UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
HOUSTON LIGHTING & POWER COMPANY	)	NRC Docket Nos. 50-498A
PUBLIC SERVICE BOARD OF SAN ANTONIO	)	50-499A
CITY OF AUSTIN	)	
CENTRAL POWER AND LIGHT COMPANY	)	
(South Texas Project, Unit Nos.	)	
1 and 2)	)	
	)	
TEXAS UTILITIES GENERATING	)	NRC Docket Nos. 50-445A
COMPANY, et al.	)	50-446A
(Comanche Peak Steam Electric	)	
Station, Units 1 and 2)	)	

NRC STAFF'S THIRD SET OF INTERROGATORIES AND REQUESTS FOR PRODUCTION OF DOCUMENTS TO HOUSTON LIGHTING AND POWER CO. AND TEXAS UTILITIES GENERATING CO., ET AL.

Preface

Pursuant to 10 C.F.R. Sections 2.740, 2.740b, and 2.741, the NRC Staff hereby propounds the following interrogatories and document requests to Houston Lighting & Power Company ("HL&P"), an applicant in the South Texas operating license antitrust proceeding, and to Texas Utilities Generating Company, Dallas Power & Light Company, Texas Power and Light Company and Texas Electric Service Company (hereinafter collectively referred to as "TU"), applicants in the Comanche Peak antitrust operating license proceeding, and parties to the aforesaid South Texas proceeding. Responses to interrogatories are due within fourteen (14) days after service unless the presiding officer allows a longer period 10 C.F.R. §2.740b(b). In addition, document production is required within thirty (30) days 10 C.F.R. §2.741(d). However, the Staff will endeavor to cooperate with the above applicants to assure an adequate response time which does not adversely affect the hearing (or discovery) schedule.

1

Instructions

1. Answer the following interrogatories separately (by parts) and fully in writing under oath or affirmation.

2. Restate the interrogatory or document request as the first part of the answer.

3. If any person significantly assisted in the preparation of any answer other than signatory counsel or affiant, state that person's name, address, employer, title, and telephone number.

4. If any interrogatory or part thereof is objected to, state separately (by part) the objection and basis therefor.

5. Documents produced shall be grouped and marked by interrogatory.

6. If privilege is claimed as to any document, identify the date of the document, the sender(s), the recipient(s) of all copies, the subject matter of the document, and the privilege claimed.

7. If any document requested is unavailable, explain the circumstances of such unavailability.

8. Any request to list, name, or identify a person or employee requires a statement of the person's full name, current employer and business address, position held, and telephone number.

9. Pursuant to the direction of the presiding Licensing Board on June 21, 1978, these interrogatories and requests for documents are continuing and require supplemental answers should Houston or TU obtain or identify supplemental information or documents.

10. For clarification of any technical term used herein, please refer to the attached IEEE "Standard Definition of Terms."

Definitions

In the event any word, term,or phrase is unclear to Houston and/or TU, it is requested that oral clarification be requested of the undersigned staff counsel. Any word, term, or phrase is to have its generally accepted meaning. Listed below, are specific definitions pertinent to this pleading:

1. "Documents" means all writings and records of every type in the possession, control or custody of the company, its directors, officers, attorneys, employees or agents, including, but not limited to, memoranda, correspondence, reports, surveys, evaluations, charts, books, minutes, notes, agenda, diaries, transcripts, microfilm, accounting statements, telephone and telegraphic communication, speeches, and all other records, written, electrical, mechanical or otherwise, but excluding documents relating to the design, construction or routine operation of electrical facilities. Where engineering feasibility studies or reports are furnished, the underlying detailed data need not be supplied.

"Documents" shall also mean copies of documents, even though the originals thereof are not in the possession, custody or control of the company, and every copy of a document which contains handwritten or other notations or which otherwise do not duplicate the original or any other copy.

2. "Relate(s) to" means relating to in any way and includes documents which are the subject of the request. (e.g.,"relating to a contract" includes the contract itself). Requests concerning a subject or item should be understood to include possible or contem-

plated actions as to such subject or item. For example, requests for documents relating to interconnection plans would include documents relating to interconnection arrangements that have been considered but rejected.

3. "ERCOT" means the Electric Reliability Council of Texas.

4. "TIS" means the Texas Interconnected System and its predecessor organizations, the South Texas Interconnected System and the North Texas Interconnected System.

