Q-2006	0.5	15.6	311,900	760	CEH	EV
MILFORD	MILVN	3641	Commercial	19,200	25%	1Q-2006	1	0.89	17,136	77	CEH	NC
MILFORD	WOOD	3651	Commercial	25,000	50%	1Q-2006	1	6.63	165,750	250	CEH	NC
MILFORD	WOOD	3658	Commercial	391,000	0%	2Q-2006	0.75	1.56	609,960	5,865	CEH	NC
MILFORD	WOOD	3651	Commercial	10,000	25%	2Q-2006	0.75	1.66	16,575	100	CEH	EV
MILFORD	MILVN	3633	Commercial	10,000	25%	4Q-2006	0.25	0.55	5,525	100	CEH	NC
MILFORD	WOOD	3652	Commercial	0	25%	4Q-2006	0.25	0	0	0	CEH	NC
MILFORD	MILVN	3631	Commercial	6,000	25%	1Q-2006	1	2.08	12,480	90	CEH	EV
MILFORD	MILVN	3633	Commercial	51,000	25%	4Q-2006	0.25	0.22	11,379	204	CEH	NC
MILFORD	WOOD	3654	Commercial	17,520	25%	1Q-2006	1	2.21	38,719	175	CEH	EV
MILFORD	MILVN	3638	Commercial	108,000	25%	1Q-2006	1	0.89	96,390	432	CEH	NC
MILFORD	MILVN	3642	Commercial	7,200	25%	1Q-2006	1	0.89	6,426	29	CEH	NC
MILFORD	MILVN	3648	Commercial	21,000	25%	4Q-2006	0.25	0.22	4,686	84	CEH	NC
MILFORD	MILVN	3633	Commercial	23,100	25%	1Q-2006	1	0.89	20,617	92	CEH	EV
MILFORD	WOOD	3657	Commercial	10,000	50%	4Q-2006	0.25	2.08	20,800	150	CEH	NC
MILFORD	WOOD	3656	Commercial	66,000	100%	2Q-2006	0.75	6.24	411,840	990	CEH	NC
MILFORD	WOOD	3656	Commercial	109,000	100%	2Q-2006	0.75	6.24	680,160	1,635	CEH	NC
MILFORD	WOOD	3651	Residential	11,000	50%	1Q-2006	1	1.79	19,635	44	CEH	NC
MILFORD	MILVN	3642	Commercial	15,580	100%	3Q-2006	0.5	4.42	68,864	156	CEH	NC
MILFORD	MILVN	3636	Residential	40,000	25%	4Q-2006	0.25	0.89	35,700	160	CEH	NC
MILFORD	MILVN	3631	Commercial	0	0%	4Q-2006	0.25	0	0	0	CEH	EV
MILFORD	WOOD	3661	Commercial	20,000	100%	4Q-2006	0.25	2.08	41,600	300	CEH	EV
MILFORD	WOOD	3651	Commercial	68,000	100%	4Q-2006	0.25	2.21	150,280	1,700	CEH	NC
MILFORD	WOOD	3657	Commercial	5,000	50%	4Q-2006	0.25	2.21	11,050	50	CEH	NC
NEW HAVEN	WATER	1532	Commercial	22,000	100%	3Q-2006	0.5	4.42	97,240	220	PST	NC
NEW HAVEN	BRDWY	1906	Commercial	112,000	75%	4Q-2006	0.25	1.66	185,640	1,120	PST	NC
NEW HAVEN	MILRV I	1852	Commercial	28,000	75%	3Q-2006	0.5	3.32	92,820	84	PST	NC
NEW HAVEN	BRDWY	1902	Commercial	60,000	50%	2Q-2006	0.75	3.32	198,900	600	PST	NC
NEW HAVEN	ESHOR	1705	Commercial	47,000	100%	4Q-2006	0.25	1.97	92,820	474	PST	NC
NEW HAVEN	WATER	1532	Commercial	84,000	75%	3Q-2006	0.5	3.32	278,460	840	PST	NC
NEW HAVEN	MILRV II	1890	Commercial	94,000	50%	3Q-2006	0.5	0.89	83,895	282	PST	NC
NEW HAVEN	WATER	1526	Commercial	35,000	25%	3Q-2006	0.5	1.11	38,675	350	PST	NC
NEW HAVEN	MILRV II	1883	Commercial	65,000	10%	3Q-2006	0.5	0.42	27,040	1,625	PST	NC
NEW HAVEN	MILRV II	1883	Commercial	54,000	10%	4Q-2006	0.25	0.21	11,232	810	PST	NC
NEW HAVEN	MILRV II	1883	Commercial	98,000	10%	4Q-2006	0.25	0.19	18,743	294	PST	NC
NEW HAVEN	WATER	1526	Commercial	35	25%	3Q-2006	0.5	1105	38,675	350	PST	NC
NEW HAVEN	MILRV II	1886	Commercial	40,000	25%	1Q-2006	1	2.21	88,400	400	PST	NC
NEW HAVEN	MILRV I	1857	Commercial	275,000	25%	3Q-2006	0.5	1.04	286,000	2,750	PST	NC
NEW HAVEN	MILRV II	1884	Commercial	30,000	25%	2Q-2006	0.75	1.66	49,725	300	PST	NC
NEW HAVEN	MILRV I	1860	Commercial	70,000	100%	1Q-2006	1	13	909,650	2,100	PST	EV
NEW HAVEN	ESHORE	1705	Commercial	10,000	50%	2Q-2006	0.75	3.32	33,150	1	PST	EV
NEW HAVEN	JUNE	1607	Commercial	12,000	25%	4Q-2006	0.25	0.22	2,678	36	PST	EV
NEW HAVEN	WATER	1526	Commercial	11,200	75%	2Q-2006	0.75	4.97	55,692	112	PST	NC
NEW HAVEN	BRDWY	1904	Commercial	180,000	75%	4Q-2006	0.25	1.56	280,800	5,400	PST	NC
NO BRANFORD	QUIN	1545	Commercial	28,000	25%	1Q-2006	1	2.21	61,880	280	PST	NC
NO. HAVEN	NHAVN	1750	Commercial	2,000,000	10%	4Q-2006	0.25	0.22	442,000	20,000	PST	EV
NORTH BRANFORD	QUIN	1548	Commercial	8,000	75%	3Q-2006	0.5	5.51	44,040	7	PST	NC
NORTH HAVEN	SACK	1645	Residential	95,665	50%	4Q-2006	0.25	0.45	42,691	287	PST	NC
ORANGE	ALNGS	1433	Commercial	50,000	50%	4Q-2006	0.25	1.11	55,250	500	CEH	NC
ORANGE	WOOD	3650	Commercial	100,000	100%	1Q-2006	1	8.84	884,000	2,500	CEH	EV
ORANGE	INDW	504	Commercial	52,800	25%	2Q-2006	0.75	0.67	35,343	211	CEH	NC
ORANGE	WOOD	3650	Commercial	80,000	25%	2Q-2006	0.75	2.91	232,950	1,600	CEH	NC
ORANGE	ALNGS	1440	Commercial	46,000	100%	1Q-2006	1	25.99	1,195,540	1,380	CEH	NC
ORANGE	ALNGS	1440	Commercial	16,300	100%	2Q-2006	0.75	11.65	189,854	408	CEH	EV
ORANGE	ALNGS	1440	Commercial	57,000	100%	2Q-2006	0.75	6.63	377,910	570	CEH	NC
ORANGE	ALNGS	1440	Commercial	50,000	25%	2Q-2006	0.75	0.67	33,469	200	CEH	NC