5. "TU/HL&P" means TU and/or HL&P.

6. "Reliability council" means a group of electric utilities that reports to the National Electric Reliability Council on a regular basis, such as ERCOT or the Southwest Power Pool.

Interrogatories

1. Provide those HLP/TU organization charts now in HLP/TU's possession for the years 1970-79. Indicate executive, departmental, and divisional responsibilities. Identify those company employees directing or responsible for subject areas or divisions.

2. Provide all documents relating to distance of lignite fuel from generating sites, both present and planned, and transportation cost of lignite to each plant site.

3. Provide all documents not heretofore produced which

   (a) relate in any way to engineering or economic (including engineering economics) assessments of intrastate operation of electric utility companies in Texas, and/or to interconnected operations between interstate and (Texas) intrastate electric utility systems (exclude correspondence addressed to the Chairman of the Texas Public Utilities Commission, all filed pleadings and exhibits, and documents generated prior to 1968). This request includes, but is not limited to, stability, load flow, and loss of load probability studies analyzing the effects of interconnections between SWPP and ERCOT on ERCOT systems.

   (b) relate to determination, estimation, or comparison of the costs (including social and regulatory costs), benefits, or other factors pertaining to interconnecting or possibly interconnecting TIS with SWPP (exclude all filed pleadings and exhibits, and documents generated prior to 1967);

   (c) relate to (or would include as an alternative) the provision of transmission services for or by Houston Lighting & Power Co., Texas Power and Light Co., and/or Texas Electric Service Co.

   (d) relate to consideration of jointly owned generating or transmission facilities, and/or purchases, exchanges, or sales of energy or capacity which would include, as an alternative, provision of transmission services by or to HL&P, TP&L, and/or TESCO (exclude all filed pleadings and exhibits, and documents generated prior to 1970);

   (e) relate to the establishment, continuation, improvement (or modification of related facilities to yield the improvement), or abandonment of any emergency interconnection between a member of ERCOT and a member of WSCC or SWPP;

(f) relate to the impact of fuel costs and capital costs of generation construction on transmission and generation planning (exclude all filed pleadings and exhibits, and documents generated prior to 1970);

(g) relate to Houston Lighting and Power Company's purchases, sales, or exchanges or possible purchases of energy or generating capacity after 1980 (exclude all filed pleadings and exhibits);

(h) relate to studies, analyses, or evaluations performed by Stagg Systems, Inc. for Houston Lighting & Power Co.,

(i) relate to the "optimalization," i.e., use of central dispatch, economy sales, or exchanges of energy, of TIS/STIS/NTIS and/or the TU system.

(j) evaluate the construction and/or use of transmission of greater capacity than 345 kv by members of TIS.

(k) relate in any way to the retention or possible retention of existing customers, or securing of new customers, or service areas or territories (or parts thereof), including, but not limited to, Conroe, Texas and the area north of Houston.

(l) relate to the conversion of gas or oil-fired generation to coal.

Any documents responsive to this document request which have not heretofore been produced and which are in the possession of the following individuals shall be produced and segregated so that they are identifiable to each individual:

HLP	TU
K.L. Williams	G. Berman
B.G. Burgess	H. Manning
Charles Hamm	L.O. Heizer
R.L. Evans	M. Spence
E.F. Pond	P. Brittain
R. Earhart	B. Hulsey
J.D. Greenwade	E.D. Scarth
R.M. McCuistion	T.L. Hatcher
T.A. Standish, Sr.	R.R. Parks
D.D. Sykora	C.D. Montgomery
D.E. Simmons	
J.F. Meyer	

4. Regarding power flows on the facilities which interconnect the TU/HLP electrical systems with each other or with other systems:

   (a) Are the flows telemetered to a central location?

   (b) If the answer to (a) is yes, where is the central location or locations?

   (c) If the answer to (a) is yes, does TU/HLP refer to the central location or locations as a control center(s)?

   (d) If the answer to (c) is no, how does HLP/TU refer to this central location or locations?

   (e) Are all tie line flows automatically totalled? (Tie lines are facilities interconnecting two or more different systems).

   (f) If the answer to (e) is no, please identify those tie line flows which are not totalled automatically.

5. (a) Is automatic tie line control used to control scheduled interchange to and from the HLP/TU system?

   (b) If the answer to (a) is yes, is the control system analog, digital, or hybrid?

   (c) Does the control system use frequency bias?

   (d) If the answer to (c) is yes, what is the frequency bias setting (or settings)?

   (e) If the answer to (a) is yes, describe in detail the operation of the automatic tie line control system.

   (f) Are all generators controlled automatically to respond to changing system load conditions (other than by governor action)?

   (g) Identify which generators, if any, are under automatic control and which, if any, are not.

   (h) If some generators are not automatically controlled, describe in detail the method(s) by which they are controlled;

   (i) Identify the future generators which, if any, will be under automatic control and those, if any, which will not.

6. (a) Identify those HLP/TU generators (both present and planned), if any, which have (or will have) speed governing systems and those, if any, which do (or will) not;

   (b) For each generator (either present or planned) which has (or will have) a speed governing system, list the "Steady-State Speed regulation"1/ and the "Governor Dead Band."

7. List the "Permissible Response Rate" 1/ for each generator on the HLP/TU system.

8. HL&P:
   List and describe all proposed

   (a) load flow studies
   (b) stability studies
   (c) production costing studies
   (d) generation reliability studies

   to be conducted by HLP, TIS, or STIS at any time during the period 1979-1985.

9. HL&P:
   List and describe all

   (a) load flow studies
   (b) stability studies
   (c) production costing studies
   (d) generation reliability studies

   conducted by HLP, TIS, or STIS during the last three years which involve representation of the HLP transmission and/or generation system.

10. HL&P:
    Please list the specific transmission lines (and their electrical characteristics) considered in Exhibit 11 to the deposition of K.L. Williams in this proceeding.

1/ As defined in the attached copy of IEEE Standard Definitions of Terms for Automatic Generation Control on Electric Power Systems, IEEE No. 94.

11. Insofar as not provided in response to Staff's Interrogatory No. 35(e) of its First Set of Interrogatories, please list the continuous and emergency ratings of each of the HLP interconnections and transmission lines over 138 kv.

12. Does HLP rate its transmission lines at less than their full continuous ratings in its load flow or other studies? If so, please describe the ratings used, and the reasons why such ratings are used.

13. HL&P:
Insofar as not provided in response to Interrogatory No. 8 of Staff's First Set of Interrogatories, please provide a list of requests by HLP to import power to its system since January 1976 along with

(a) an explanation of why each import was requested,
(b) the date of each request,
(c) the result of each request,
(d) the amount of each request.
(e) Please produce those documents relating to this interrogatory.

14. HL&P:
Please provide a list of requests by other electric systems to HLP to export power to other systems since January 1976 along with

(a) the reason (if known) why each export was requested;
(b) the date of each request,
(c) the result of each request,
(d) the amount of each request.
(e) If any export did not materialize, please explain why.
(f) Please provide all documents relating to this interrogatory.

15. Please provide copies of any drafts or finalized agreements between the City of Austin and HL&P regarding HL&P's purchase of energy or capacity from that system.

16. Please describe the method or methods employed by TIS, HL&P, and TU in representing machine governor response characteristics in load flow and stability studies (TU: describe methods used only by TUCS and its members, and by TIS; HL&P: describe methods used only by HL&P and TIS).

17. Please describe the method or methods employed by TIS, HLP, and TU in representing tie line load control in load flow and stability studies. (TU: describe only methods used by TUCS and its members, and by TIS; HL&P: describe methods used only by HL&P and TIS).

18. Please list by year for the years 1970-79, for each generating unit (TU for its units, HLP for its units) in operation during that period, the

    (a) capacity factor
    (b) scheduled maintenance (in weeks per year)
    (c) forced outage rate
    (d) load factor

19. Provide all documents relating to consideration of TIS policies regarding wheeling and inadvertant flows generated in the past two years.

Respectfully submitted,

M Blume

Roy P. Lessy, Jr.
Fredric D. Chanania
Michael B. Blume
Ann P. Hodgdon
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 26th day of November 1979.