Town	Sub	Circuit	Description	Size (sq.ft.)	Probability (1)	Time Period (3)	Fraction of Year	kWh/Sq Ft/Yr	kWh	kW	Contact	New construction (NC) or existing vacant (EV)
SHELTON	INDW	500	Residential	21,000	25%	2Q-2006	0.75	0.67	14,057	84	CEH	NC
SHELTON	TRAP	3542	Commercial	100,000	25%	1Q-2006	1	0.89	89,250	400	CEH	NC
SHELTON	INDW	510	Residential	120,000	100%	4Q-2006	0.25	0.89	107,100	480	CEH	EV
SHELTON	TRAP	3548	Commercial	200,000	25%	4Q-2006	0.25	0.04	7,856	800	CEH	NC
SHELTON	TRAP	3548	Commercial	35,212	25%	4Q-2006	0.25	5.91	208,000	528	CEH	NC
SHELTON	INDW	503	Commercial	16,000	25%	2Q-2006	0.75	0.67	10,710	64	CEH	NC
SHELTON	OLDTN	2621	Commercial	10,000	25%	4Q-2006	0.25	0.55	5,525	100	CEH	NC
SHELTON	INDW	506	Commercial	48,000	25%	2Q-2006	0.75	0.67	32,130	192	CEH	NC
SHELTON	INDW	503	Commercial	160,000	25%	3Q-2006	0.5	1.11	176,800	1,600	CEH	EV
SHELTON	INDW	512	Commercial	60,000	25%	3Q-2006	0.5	0.45	26,775	240	CEH	NC
SHELTON	TRAP	3540	Commercial	31,000	100%	1Q-2006	1	8.32	257,920	465	CEH	EV
SHELTON	INDW	516	Commercial	25,000	50%	4Q-2006	0.25	6.5	162,438	750	CEH	NC
SHELTON	TRAP	3540	Commercial	9,300	50%	1Q-2006	1	4.16	38,688	140	CEH	NC
SHELTON	TRAP	3543	Commercial	270,000	50%	1Q-2006	1	1.79	481,950	1,080	CEH	NC
SHELTON	TRAP	3540	Commercial	14,000	25%	2Q-2006	0.75	1.56	21,840	140	CEH	NC
SHELTON	TRAP	3548	Commercial	14,788	100%	4Q-2006	0.25	2.08	30,759	222	CEH	NC
SHELTON	INDW	516	Commercial	42,152	25%	1Q-2006	1	2.21	93,156	422	CEH	EV
SHELTON	INDW	516	Commercial	100,000	25%	4Q-2006	0.25	2.21	221,000	1,000	CEH	NC
SHELTON	TRAP	3546	Commercial	19,505	50%	1Q-2006	1	14.68	286,333	585	CEH	EV
SHELTON	TRAP	3551	Commercial	175,000	50%	4Q-2006	0.25	0.89	156,188	700	CEH	NC
SHELTON	TRAP	3551	Commercial	17,000	25%	4Q-2006	0.25	0.89	15,173	68	CEH	NC
SHELTON	TRAP		Commercial	18,000	100%	3Q-2006	0.5	4.16	74,880	270	CEH	NC
STRATFORD	TRAP	3543	Commercial	35,200	25%	4Q-2006	0.25	0.22	7,854	106	PST	NC
STRATFORD	OLDTN	2620	Commercial	10,000	50%	0Q-2006	1.25	5.53	55,250	150	PST	EV
STRATFORD	OLDTN	2620	Commercial	20,000	50%	0Q-2006	1.25	5.53	110,500	300	PST	EV
STRATFORD	OLDTN	2620	Commercial	88,000	50%	0Q-2006	1.25	4.16	366,080	1,320	PST	EV
STRATFORD	BAIRD	2630	Industrial	30,000	75%	2Q-2006	0.75	4.97	149,175	750	PST	EV
STRATFORD	TRAP	3543	Commercial	13,500	25%	4Q-2006	0.25	0.22	3,012	41	PST	NC
STRATFORD	TRAP	3543	Commercial	88,000	50%	4Q-2006	0.25	0.45	39,270	264	PST	NC
TRUMBULL	OLDTN		Commercial	20,000	75%	4Q-2006	0.25	0.67	13,388	60	PST	NC
TRUMBULL	OLDTN	2624	Commercial	24,000	50%	4Q-2006	0.25	1.11	26,520	240	PST	NC
TRUMBULL	OLDTN	2617	Commercial	100,800	25%	3Q-2006	0.5	0.45	44,982	302	PST	NC
TRUMBULL	OLDTN	2624	Commercial	24,000	50%	2Q-2006	0.75	3.32	79,560	240	PST	NC
TRUMBULL	OLDTN	2617	Commercial	10,000	75%	4Q-2006	0.25	1.66	16,575	100	PST	EV
WEST HAVEN	ELMWT	627	Commercial	1,000,000	25%	4Q-2006	0.25	0.55	552,500	10,000	CEH	NC
WEST HAVEN	ELMWT	646	Commercial	36,000	100%	4Q-2006	0.25	0.89	32,130	144	CEH	NC
WEST HAVEN	ELMWT	644	Commercial	71,000	100%	4Q-2006	0.25	7.8	553,623	2,698	CEH	NC
WEST HAVEN	ELMWT	625	Commercial	33,000	10%	3Q-2006	0.5	0.42	13,728	495	CEH	NC
WEST HAVEN	ALNGS	1431	Commercial	142,000	75%	4Q-2006	0.25	2.08	295,360	2,130	CEH	NC
WEST HAVEN	ELMWT	631	Commercial	25,000	25%	1Q-2006	1	0.89	22,313	75	CEH	EV
WEST HAVEN	ELMWT	631	Commercial	10,000	25%	1Q-2006	1	2.21	22,100	100	CEH	EV
WEST HAVEN	ELMWT	625	Commercial	15,000	25%	3Q-2006	0.5	4.42	66,300	375	CEH	NC
WEST HAVEN	ALNGS	1431	Commercial	80,000	25%	4Q-2006	0.25	0.97	77,650	2,000	CEH	NC
WEST HAVEN	ELMWT	621	Commercial	20,000	50%	1Q-2006	1	1.79	35,700	80	CEH	NC
WEST HAVEN	ELMWT	646	Commercial	25,000	25%	4Q-2006	0.25	0.55	13,813	250	CEH	NC
WEST HAVEN	ELMWT	622	Commercial	84,000	25%	4Q-2006	0.25	0.89	74,970	336	CEH	NC
WOODBRIDGE	JUNE	1608	Commercial	17,000	15%	2Q-2006	0.75	0.38	6,500	68	CEH	NC
WOODBRIDGE	JUNE		Commercial	20,000	25%	4Q-2006	0.25	0.55	11,050	200	CEH	NC
WOODBRIDGE	JUNE	1608	Commercial	80,000	10%	4Q-2006	0.25	0.22	17,850	320	CEH	NC
WOODBRIDGE	JUNE	1608	Commercial	44,000	15%	2Q-2006	0.75	0.4	17,672	132	CEH	NC
Total 2006 forecast									**23,982,880**	**142,124**		
2007												
ANSONIA	ANS	3677	Commercial	127,400	25%	1Q-2007	1	2.08	264,992	1,911	CEH	NC
BRIDGEPORT	CONG I	590	Commercial	75,000	75%	4Q-2007	0.25	8.32	624,000	225	PST	EV
BRIDGEPORT	CONG I	2539	Commercial	70,000	100%	2Q-2007	0.75	0.89	62,475	560	PST	EV
BRIDGEPORT	PEQ		Commercial	1,000	25%	4Q-2007	0.25	0	0	0	PST	NC
BRIDGEPORT	CONG II	550	Commercial	100,250	10%	4Q-2007	0.25	3.67	367,918	3,008	PST	NC
BRIDGEPORT	CONG II		Commercial	500,000	25%	4Q-2007	0.25	0.55	276,250	5,000	PST	NC
BRIDGEPORT	CONG I	590	Commercial	4,850,000	50%	4Q-2007	0.25	1.1	5,356,777	48,500	PST	NC
BRIDGEPORT	CONG I	590	Commercial	188,000	50%	4Q-2007	0.25	0.55	103,870	1,880	PST	EV