IEEE Standard
Definitions of Terms
for
AUTOMATIC GENERATION CONTROL
ON ELECTRIC POWER SYSTEMS

IEEE Standard Definitions of Terms for

AUTOMATIC GENERATION CONTROL ON ELECTRIC POWER SYSTEMS

CONTENTS

Approved by the IEEE STANDARDS Committee on [illegible] 1968. Individual reprints of this Standard are published by the IEEE [illegible]

FOREWORD

This is the first revision of this publication, which formalizes the work of the System Controls Subcommittee of the Power System Engineering Committee on the terminology for automatic generation control on electric power systems. The need for standard terminology in this field became apparent after a study of technical papers indicated that many authors were using different definitions for their terms. Requests for the standardization of terms were also received from the operating groups of the large interconnected power systems in this country and Canada. This is the first publication in English devoted specifically to the terminology used in automatic generation control.

The definitions in this publication were prepared for use primarily in the field of automatic generation control on electric power systems. Therefore, it is recognized that many of the terms are defined in too limited a manner for use in other fields.

In the preparation of this publication, reference to the following publications proved extremely helpful:

1. IEEE 122 (AIEE No. 600) (December 1959), "Recommended Specification for Speed-Governing of Steam Turbines Intended to Drive Electric Generators Rated 500 kW and Larger."
2. IEEE 125 (AIEE No. 605) (September 1950), "Recommended Specification for Speed-Governing of Hydraulic Turbines Intended to Drive Electric Generators."
3. IEEE 270 (September 1966), "Proposed Standard Definitions of General (Fundamental and Derived) Electrical and Electronics Terms."
4. "American National Standard Terminology for Automatic Controls." ANSI C85.1-1963.
5. ASME Standard 105, "Automatic Control Terminology."
6. American National Standard C42.35-1957—Definitions of Electrical Terms—Group 35—Generation, Transmission and Distribution.
7. American National Standard C42.30-1957—Definitions of Electrical Terms—Group 30—Instruments, Meters and Meter Testing.
8. American National Standard C42.25-1957—Definitions of Electrical Terms—Group 25—Industrial Control Equipment.

In accordance with ANSI instructions C12.16, dated June 9, 1960, titled "Procedure to Be Followed in the Preparation or Revision of Definitions of Electrical Terms in Proposed American National Standards," the following note applies to items 114, 133, 302, 315, 401, 402, 412:

> "At the time this Standard was submitted for approval, this committee and the appropriate C42 committee had not agreed on a mutually acceptable term and definition, and the term and definition given herein are recognized as American National Standard for the purpose of this particular Standard."

ACKNOWLEDGMENT

The Institute wishes to acknowledge its indebtedness to those who have so freely given of their time and knowledge and have conducted experimental work on which many of the IEEE publications are based.

The work of revising this publication was carried out by the System Controls Subcommittee of the Power System Engineering Committee of the IEEE Power Group. The members of this subcommittee were:

T. W. Hissey, *Chairman*

D. H. Berry	J. W. Kepner
G. A. Davis	J. Miller
F. P. deMello	D. E. Simmons
C. W. Eggers	E. E. Swanson
J. H. Graham	R. O. Usry
G. L. Hood	C. N. Whitmire
J. R. Huff	D. G. Wohlgemuth

IEEE Standard
Definitions of Terms
for
AUTOMATIC GENERATION CONTROL ON ELECTRIC POWER SYSTEMS

100. TERMS USED IN POWER SYSTEM OPERATION

101. Power System. A group of one or more generating sources and or connecting transmission lines operated under common management or supervision to supply load.

102. Interconnected System. Two or more individual power systems normally operating with connecting tie lines.

103. Control Area. A power system, a part of a system, or a combination of systems to which a common generation control scheme is applied.

104. Tie Line. A transmission line connecting two or more power systems.

105. Area Tie Line. A transmission line connecting two control areas.

Note: Similar to "interconnection tie" as defined in C42.55.40.190

106. Tie Point. The location of the switching facilities of a tie line which, when closed, permit energy to flow between two power systems.

107. Control Metering Point. The location of the tie-line metering equipment that is used to measure power on the tie line for the purpose of control.

108. Energy Metering Point. For a tie line, the location of the integrating metering equipment used to measure energy transfer on the tie line.

109. Net Interchange (Power and/or Energy). The algebraic sum of the powers and/or energies on the area tie lines of a control area. Positive net interchange due to excess generation is out of the area.

110. Scheduled Net Interchange. For a control area, the mutually prearranged intended net power and or energy on the area tie lines.

111. Net Interchange Deviation. For a control area, the net interchange minus the scheduled net interchange.

112. System Frequency. The actual frequency of the power system alternating voltage.

113. Rated Frequency. For a power system or interconnected systems, the normal cycles per second for which alternating-current generating equipment operating on such system is designed.