Town	Sub	Circuit	Description	Size (sq.ft.)	Probability (1)	Time Period (3)	Fraction of Year	kWh/Sq Ft/Yr	kWh	kW	Contact	New construction (NC) or existing vacant (EV)
BRIDGEPORT	CONG I	590	Commercial	100,800	50%	1Q-2007	1	1.49	149,814	302	PST	EV
BRIDGEPORT	CONG I	590	Commercial	105,000	50%	2Q-2007	0.75	0.74	78,159	315	PST	EV
BRIDGEPORT	CONG I	590	Commercial	150,000	50%	3Q-2007	0.5	1.04	156,000	2,250	PST	EV
BRIDGEPORT	ASH	2674	Commercial	38,000	25%	3Q-2007	0.5	1.79	67,830	152	PST	NC
BRIDGEPORT	CONG I	2545	Commercial	114,956	75%	3Q-2007	0.5	9.75	1,120,390	2,874	PST	NC
DERBY	INDW	505	Commercial	0	25%	4Q-2007	0.25	0	0	0	CEH	NC
DERBY	INDW	505	Commercial	100,000	25%	4Q-2007	0.25	0.45	44,625	1,500	CEH	NC
DERBY	INDW	505	Commercial	30,000	25%	4Q-2007	0.25	1.04	31,200	450	CEH	EV
DERBY	ANS	3674	Commercial	38,000	25%	2Q-2007	0.75	1.66	62,985	950	CEH	EV
FAIRFIELD	ASH	2664	Commercial	270,000	50%	4Q-2007	0.25	1.04	280,800	270	PST	NC
FAIRFIELD	ASH	2664	Commercial	135,000	50%	4Q-2007	0.25	1.04	140,400	1,350	PST	NC
FAIRFIELD	ASH C	2662	Residential	8,400	100%	4Q-2007	0.25	0.89	7,497	34	PST	EV
FAIRFIELD	HAWTH	2684	Commercial	93,000	25%	4Q-2007	0.25	0.55	51,382	930	PST	NC
FAIRFIELD	ASH	2669	Commercial	144,000	25%	2Q-2007	0.75	0	0	0	PST	EV
FAIRFIELD	ASH	2675	Commercial	39,000	100%	2Q-2007	0.75	2.08	81,120	585	PST	NC
HAMDEN	MIX	1687	Commercial	25,500	25%	1Q-2007	1	0.88	22,313	72	CEH	NC
HAMDEN	MIX	1687	Commercial	20,000	25%	1Q-2007	1	2.21	44,200	223	CEH	NC
HAMDEN	MIX	1685	Commercial	50,000	25%	1Q-2007	1	2.21	110,500	1,250	CEH	NC
HAMDEN	MIX	1685	Commercial	577,300	25%	1Q-2007	1	0.89	515,240	2,309	CEH	NC
HAMDEN	MIX	1685	Commercial	235,900	100%	1Q-2007	1	3.31	780,683	1,570	CEH	NC
MILFORD	MILVN	3638	Commercial	100,000	25%	2Q-2007	0.75	0.45	44,625	400	CEH	NC
MILFORD	MILVN	3637	Commercial	48,000	75%	1Q-2007	1	0.86	41,334	144	CEH	NC
MILFORD	MILVN	3637	Commercial	21,000	75%	1Q-2007	1	6.24	131,040	315	CEH	EV
MILFORD	WOOD	3652	Commercial	250,000	25%	1Q-2007	1	8.32	2,080,000	3,750	CEH	EV
MILFORD	MILVN	3638	Commercial	175,000	25%	4Q-2007	0.25	0.55	96,688	1,750	CEH	NC
MILFORD	WOOD	3661	Commercial	99,000	25%	3Q-2007	0.5	0.58	57,200	1,485	CEH	NC
MILFORD	MILVN	3637	Commercial	10,000	25%	2Q-2007	0.75	1.66	16,575	100	CEH	NC
MILFORD	MILVN	3642	Commercial	35,000	100%	4Q-2007	0.25	2.21	77,350	350	CEH	NC
NEW HAVEN	MILRV II	1881	Commercial	19,808	75%	3Q-2007	0.5	3.32	65,664	198	PST	NC
NEW HAVEN	MILRV II	1884	Commercial	105,000	50%	3Q-2007	0.5	2.08	218,400	1,050	PST	NC
NEW HAVEN	MILRV I	810	Commercial	150,000	50%	2Q-2007	0.75	3.32	497,250	1,500	PST	NC
NEW HAVEN	MILRV I	1852	Commercial	10,000	25%	4Q-2007	0.25	0.55	5,525	100	PST	NC
ORANGE	ALNGS	1440	Commercial	150,000	25%	4Q-2007	0.25	1.62	243,656	3,750	CEH	NC
ORANGE	WOOD	3653	Residential	54,000	25%	4Q-2007	0.25	0.22	12,049	216	CEH	NC
ORANGE	ALNGS	1440	Commercial	239,000	25%	4Q-2007	0.25	2.34	559,081	9,082	CEH	NC
SHELTON	INDW	510	Commercial	50,000	25%	1Q-2007	1	6.5	324,875	1,250	CEH	EV
SHELTON	INDW	510	Commercial	40,000	50%	1Q-2007	1	4.16	166,400	600	CEH	NC
SHELTON	TRAP	3548	Commercial	170,000	25%	2Q-2007	0.75	1.66	281,775	1,700	CEH	NC
SHELTON	TRAP	3551	Commercial	150,000	25%	1Q-2007	1	0.37	55,250	1,500	CEH	NC
SHELTON	INDW	516	Commercial	200,000	25%	1Q-2007	1	125.28	25,056,000	5,000	CEH	NC
SHELTON	TRAP	3551	Commercial	155,571	100%	1Q-2007	1	8.84	1,375,248	1,556	CEH	EV
STRATFORD	BARN	2740	Commercial	78,000	50%	1Q-2007	1	1.79	139,230	234	PST	NC
TRUMBULL	OLDTN	2617	Commercial	115,000	25%	4Q-2007	0.25	0	0	0	PST	NC
WEST HAVEN	ELMWT	631	Commercial	100,000	5%	4Q-2007	0.25	0.11	11,050	1,500	CEH	NC
WEST HAVEN	ELMWT	644	Commercial	96,000	25%	4Q-2007	0.25	0.92	88,080	2,400	CEH	NC
WOODBRIDGE	JUNE	1605	Commercial	80,000	25%	1Q-2007	1	2.21	176,800	800	CEH	NC
Total 2007 forecast									**42,622,565**	**119,199**		
2008												
ANSONIA	ANS	3671	Commercial	100,000	25%	4Q-2008	0.25	0.55	55,250	1,000	CEH	NC
ANSONIA	ANS	3671	Commercial	45,000	25%	4Q-2008	0.25	0.55	24,863	675	CEH	NC
BRIDGEPORT	CONG I	2539	Commercial	120,000	50%	4Q-2008	0.25	1.66	198,808	1,200	PST	NC
BRIDGEPORT	CONG I	590	Commercial	235,000	50%	4Q-2008	0.25	0.45	104,869	705	PST	EV
BRIDGEPORT	CONG I	2539	Commercial	80,000	25%	4Q-2008	0.25	0.55	44,200	800	PST	NC
FAIRFIELD	ASH	2664	Commercial	900,000	50%	4Q-2008	0.25	0.69	624,000	6,000	PST	NC
FAIRFIELD	ASH	2664	Commercial	10,000	50%	4Q-2008	0.25	1.04	10,400	150	PST	NC
FAIRFIELD	ASH	2664	Commercial	30,000	100%	4Q-2008	0.25	2.08	62,400	300	PST	NC
NEW HAVEN	JUNE	1603	Commercial	290,000	10%	2Q-2008	0.75	0.18	51,765	120	PST	EV
NEW HAVEN	MILRV I	1852	Commercial	60,000	25%	4Q-2008	0.25	0.52	31,200	600	PST	NC
NEW HAVEN	MILRV II	1884	Commercial	40,000	25%	4Q-2008	0.25	1.11	44,200	400	PST	NC
NEW HAVEN	WATER	1526	Commercial	497,000	25%	4Q-2008	0.25	0.55	274,593	7,455	PST	NC