114. Regulated Frequency (C42.35.10.050).[1] Frequency so adjusted that the average value does not differ from a predetermined value by an appreciable amount.

115. Standard Frequency. A precise frequency intended to be used for a frequency reference.

116. Scheduled Frequency. That frequency which a power system or an interconnected system attempts to maintain.

117. Frequency Deviation. For a power system, system frequency minus the scheduled frequency.

118. Scheduled Frequency Offset. The amount, usually expressed in hundredths of a cycle per second, by which the frequency schedule is changed from rated frequency in order to correct a previously accumulated time deviation.

119. Frequency Bias. An offset in the scheduled net interchange power of a control area that varies in proportion to the frequency deviation. This offset is in a direction to assist in restoring the frequency to schedule.

120. Frequency Bias Setting. A factor with negative sign that is multiplied by the frequency deviation to yield the frequency bias for a control area.

121. Time Deviation. For a power system, the integrated or accumulated difference between system frequency and rated frequency divided by the rated frequency.

122. Time Bias. An offset in the scheduled net interchange power of a control area that varies in proportion to the time deviation. This offset is in a direction to assist in restoring the time deviation to zero.

123. Time Bias Setting. A factor with negative sign that is multiplied by the time deviation to yield the time bias for a control area.

124. Biased Scheduled Net Interchange. The scheduled net interchange plus the frequency and/or other bias of a control area.

125. Area Control Error. The frequency deviation of an isolated power system consisting of a single control area is the area control error. The area control error of

[1] See asterisk note in Foreword.

a certain value of an interconnected system is the net interchange minus the [illegible] net interchange.

Note: The above polarity is that which has been generally accepted by electric power systems and is in wide use. It is recognized that this is the reverse of the sign of control error generally used in servomechanism and control literature, which defines control error as the reference quantity minus the controlled quantity.

126. Area Load-Frequency Characteristic. For a control area, the change in total area load that results from a change in system frequency.

127. Area Frequency-Response Characteristic. For a control area, the sum of the change in total area generation caused by governor action and the change in total area load, both of which result from a sudden change in system frequency, in the absence of automatic control action.

128. Station Control Error. The station generation minus the assigned station generation.

Note: Refer to note on polarity under definition 125.

129. Unit Control Error. The unit generation minus the assigned unit generation.

Note: Refer to note on polarity under definition 125.

130. Inadvertent Interchange. For a control area, the time integral of the net interchange minus the time integral of the scheduled net interchange.

Note: This includes the intentional interchange energy resulting from the use of frequency and other bias as well as the unscheduled interchange energy resulting from human or equipment error.

131. Tandem Control. A means of control whereby the area control error of an area or areas A, connected to the interconnected system B only through the facilities of another area C, is included in control of area C's generation.

132. Power Control Center. The location where the area control error of a control area is computed for the purpose of controlling area generation.

133. Automatic Generation Control. The regulation of the power output of electric generators within a prescribed area in response to changes in system frequency, tie-line loading, or the relation of these to each other, so as to maintain the scheduled system frequency and/or the established interchange with other areas within predetermined limits.

134. Area Supplementary Control. The control action applied, manually or automatically, to area generator speed governors in response to changes in system frequency, tie-line loading, or the relation of these to each other, so as to maintain the scheduled system frequency and/or the established net interchange with other control areas within predetermined limits.

135. Gross Generation. The generated output power at the terminals of the generator.

136. Net Generation. Gross generation less station or unit power requirements.

200. PRIME-MOVER AND GOVERNOR CHARACTERISTICS

201. Speed-Governing System. The speed governor, the speed-control mechanism and the governor-controlled valves.[2]

202. Speed Governor. Those elements which are directly responsive to speed and which position or influence the action of other elements of the speed-governing system.[2]

203. Speed-Control Mechanism. All equipment such as relays, servomotors, pressure or power-amplifying devices, levers, and linkages between the speed governor and the governor-controlled valves.[2]

204. Governor-Controlled Valves (on a Steam Turbine). Those valves which control the power input to the turbine, and which are normally actuated by the speed governor directly or through the medium of the speed-control mechanism.

205. Governor-Controlled Gates (on a Hydroturbine). Those gates which control the power input to the turbine, and which are normally actuated by the speed governor directly or through the medium of the speed-control mechanism.

206. Cam Shaft Position. The angular position of the main shaft directly operating the governor-controlled valves.

207. Governor Speed Changer. A device by means of which the speed-governing system may be adjusted to change the speed or power output of the turbine while the turbine is in operation.[2]

208. Governor Speed Changer Position. The position of the speed changer indicated by the fraction of its travel from the position corresponding to minimum turbine speed to the position corresponding to maximum speed and power input. It is usually expressed in percent.

209. Steady-State Speed Regulation. For straight condensing and noncondensing steam turbines, for nonautomatic extraction turbines and hydroturbines, the change in steady-state speed, expressed in percent of rated speed, when the power output of the turbine is gradually reduced from rated power output to zero power output with unchanged settings of all adjustments of the speed-governing system.[2] *reversed*

210. Steady-State Incremental Speed Regulation. At a given steady-state speed and power output, the rate of change of the steady-state speed with respect to the power output. It is the slope of the tangent to the steady-state speed-power output curve at the point of power output under consideration. It is expressed in percent of rated speed when the difference in steady-state speed, expressed in percent of rated speed for any two points on the tangent,

[2] See reference 1 in Foreword

...ing difference in power output ...rated power output.[1]

211. Permissible Response Rate. For a steam-generating unit, the maximum assigned rate of change in generation for load-control purposes based on estimated and known limitations in the turbine, boiler, combustion control, or auxiliary equipment.

The permissible response rate for a hydro-generating unit is the maximum assigned rate of change in generation for load-control purposes based on estimated and known limitations of the water column, associated piping, turbine, or auxiliary equipment.

212. Load Limit Changer. A device that acts on the speed-governing system to prevent the governor-controlled valves from opening beyond the position for which the device is set.[2]

213. Governor Dead Band. The magnitude of the total change in steady-state speed within which there is no resulting measurable change in the position of the governor-controlled valves. Dead band is the measure of the insensitivity of the speed-governing system and is expressed in percent of rated speed.[2] revised

300. TYPES AND CHARACTERISTICS OF AUTOMATIC CONTROL ACTION

301. Constant Frequency Control. For a power system, a mode of operation under load-frequency control in which the area control error is the frequency deviation.

302. Holding Frequency (C42.35.10.045).[1] A condition of operating a generator or station to maintain substantially constant frequency irrespective of variations in load. A plant so operated is said to be regulating frequency.

303. Constant Net Interchange Control. For a power system, a mode of operation under load-frequency control in which the area control error is determined by the net interchange deviation.

304. Base Load Control. For an electric generating unit or station, a mode of operation in which the unit or station generation is held constant.

305. Tie-Line Bias Control. For a control area, a mode of operation under load-frequency control in which the area control error is determined by the net interchange minus the biased scheduled net interchange.

306. Proportional Control Action. Action in which there is a linear relation between the output and the input of the controller. The ratio of the change in output produced by the proportional control action to the change in input is defined as the proportional gain.

307. Integral Control Action. Action in which the output of the controller is proportional to the time integral of the input.

308. Reset Control Action.

Note: Applies only to a controller with proportional control action plus integral control action.

Action in which the controller output is proportional to the input signal and the time integral of the input signal. The number of times per minute that the integral control action repeats the proportional control action is called the reset rate.

309. Derivative Control Action. Action in which the output of the controller is proportional to the first time derivative of the input.

310. Rate Control Action.

Note: Applies only to a controller with proportional control action plus derivative control action.

Action in which the output of the controller is proportional to the input signal and the first derivative of the input signal. Rate time is the time interval by which the rate action advances the effect of the proportional control action.

311. Area Assist Action. The component of area supplementary control that involves the temporary assignment of generation changes to minimize the area control error prior to the assignment of generation changes on an economic dispatch basis.

312. Command Control. A control mode in which each generating unit is controlled to reduce unit control error.

313. Permissive Control. A control mode in which generating units are allowed to be controlled only when the change will be in the direction to reduce area control error.

314. Continuous Type Control. A control mode that provides a continuous relation between the deviation of the controlled variable and the position of the final controlling element.

315. Closed-Loop Control System (C42.25.05.041).[1] A control system in which the controlled quantity is measured and compared with a standard representing the desired performance. Any deviation from the standard is fed back into the control system in such a sense that it will reduce the deviation of the controlled quantity from the standard.