Town	Sub	Circuit	Description	Size (sq.ft.)	Probability (1)	Time Period (3)	Fraction of Year	kWh/Sq Ft/Yr	kWh	kW	Contact	New construction (NC) or existing vacant (EV)
SHELTON	INDW	516	Commercial	200,000	25%	1Q-2008	1	162	32,400,000	7,000	CEH	NC
SHELTON	INDW	510	Commercial	75,000	25%	4Q-2008	0.25	0.53	39,703	750	CEH	EV
SHELTON	INDW	510	Commercial	100,000	25%	4Q-2008	0.25	0.22	22,312	400	CEH	EV
STRATFORD	OLDTN	2620	Commercial	100,000	25%	4Q-2008	0.25	0.92	91,750	1,500	PST	NC
Total 2008 forecast									**34,080,313**	**29,055**		
2009												
DERBY	INDW	505	Commercial	100,000	25%	4Q-2009	0.25	0.52	52,000	1,500	CEH	NC
DERBY	INDW	505	Commercial	700,000	25%	4Q-2009	0.25	0.21	145,250	2,100	CEH	NC
HAMDEN	SACK	1648	Commercial	250,000	15%	1Q-2009	1	2.2	550,500	6,250	CEH	NC
MILFORD	MILVN	3636	Commercial	25,000	25%	2Q-2009	0.75	1.56	39,000	250	CEH	NC
NEW HAVEN	MILRV I	810	Commercial	358,000	50%	4Q-2009	0.25	0.55	198,071	3,585	PST	EV
NEW HAVEN	MILRV II	1883	Commercial	60,000	25%	3Q-2009	0.5	0.78	46,590	1,200	PST	NC
NEW HAVEN	WATER	1526	Commercial	40,000	10%	4Q-2009	0.25	0.22	8,840	400	PST	NC
NEW HAVEN	WATER	1526	Commercial	360,000	50%	4Q-2009	0.25	0.55	198,900	3,600	PST	NC
SHELTON	INDW	516	Commercial	200,000	25%	1Q-2009	1	162	32,400,000	9,000	CEH	NC
STRATFORD	BARN		Commercial	470,000	25%	4Q-2009	0.25	0.92	431,320	4,700	PST	NC
STRATFORD	BAIRD	2639	Commercial	100,000	25%	4Q-2009	0.25	30.06	3,005,600	1,000	PST	EV
STRATFORD	BAIRD	2639	Commercial	1,100,000	25%	4Q-2009	0.25	1.84	2,018,943	11,000	PST	EV
WOODBRIDGE	JUNE	1602	Commercial	10,000	15%	4Q-2009	0.25	0.13	1,339	30	CEH	NC
Total 2009 forecast									**39,096,353**	**44,615**		
2010												
SHELTON	INDW	516	Commercial	200,000	25%	1Q-2010	1	162	32,400,000	11,000	CEH	NC
Total 2010 forecast									**32,400,000**	**11,000**		
2006-2010 Totals									**172,182,111**	**345,993**		

Town	Substation	Circuit Number	Description	Probability (1)	Time Period (3)	Fraction of Year	kWh lost	contact/source
MILFORD	WOOD	3660	Commercial	100%	4Q-2006	0.25	-65,736	CEH
MILFORD	MILVN	3647	Industrial	50%	4Q-2006	0.25	-3,000,000	CEH
ORANGE	ALNGS	1440	Commercial	100%	4Q-2006	0.25	-20,345	CEH
ORANGE	ALNGS	1440	Commercial	100%	1Q-2006	1	-534,000	CEH
STRATFORD	BAIRD	2636	Industrial	100%	4Q-2006	0.25	-12,717,817	CEH
STRATFORD	BAIRD	2636	Industrial	100%	4Q-2006	0.25	-24,417	CEH
Total 2006 forecast							**-16,362,315**	

Town	Substation	Circuit Number	Description	Probability (1)	Time Period (3)	Fraction of Year	kWh lost	contact/source
2007								
ORANGE	ALNGS	1441	Commercial	100%	1Q-2007	1	0	CEH
ORANGE	ALNGS	1443	Commercial	100%	1Q-2007	1	-1,066,800	CEH
SHELTON	TRAP	3551	Commercial	50%	4Q-2007	0.25	0	CEH
Total 2007 forecast							**-1,066,800**	
Total 2006 - 2007							**-17,429,115**	

<u>Interrogatory CEAB-8</u>

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves

Q-CEAB-8- Regarding page 28 of Volume I, please provide additional details on the 8 MVA load transfer. Which substations will that load be transferred to?

A-CEAB-8 Each load transfer involves switching distribution load (at 13.8 kV) among substations adjacent to Trap Falls Substation. There are four load transfers that have been identified that may be made in order to keep the peak load at Trap Falls Substation below its firm rating of 76.78 MVA. Not all of the load needs to be transferred to accomplish this, depending upon the actual daily Trap Falls load. The load transfers are temporary and would only be made when the peak load at Trap Falls Substation is expected to be at or above 74 MVA. Once the transfers are made, the load will be transferred back to Trap Falls Substation when the load on Trap Falls Substation falls below 72 MVA. The following are the individual transfers that may be made that can provide 8.0 MVA of temporary peak load relief:

2.6 MVA from Trap Falls Substation to Barnum Substation
2.0 MVA from Trap Falls Substation to Indian Well Substation
2.2 MVA from Trap Falls Substation to Old Town Substation
1.2 MVA from Trap Falls Substation to Old Town Substation.

In addition, in order to keep Old Town Substation below its firm rating, a load transfer of 4.5 MVA to Congress Street I is available.

<u>Interrogatory CEAB-9</u>

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves
Page 1 of 1

Q-CEAB-9: Regarding page 31 of Volume I, will the new Trumbull Substation alleviate or eliminate the reduction in ratings at Old Town and Hawthorne due to voltage stability?

A-CEAB-9: The new Trumbull Substation does not impact the voltage stability ratings at Old Town and Hawthorne substations. The present 65 MW voltage stability limitations for both Old Town and Hawthorne is due to the single contingency loss of the 1710 115 kV line and the possible "voltage collapse" condition that exists upon the loss of Old Town substation transformer A. At an Old Town Substation load of 65 MW or greater, the UI System Operator, remotely opens a bus tie breaker at Old Town Substation. This UI pre-contingency operational strategy is to avoid inductive (motor) load creating in a possible "voltage collapse" condition.

Voltage collapse could occur at Old Town upon the loss of the 1710 115 kV line and the possible corresponding loss of the Old Town transformer A because. With the bus tie closed, the remaining Old Town transformer B immediately picks up the entire substation load allowing no time for the load transformer B load tap changer to adjust to the new loading requirements.

The voltage collapse issue can be avoided by operating the Old Town Substation with the bus-tie open at 65 MW or greater and then picking up any dropped load in a manner that gives the remaining load tap changer a chance to re-adjust. The result for customers fed from the B transformer is a short outage as the feeders are restored with a delay that allows the tap changers to operate.

In order to increase to Old Town and Hawthorne Substation voltage stability rating to equal or exceed their substation firm ratings, additional transmission infrastructure capacity in the form of an additional 115 kV line would be required in the Old Town area. Although there is no improvement in the voltage stability limitation, the new Trumbull Substation with its proposed load transfers from Old Town will reduce the load on Old Town Substation, thereby considerably reducing the amount of hours Old Town Substation operates above the 65 MVA threshold.

Interrogatory CEAB-10

The United Illuminating Company
CSC Docket 317

Witness: Charles Eves
Page 1 of 1

Q-CEAB-10: Please provide a copy of UI's Design Reliability Criteria (DEG 1.0).

A-CEAB-10: A copy of UI's Design Reliability Criteria (DEG 1.0) dated 5/16/2005 is attached.

United Illuminating – Electric Systems Operating Procedure Cover Page

OPERATING PROCEDURE INDEX	DEG-1.0		
OPERATING PROCEDURE NAME:	DISTRIBUTION SYSTEM DESIGN		
APPLIES TO DEPARTMENT(S):	ENGINEERING, DISTRIBUTION ENGINEERING GUIDES, DISTRIBUTION SYSTEM DESIGN		
PROCEDURE OWNER(S):	ROBERT MANNING	ORIGINATION DATE:	01/01/1990
PROCEDURE OWNER(S) TITLE:	RELIABILITY ENGINEER	LAST REVISION DATE:	05/16/2005
REVISED BY:	DIANE M DIEDRICH	NEXT REVIEW DATE:	05/16/2006
PROCEDURE TYPE:	DISTRIBUTION SYSTEM DESIGN		

APPROVALS

PROCEDURE OWNER	ROBERT MANNING		
	Print	Signature	Date
PROCESS OWNER	MAREK WACLAWIAK		
	Print	Signature	Date
2nd PROCESS OWNER			
(if required)	Print	Signature	Date

TOTAL PAGES IN THIS OPERATING PROCEDURE = 24

PROCEDURE NAME:	PROCEDURE NUMBER:
DISTRIBUTION SYSTEM DESIGN	DEG-1.0

REVISION HISTORY

DEG-1.0

DISTRIBUTION SYSTEM DESIGN

Date	Action	Who Made Changes
12/31/2001	DEG-1.0 moved to Lotus Notes Electric System Procedure database	Paul Fontaine/Ted Criscuolo
09/09/2002	Revised by Paul Fontaine	Anna Zinsmeister
01/31/2003	OP revisions per Alex Boutsioulis	ANNA ZINSMEISTER
03/21/2003	OP revisions per Robert Manning	Anna Zinsmeister
12/17/2004	Revision date changed per Robert Manning	Diane M Diedrich
05/16/2005	OP revisions per Robert Manning	Diane M Diedrich

PROCEDURE NAME:	**PROCEDURE NUMBER:**
DISTRIBUTION SYSTEM DESIGN	DEG-1.0

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PROCEDURE NAME:	PROCEDURE NUMBER:
DISTRIBUTION SYSTEM DESIGN	DEG-1.0

1. PURPOSE

The purpose of this procedure is to provide guidelines for: Distribution System Design.

2. PROCEDURE DESCRIPTION

The Distribution System Design Criteria is intended to provide guidelines for the orderly development of the distribution electric supply system to meet the needs of our customers with an acceptable level of reliability, flexibility and economics. The criteria recognizes that thermal and operating limitations exist for the normal and contingency operation of the system, as well as the necessity of maintaining a proper balance between service reliability and the cost of providing that service.

All electric power distribution facilities shall be designed using prudent engineering judgment, in accordance with good industry practice, and shall conform to any and all applicable UI and industry standards, and regulatory requirements.

This criteria is intended to be the basis of, not a substitute for, Company Distribution Policy and Procedures, Terms and Conditions for Service, Construction Standards, or other Distribution Engineering Guides.

When applying the Distribution System Design Criteria it is important to define the risk of equipment damage and/or loss of normal life expectancy, service interruption risks, low voltage and safety risks which would result from the postponement of a proposed system change. The value of the equipment damage and the number and type of customers affected are also important considerations.

The customer should be involved, as deemed necessary by the Account Manager or the Customer Engineer, when it affects the service to his building.

3. DISTRIBUTION SYSTEM CONSTRUCTION

Construction of all overhead and underground distribution systems will be done in accordance with currently approved construction standards and using currently approved materials.

All new system facilities construction and system facilities replacements, both overhead and underground, should allow for supply from a grounded-y source. Generally, all new and replacement overhead facilities, should be constructed to 13.8 kV grounded-y standards.

The Distribution System in general is limited in its ability to accept parallel operation of co-generators. Each potential co-generator installation must be analyzed as to its effect on the distribution system and approved prior to interconnection.

4. CIRCUIT OPERATION AND DESIGN

A. <u>Criteria for Circuit Design and Relief</u>

1. The thermal loading of the wire and cable portions of a circuit should not exceed the I.C.E.A. ratings under normal conditions and, as approved, for first contingency conditions lasting not longer than one 24 hour load cycle. The normal rating of wire and cable shall be used for any first contingency condition that can be expected to last beyond one 24 hour load cycle.

2. All circuits should:
   a. Have suitable ties to adjacent circuits to restore service to customers for the failure of the cable portion of the circuit leaving the substation or unfused portion of cable used to supply multiple customers.
   b. Have load transferred to adjoining circuits within the approved service reliability criteria after fault conditions. In general, up to 6 switching locations to restore power and 4 additional switching locations to restore system loading to within contingency levels are acceptable. The Bridgeport and New Haven Underground Networks are excluded from this design criteria.

3. Where SCADA feeder telemetry is employed, the actual coincident peak values should be used when combining the faulted circuits load and the backup circuits load. For circuits

that do not have feeder telemetry, a Load Diversity Factor (LDF) of 95% will be applied when combining the faulted circuits load and the backup circuits load for circuits that do not have feeder telemetry. The LDF is used to introduce some risk to the conservative approach of assuming a coincident peak and an eight hour duration. An example of this is the combined peak load of the faulted and backup circuits is 500 Amps (from TDA readings). Applying a LDF of 95% reduces the combined load to 475 Amps. By applying this factor, during the design and operating analysis process, additional limited risk can be achieved prior to a circuit contingency capacity increase requirement.

4. The outage of a double-potheaded circuit shall be considered a first contingency outage. Both double-potheaded circuits shall be viewed as one circuit in interpreting Section II, A.2.b.

5. All circuits should be in compliance with the Regulations of Connecticut State Agencies, Division of Public Utility Control, section 16-11-115 (a), (b) and (c), (formerly Docket #9000), relating to the allowable limits for voltage variations.

Section 16-11-115 (a), amended March 22, 1990, states: "(a) For service rendered principally for residential or commercial purposes, the voltage variation shall not exceed an upper limit as low as practically possible, not to exceed a maximum three per cent above or five percent below standard voltage. Voltage excursions below the lower limit and above the upper limit shall not exceed one minute. Providing voltage below the lower limit shall be limited in extent, frequency and duration. Corrective action shall be promptly taken whenever deviations result from other than temporary conditions. Temporary conditions, such as automatic switching to supply interrupted feeders, should not exceed 24 hours where practical. American National Standards Institute (ANSI) Standard C84-1 shall be used to determine the lowest temporary voltage excursions permissible".

This regulation translates to a delivered voltage to the customer at the first point of attachment from 123.6 volts to 114.0 volts on a 120 volt base under normal conditions.

When performing voltage drop calculations for residential and commercial customers, the maximum primary voltage drop from the first customer to the last is 5% at peak load. This is based on an assumed 3% voltage drop in the distribution transformer, secondary wire and customer service cable.

6. All circuits will be analyzed based on the following **Service Reliability Criteria** outage threshold. (Note: Each outage is at least 5 minutes in duration).
   a. 3 outages in a rolling 12 month period.
   b. 2 part power outages in a rolling 12 month period.
   c. 4 total hours duration involving a single outage.
   d. 6 outages in 3 years.

   Threshold values are an indicator of whether a more complete reliability investigation is warranted.

7. Circuit modifications are also considered justifiable if the costs for the project are less than the savings resulting from the project, using approved methods of economic justification.

B. Methods of Providing Relief

In all the methods of relief used, an engineering evaluation shall be made which considers reliability, economic, flexibility, safety, environmental, and legal consequences. The best method consistent with long range plans shall be used. Where applicable, consider:

1. Transferring loads to adjacent circuits if this transfer will not cause other circuit contingency load or voltage problems.

2. Replacing, relocating, or adding equipment (e.g., wire, cable, capacitors, regulators, etc.) to relieve the circuit load and/or voltage problem.

3. Installing a new circuit if the substation transformer and supply cable are adequate.

4. Installing a step-down bank per section IV.D.

5. Converting a portion of the load to 4.16 kV or 13.8 kV distribution.

C. Methods of Maintaining Reliability

The methods of maintaining circuit reliability may include, but not be limited to, the following:

1. Install automatic fault clearing devices. (Refer to Automatic Sectionalizing – Reclosers & Sectionalizers Guide DEG 90.2.)

2. Install equipment (e.g., reclosers, lightning arresters, animal guards, etc.) designed to minimize outages.

3. Investigate equipment failures which have caused the Service Reliability Criteria threshold values to be exceeded.

5. UNDERGROUND DISTRIBUTION SYSTEMS (REFER TO DEG 140)

Splicing chamber, duct and underground cable systems shall be engineered so that cables and equipment can be installed to avoid damage to the facility. The area, soil conditions, existing underground facilities, and future requirements shall all be considered when designing an underground system. Cable pulling tension calculations should be performed before approval of construction. All equipment installed must be able to withstand the expected fault current duty at that location. The following systems are typical: Urban Underground, Residential Underground, Commercial Underground, and Secondary Network.

A. Urban Underground Systems

An Urban Underground Distribution System consists of a splicing chamber and duct system which allows for future installation of cables, as well as replacement and maintenance of existing cables, without requiring excavation to be done to gain access to the facilities. This system is generally installed in city streets, where the need for circuit cables exceeds the capacity of a street pole line, or where required by state or municipal order. An Urban System is installed in areas expected to be permanently paved over and which will have the need for future expandability.

1. Splicing Chambers
   a. All splicing chambers shall be sized and located to allow for a safe working environment and provide sufficient space for racking, splicing, and maintaining the expected cable system.
   b. Chambers shall be engineered to maximize the splicing space available and minimize cable bending.

2. Duct Lines
   a. Duct lines should be constructed in a straight line, using 5" conduit. In order to provide the best possible duct line cooling, field conditions are required to be taken into account prior to construction.
   b. Primary laterals from splicing chambers to riser poles shall consist of 2 - 4" conduits. The conductor size installed in a 4" lateral is limited to 500 kCM cable or smaller.
   c. Primary laterals from substation breaker positions directly to riser poles shall consist of 2 - 5" conduits. When 750 kCM cable riser is justified for thermal loading reasons, 5" conduit is required.
   d. Wherever possible splicing chambers should be located in the intersection of streets. The standard splicing chamber shall include the installation of bell mouths.
   e. The splicing chamber and conduit system exiting any substation shall be designed such that there will be two independent paths to the street.
   f. An adequate duct line system should be provided in the vicinity of new bulk substation locations to allow for feeder requirements through the first ten years.
   g. Provisions shall be made for at least one spare duct in all new ductline construction.

h. The number of ducts that will replace the equivalent capacity of a street pole line shall be a minimum of eight ducts.

3. <u>Underground Cable</u> (Refer to DEG 10.2)

a. No size smaller than 500 kCM copper or equivalent aluminum underground cable (excluding network feeder) should be installed in the mainline of any new 13.8 kV feeder. When extension or replacement of a smaller size cable is needed, it should conform to the above cable size requirement and also be commensurate with the existing ductline system size.

b. In some situations (e.g., unusual load carrying requirements 13.8 kV circuits which rise directly to open wire, etc.) the use of 750 kCM copper underground cable may be warranted.

c. System grounding and cable bonding shall be installed per Construction Standards. Provisions shall be made to insure an adequate continuous neutral path for all cable systems.

d. Cable ratings are per section II.A.1. Underground cable is rated on the basis of the number of equivalent fully loaded cables in the duct line. Future cable loading conditions should be considered when calculating the number of equivalent fully loaded cables. Where applicable, actual cable construction, ductbank configuration and loading should be utilized to determine cable ratings.

e. The normal supply and the contingency supply to a distribution substation or major Commercial/Industrial load area should not originate from the same bulk substation bus section where practical. This, however, does not imply that all of a substation's bus load must be backed up for a bus outage.

g. Double-potheading two radial load carrying circuits should be avoided whenever possible, as a fault on one circuit will open the circuit breaker thus deenergizing both circuits. Automatic fault clearing devices, such as reclosers, should be considered to maintain the reliability of both circuits. A substation capacitor bank may be placed on a double-potheaded positioned so as not to hinder the use of a circuit breaker position. (Refer to Automatic Sectionalizing – Reclosers & Sectionalizers Guide DEG 90.2)

h. A 4/0 tinned copper neutral wire should be installed when extending or replacing an underground circuit, including risers, if the existing system is non-standard for operation from a grounded-wye source.

B. Underground Residential Distribution (Refer to OP-D36)

An underground residential distribution (URD) system consists of a splicing chamber, conduit, and cable system which are intended to supply residential developments and their associated loads. Each system is generally sized with only enough capacity to feed the development. Loop capability should be considered where appropriate to facilitate restoration time in the event of an outage within the development. The system is only installed at the request of the developer, and generally installed on private property.

1. Conduit System
   a. All primary and secondary cable shall be installed in conduit.
   b. Conduit layout design shall take into account cable installation practices, future project expansion and service restoration, so that an adequate system is built.

2. Underground Cable and Facilities
   a. All transformers and switching facilities shall be installed above grade.
   b. The customer load and future expected development loads should be considered when sizing URD equipment.
   c. Padmounted transformers will only be placed when a load is ready for connection within 60 days, otherwise future padmount locations will have enough cable coiled for future connection or a splice through flowerpot connector.

C. Commercial Underground Distribution (Refer to OP-D32)

Underground distribution within commercial or industrial developments shall be done only at the request of the developer. The system shall consist of splicing chambers, conduits, underground cable, transformers and related switching facilities. Loop capability should be considered where appropriate to facilitate restoration time in the event of an outage within the development. Depending on system requirements, a Commercial Underground Distribution project may include design details of an Urban Underground System. (See Section III.A).

D. Secondary Network System (Refer to DEG 50.2)

A Secondary Network System consists of an electrical system installed in an Urban Underground System. The electrical portion consists of primary cables, transformers, secondary and service cables, and switching equipment. The secondary of all transformers are interconnected and protected by fuses and network protectors so that a first contingency outage of any secondary cable will not cause an outage to another portion of the network. The protection insures that a first contingency outage to any primary portion of the network will not cause a customer interruption. New customers within the established network boundaries shall be supplied either by existing network system if economical or a radial circuit design with a manual throw over. Auto-throw over design should be made available as an option to the customer and at additional cost to the customer.

1. Conduit System
   a. The conduit system shall be equivalent to the Urban Underground Systems. (See Section III.A).
   b. Transformer vaults shall be installed, if practical, with adequate provisions for the installation, operation, and maintenance of a minimum of two network transformers, associated cable, and bus work.

2. Underground Cable and Facilities
   a. 120/208 Volt secondary should not be installed in a vault or splicing chamber used for 240 volt or 480 volt secondary, whether network cables or not.
   b. All secondary network junctions, excluding neutrals, shall be made with fusible connectors.

c. All primary cables that feed a network shall originate in the same bulk substation. Each feeder should commence from separate bus sections to maximize capacity.

6. OVERHEAD DISTRIBUTION SYSTEMS

The design of new overhead systems shall conform to current Construction Standards using currently approved equipment. Current system requirements as well as long term system needs shall be considered when evaluating a system problem and alternative solutions.

A. Aerial Cable

1. For new system construction, no size smaller than 350 kCM copper aerial cable or equivalent aluminum in capacity should be installed.

2. In general, no more than four aerial cables should be installed on the same pole line. In some cases, construction limitations, condition of the pole line and guying the number of aerial cables could be restricted to fewer than four.

3. Where feasible, the normal supply and contingency supply to a distribution substation or major Commercial/Industrial load should not be located on the same pole line.

4. 13.8 kV Circuit cables shall be tied to open wire using a three phase disconnecting device. Cable dips under highway bridges, etc., only require a three phase disconnecting device on the normal source end of the cable and an alternate disconnecting means, generally single phase devices, on the load side.

5. Cable ratings are per section II.A.1.

6. Provisions shall be made to insure an adequate continuous neutral path for all cable systems.

B. Overhead Design

1. Overhead systems, with the exception of wire type and size, shall conform to current Construction Standards, and Circuit Operations/Designs as described in Section II.

2. All new construction should be built to 13.8 kV Construction Standards.

3. Three phase manual disconnecting devices shall be installed at cable terminations as described in Section IV.A.4., at normally open tie points between circuits, and at locations to be used for contingency switching. All other sectionalizing points shall be three single phase disconnecting devices.

4. Overhead design, including sectionalizing devices (e.g., reclosers, underarm disconnect switches, in-line disconnect switches, and fuses) shall be employed to achieve the desired level of reliability. In-line disconnect switches shall only be used where switching is desired and pole space is unavailable, and for bypassing reclosers.

5. Conditions that might lead to a ferroresonant circuit should be kept in mind. A typical potential ferroresonant condition is a long cable feed to a three phase customer which is protected by three single phase fused cutouts. Three phase switching may be necessary to sectionalize under ferroresonant conditions.

6. Provisions shall be made to insure an adequate continuous neutral path for all overhead systems.

7. Tree trimming shall be done to support achieving the desired level of reliability.

8. All side taps off the mainline shall be protected with either fused cutouts or reclosers.

9. All cutouts protecting equipment and side-taps shall be installed where practical on the mainline junction pole.

10. All Completely Self Protected (CSP) transformers along a 13.8 kV mainline shall be protected with current limiting fuses. In special cases where line cutouts will be overdutied by fault current, in-line current limiting fuses may be required.

C. 2.4 and 4.16 kV Design

In general all new 2.4 kV and 4.16 kV circuit work shall be built to 13.8 kV Construction Standards and Specifications, except for voltage specific requirements, such as fuse size, lightning arrester class, etc.

1. When converting from 2.4 kV to 4.16 kV a continuous neutral is necessary. Neutral wire should be replaced with 1/0 aluminum as necessary, out of the substation (minimum of two), with the first two circuits in the duct lines, at the circuit risers, at customer services, and in the overhead line.

2. On single phase lines, the neutral wire will be installed in the secondary space by shifting an existing phase wire or by the addition of a neutral wire to missing sections. This is to achieve system conformity, clean up the pole, make field identification easier for trouble shooters and outside personnel, and make service connections easier and neater.

3. One cutout and one lightning arrester must be removed from each single phase transformer when converting from 2.4 kV to 4.16 kV.

4. If an entire substation is to be converted from 2.4 kV to 4.16 kV, neutral relays are required on all incoming and outgoing circuit breaker positions. Also, there should be three potential transformers connected in a wye configuration for bus voltage metering.

D. Step-Down Banks

Step-down transformer banks may be considered as alternatives to 13.8 kV conversions to relieve 2.4 kV and 4.16 kV circuits. Their use, however, should be limited only to one of the following applications:

a) Where they are economically beneficial

b) Where they can offset expenditure of resources

c) Where they allow the avoidance of a difficult physical construction condition.

1. The true cost of potential step-down bank applications should be calculated, including the cost of transformers, present worth cost of the future 13.8 kV conversion and the present worth cost of added losses for the step-down bank and circuit.

2. The thermal rating of step-down bank transformers is per ANSI guide C57.91 assuming an 8 hour peak and a 24 hour load cycle unless actual load cycle data is provided.

3. Typically, the nameplate transformer rating can be increased 20 percent in the summer and 40 percent in the winter and upon reaching this level, load/voltage analysis shall be performed.

4. In general, backups are not provided to step-down banks, however, a contingency supply should be provided on the load side of transclosure installations to mitigate the effects of cable failures.

5. Currently, the maximum size step-down bank is 1500 kVA (3-500 kVA transformers) with a maximum of 500 kVA (3-167 kVA transformers) installed in a cluster on a single pole. The maximum single phase step-down transformer installed on a single pole is 250 kVA.

6. A new installation of a step down bank shall be loaded up to 80% of nameplate rating. This will allow for load growth which is currently not monitored. Actual load cycle information may be required prior to installation of a step-down bank.

7. Analysis and trending of step-down bank loading shall be performed when the actual instantaneous peak load exceeds transformer nameplate rating.

7. DISTRIBUTION SUBSTATIONS

A. Substation Design

The fundamental principle of design is that all distribution substations should be operated as single transformer stations, unless they presently have more than one transformer installed sharing the load. Where there exist multiple transformer substations, these may continue unless additional substation/feeder capacity is needed.

1. No new 2.4 kV or 4.16 kV distribution substations should be built.

2. All future design plans shall include the eventual elimination of all 2.4 kV and 4.16 kV distribution substations. An engineering analysis shall be done in each case to determine when stations should be eliminated.

3. When the engineering analysis determines that the load of a distribution substation will overload the transformer and there is ample circuit capacity, the following means of increasing and utilizing the available transformer capacity shall be considered:
   a. Add fans if not already installed.
   b. If feasible, replace the transformer with a larger available unit.
   c. With a multiple transformer substation, increase overall capacity by separating bus connections. (Evaluation of station control power needs to be reviewed prior to separating bus connections).
   d. Obtain acceptable substation load levels by converting a portion of the overloaded substation to 13.8 kV.

B. Substation Ratings

1. Substation ratings shall be based on the electrical and operating condition of all of the equipment on site (e.g., station transformers, incoming cable leads, circuit breakers, bus work, etc.)

2. Substation transformer ratings shall be based upon ANSI Standard C57.92 and good industry practice.

3. Single transformer substations shall be operated such that the transformer will not exceed a 5% loss of life under contingency.

4. For single transformer substations the maximum load which can be supplied is the lower of the following two conditions:
   a. The rating of the existing equipment on site, or
   b. The rating of the mobile substation transformer plus any available load swaps to adjacent substations which may be done within one 24 hour load cycle.

5. For multiple transformer substations, the maximum load which can be supplied is the lower of the following three conditions:
   a. During the first 24 hour load cycle, the emergency rating of the remaining existing equipment on site after the loss of the largest rated transformer, or
   b. Beyond the first 24 hour load cycle, the normal rating of the remaining existing equipment on site after the loss of the largest rated transformer, including the rating of the mobile substation transformer plus any available load swaps to adjacent transformers, or
   c. Beyond the first 24 hour load cycle, if the mobile substation transformer can not be installed, then the loading on the substation shall be based only on the remaining existing equipment on site after the loss of the largest rated transformer, plus any available load swaps to adjacent substations.

6. All single transformer substations shall have two manual switchable feeds (preferred and alternate) to the transformer.

7. All single transformer substations shall have mobile substation transformer connections.

8. Spare transformation shall be available to replace the largest transformer of each voltage type in the system.

8. POWER QUALITY

United Illuminating is responsible for providing high power quality supply in terms of voltage level and waveform. The following criteria, determines the level of quality, will initiate further investigations into power quality incidents and related causes and sources. These limits are dynamic and may change as customer equipment and requirements change and shall be reviewed annually by UI.

A. Definitions

A Voltage Sag is defined as a reduction of the RMS 60 Hertz voltage to between 10% and 90% for duration of one-half cycle to one minute.

A Voltage Swell is defined as an increase in the RMS 60 Hertz voltage to between 110% and 180% of the nominal value for a duration of one-half cycle to one minute.

Multiple related 'events' in a one-minute period will count as one event for the purposes of this criteria.

"SARFI" - System Average RMS Voltage Variation Frequency Index represents the number of voltage variation incidents (i.e., sags and swells) at the substation bus averaged for 30 days. The National Average SARFI, (i.e., 10% - 90% reduction in voltage) based on a 1996 study is 3.59.

Short Term SARFI - This index is based on the latest 90 day period and is normalized for 30 days. The Short Term SARFI will be compiled every 30 days. Further investigations are required if the Short Term SARFI is greater than 2.9.

Long Term SARFI - This index is based on the latest 12 month period and is normalized for 30 days. The Long Term SARFI will be compiled every 3 months. Further investigations are required if the Long Term SARFI is greater than 2.4.

Further investigations should identify power quality causes and sources and recommend operational practice and equipment design changes to ensure future high quality supply.

B. Flicker

Flicker can be described as a sudden decrease in the intensity of lighting due to a rapid change in supply voltage.

Transformers shall be located and sized based on voltage drop and reliability, neglecting flicker effects.

The "UI Flicker Curve" (see DEG 180) limits shall be utilized for possible major flicker sources and customer voltage complaints. For customer voltage complaints, the definite source of flicker shall be determined, if practical, before resizing or adding transformers.

If the source of flicker is determined to be caused by customer's equipment and produces no adverse power quality effects to other UI customers, the remedy of power quality problem is the responsibility of the customer. If the source of flicker is determined to be caused by customer's equipment and or produces adverse power quality effects to other customers, the remedy of the power quality problem shall ultimately be the responsibility of UI, but shall not exclude customer equipment design changes or repair if appropriate.

C. Voltage Unbalance

Following ANSI 84.1, Appendix D, Polyphase Voltage Unbalance (1989 Edition): Voltage Unbalance of a polyphase system is expressed as a percentage value and calculated as follows:

$$\text{Voltage Unbalance} = \frac{(100 \times \text{max deviation from average voltage})}{(\text{average voltage})}$$

UI's electric supply system shall be designed and operated to limit the maximum voltage unbalance to 3 percent when measured at UI's revenue meter under no-load conditions. This criteria is consistent with ANSI 84.1.

If this unbalance limit is exceeded, an investigation shall be initiated and corrective measures undertaken within a reasonable time to reduce the unbalance to below limits while maintaining proper voltage levels.

Examples: With phase-to-phase voltages of 230, 232, and 225, the average is 229; the maximum deviation from average is 4; and the percent unbalance is (100 x 4)/229 = 1.75 percent.

D. Load Unbalance

Analysis to be performed annually:

1. 13.8 kV Circuits - Perform load balancing as necessary if phases are unbalanced by more than 50 amps during two or more consecutive summer months. Perform load balancing as necessary if the load of an individual phase exceeds the normal conductor or transformer rating.
2. 2.4/4.16 kV Circuits - Perform load balancing as necessary if phases are unbalanced by more than 100 amps during two or more consecutive summer months. Perform load balancing as necessary if the load of an individual phase exceeds the normal conductor or transformer rating.

E. Part Power and Single Phasing

An investigation of the facility's reliability history shall be initiated following two part power or single phasing in a rolling 12 month period.

F. **Harmonics, Transients and Notching**

At the substation level, voltage distortion exceeding the limits (IEEE Standard 519-1992, table 11.1) below shall be investigated. This analysis shall be initiated annually.

Bus Voltage At Point of Service Attachment	Individual Voltage Distortion (%)	Total Voltage Distortion THD (%)
69 kV and below	3	5

Harmonic current distortion, harmonic voltage distortion and voltage notching limits at the point of service attachment shall be based on IEEE 519-1992. Investigation will be initiated by unexplained power quality related incidents and/or customer power quality

9. DISTRIBUTION INFRASTRUCTURE OBSOLESCENCE

Substation equipment, distribution feeder cables, poles, wire and pole hardware are considered the major system components of the distribution infrastructure. Since the majority of the distribution substation equipment and distribution feeder cable system's age is presently beyond the typical life expectancy of 40 years, UI has a higher future risk of failure to occur in these areas. Conversely, since the majority of the pole, wire and pole hardware infrastructure is below the typical life expectancy of 35 years, UI has less risk of system failures to occur in these areas.

A. Substation Equipment

Substation equipment which includes cables, reactors, circuit breakers, disconnecting switches, relaying, fuses, voltage transformers, load tap changers and current transformers that demonstrate the following conditions, shall be reviewed. A cost benefit present worth analysis shall be utilized to determine the most cost effective solution to solve identified substation equipment problems. (Refer to Distribution Cost Analysis DEG 110).

1. Safety/operability or condition of equipment/facility which poses a potential safety risk to employees or to the general public.

2. Environmental non-compliance exists or significant potential environmental risk exists.

3. Unavailability of spare parts.

4. High operating and maintenance costs due to age and equipment familiarity.

5. Exceeds service reliability criteria due to failures. (Refer to Section II.6).

6. The Substation Removal Task Report, 8/27/96, provides a ranking of 2.4/4.16 kV substations which have the highest risk of safety, environmental operating, maintenance and reliability problems. Substations with a category score of 100 or in the top 25 percentile shall have a current cost effective solution for substation removal.

B. <u>Distribution Feeder Cables</u>

Distribution feeder cables shall be replaced within prudent engineering judgment if one of the following criteria is met:

1. Five cable faults over a rolling 3 year period.

2. Four cable faults over a rolling 3 year period if the cable age exceeds 40 years.

3. A present worth analysis that indicates a cable replacement is less costly alternative than continuing to pay maintenance repair and customer claim costs.

C. <u>URD Cables</u>

1. Direct buried primary cables that experience one cable fault shall be prepared for silicone injection. Injection elbows or terminators shall be applied prior to re-energizing the faulted section. Silicone injection should be completed on faulted section within one year.

2. Complete replacement of a direct buried faulted URD cable in conduit shall be performed if determined that the neutral has experienced excessive corrosion and is brittle.

3. Direct buried URD cables, with five cable faults over a rolling 3 year period, should be replaced.

D. Overhead Distribution Equipment

Overhead distribution equipment which includes pole, wire, pole hardware, fusing, regulators, capacitor banks, disconnecting switches and transformers that demonstrate the following conditions shall be reviewed. A cost benefit present worth analysis shall be utilized to determine the most cost effective solution to solve overhead distribution equipment problems. (Refer to Distribution Cost Analysis DEG 110).

1. Safety/operability or condition of equipment which poses a potential safety risk to employees or to the general public.

2. Environmental non-compliance exists or significant potential environmental risk exists.

3. Unavailability of spare parts.

4. High operating and maintenance costs.

5. Exceeds service reliability criteria due to failures. (Refer to Section II.6).

6. Distribution equipment is overdutied due to fault currents.

7. Equipment fails to perform primary function.

Interrogatory CEAB-11

The United Illuminating Company
CSC Docket 317

Witness: Patrick McDonnell

Q-CEAB-11: Regarding page 33 of Volume I, please describe UI's implementation of conservation and load management in the area served by Trap Falls and Old Town, including an estimate of the MW reductions achieved to date. Has UI assessed the potential for additional DSM in this area?

A-CEAB-11: UI has implemented a broad array of energy efficiency programs since the electric industry was restructured in 1998 and the fund for Conservation and Load Management was created. The result of these efforts has been the completion of energy efficiency projects resulting in 9,590 kW of demand reduction.

UI does not perform potential studies of energy efficiency for limited geographic areas such as the area served by the proposed sub station. There are, however, over 100 energy efficiency projects in various stages of development resulting in an additional 1,800 kW of demand savings in this area.

Q-CEAB-12: Regarding page 8 of Exhibit C of Volume I, the firm rating for the substation at Indian Wells is 74.5 MVA with two 24/32/40 MVA transformers. The firm rating for the new Trumbull Substation will be 58 MVA with two transformers of the same size. Please explain the difference in firm rating of these two substations.

A-CEAB-12: UI's firm rating (emergency capability) of multiple transformer substations with interconnected secondary windings is equal to the peak of the maximum daily load cycle which can be carried by the substation for 24 hours upon the first contingency loss of one power transformer. The emergency loading capability of power transformers is commonly the determinant of the firm capacity of a substation. The overload capability specified for UI's transformers is 1.45 times the transformer's top rating. Manufacturers have designed the transformers to meet or exceed this criteria.

Some manufacturers design the cooling systems of the transformers to be more robust, resulting in a higher calculated firm rating of a substation. Others use a more moderate design, resulting in a calculated firm rating at or near 58 MVA. Using the temperature rises measured in the factory thermal overload testing, the firm rating calculated for the Indian Well transformers was 74.5 MVA. Since it is not known what the specific thermal design of a future transformer will be, UI has assumed a transformer firm rating of 58 MVA for transformers rated 24/32/40 MVA.

<u>Interrogatory CEAB-13</u>

The United Illuminating Company
CSC Docket 317

Witness:Alex Boutsioulis

Q-CEAB-13: Regarding page 8 of Exhibit C of Volume I, it states that the new Trumbull Substation will reduce transmission line charges by $220,000 per year. Please explain the derivation of that estimate, including the transmission tariff applicable to this situation.

A-CEAB-13:

There are presently six UI 115/13.8 kV substations that are supplied by CL&P owned 115 kV transmission lines:

- Hawthorne
- Old Town
- Trap Falls
- Indian Well
- Ansonia
- June Street

The peak load for these six UI substations coincident with the July 27, 2005 CL&P peak was 378 MW.

<u>Possible Future CL&P Transmission Cost Allocation/Recovery Strategy</u><u>:</u>

The result of ISO-NE's Transmission Cost Allocation review of the Bethel-Norwalk and Middletown-Norwalk Reliability projects will determine the portion of the projects that should be locally supported Pool Transmission Facilities (PTF) with the remaining portions designated as regionally supported PTF would be charged to all NEPOOL customers. In this possible scenario, CL&P will attempt to collect their revenue requirements for localized PTF costs from both their retail distribution customers and their wholesale transmission customers. Since the six UI substations are electrically supplied by the CL&P 115 kV lines, UI is considered a wholesale transmission customer of CL&P.

Therefore, CL&P may attempt to charge UI a localized transmission rate based on the pro rata share of load that the six UI substations supplied by CL&P's 115 kV lines contributes to CL&P's Connecticut transmission grid peak load requirements. The UI substation pro rata peak load calculation is as follows:

CL&P	5403
UI	378
CMEEC	372
	6153 MW

UI Share = 378/6153=6.15%

Since locally supported PTF costs for the Bethel-Norwalk and the Middletown-Norwalk 345 kV Transmission Projects have not yet been determined, an estimate of CL&P's revenue requirements for each $1M of new transmission investment needs to be calculated. In 2002 (the most current information available) CL&P had a PTF revenue requirement of $135,000 for every $1M in gross transmission plant. UI's 6.15% pro rata share of that revenue requirement is approximately $8,303 annually for the life of the asset which in this case will be 30 years.

Example: ***Localized PTF Costs for CL&P as part of the Bethel-Norwalk and Middletown-Norwalk Projects are estimated to be conservatively at $300M.***

UI customer's annual revenue requirement for $300M of CL&P Bethel-Norwalk and Middletown-Norwalk Localized PTF Costs would be as follows:

$8,303 x 300 = $2,491,000

Possible Trumbull Substation Load Transfer Benefit:
If Trumbull substation is completed as proposed, approximately **34 MW** of peak load will be initially transferred from Old Town and Trap Falls substations to Trumbull substation. UI customer's annual revenue requirement for a possible $300M of CL&P Bethel-Norwalk and Middletown-Norwalk Localized PTF Costs would be **reduced $226,000** accordingly because the proposed Trumbull substation will be supplied by UI owned 115 kV transmission lines not CL&P owned 115 kV transmission lines.

[$8,303 x 300] - [$135,000 x (378-34/6153) x 300] = $226,489

Any additional load transfers from Old Town and Trap Falls to Trumbull substation **will further reduce UI customer's annual revenue**

requirement for a possible $300M of CL&P Bethel-Norwalk and Middletown-Norwalk Localized PTF Costs.