Note: In automatic generation control, the controlled quantities are frequency, unit generation, and net interchange.

316. Final Controlling Element. That controlling element which directly changes the value of the manipulated variable.

317. Valve Point Loading Control. A control means for making a unit operate in the more efficient portions of the range of the governor-controlled valves.

318. Computer Control. A mode of control of a physical process which a computer, using as input the process variables, introduces outputs that control the process.

319. Direct Digital Control. A mode of control wherein digital computer outputs are used to control the process directly.

320. Hybrid Control. A mode of control utilizing both analog and digital computers in combination to control a process.

400. ELEMENTS AND COMPONENTS OF AUTOMATIC CONTROL SYSTEMS

401. Measurement Device (C42.30.11.020).[1] For an automatic control system, a device that measures physical and electrical quantities.

402. Primary Detector (C42.30.11.035).[1] That portion of the measurement device which either utilizes or transforms energy from the controlled medium to produce a measurable effect which is a function of change in the value of the controlled variable.

403. Controlling Means. For an automatic control system, those elements which are involved in producing a corrective action.

404. Master Controller. For a load-frequency control system, the central device that develops corrective action, in response to the area control error, for execution at one or more generating units.

405. Schedule Setter or Set Point Device. A device for establishing or setting the desired value of a controlled variable.

406. Net Interchange Schedule Programmer. A means of automatically changing the net interchange schedule from one level to another at a predetermined time and during a predetermined period or at a predetermined rate.

407. Regulating Limit Setter. A device in the load-frequency control system for limiting the regulating range on a station or unit.

408. Regulating Range. In load-frequency control, a range of power output within which a generating unit is permitted to operate.

409. Unit Rate Limiting Controller. A controller that limits rate of change of generation of a generating unit to an assigned value or values.

Note: The limiting action is normally based on a measured megawatt per minute rate.

410. Function Generator. A device in which a mathematical function such as $y = f(x)$ can be stored so that for any input equal to x, an output equal to $f(x)$ will be obtained.

411. Power Primary Detector. A power measuring device for producing an output proportional to power input.

412. Frequency Standard. A device that produces a standard frequency. See definition 115.

500. TELEMETERING SIGNAL CHARACTERISTICS

501. Pulse Duration Telemetering (Pulse Width Modulation): A type of telemetering in which the duration of each transmitted pulse is varied as a function of the magnitude of the measured quantity.

502. Pulse Rate Telemetering. A type of telemetering in which the number of unidirectional pulses per unit time is varied as a function of the magnitude of the measured quantity.

503. Variable Frequency Telemetering. A type of telemetering in which the frequency of the alternating voltage signal is varied as a function of the magnitude of the measured quantity.

504. Phase Modulation Telemetering. A type of telemetering in which the phase difference between the transmitted voltage and a reference voltage varies as a function of the magnitude of the measured quantity.

600. CONTROL EQUIPMENT CHARACTERISTICS

601. Analog Device. A device that operates with variables represented by continuously measured quantities such as voltages, resistances, rotations, and pressures.

602. Digital Device. A device that operates on the basis of discrete numerical techniques in which the variables are represented by coded pulses or states.

603. Electron Device. A device in which conduction by electrons takes place through a vacuum, gas, or semiconductor.

604. Electromechanical Device. A device that is electrically operated and has mechanical motion such as relays and servos.

605. Accuracy in Measurement. The degree of correctness with which a measurement device yields a value of measured quantity.

606. Repeatability in Measurement. The closeness of agreement among repeated measurements of the same variable under the same conditions.

607. Error in Measurement. The algebraic difference between a value that results from measurement and a corresponding true value.[3]

608. Dead Band. The range through which an input can be varied without initiating response.[4]

609. Hysteresis in Measurement or Control. The difference between the increasing input value and the decreasing input value which effect the same output value. This term applies only where the output value is a continuous function of the input value.[3]

[3] See reference 5 in Foreword.
[4] See reference 4 in Foreword.

700. ECONOMIC DISPATCH TERMS

701. Incremental Loading. The assignment of loads to generators so that the additional cost of producing a small increment of additional generation is identical for all generators in the variable range.

702. Economic Dispatch. The distribution of total generation requirements among alternative sources for optimum system economy with due consideration of both incremental generating costs and incremental transmission losses.

703. Incremental Heat Rate. For a steam turbogenerator unit at any particular output, the ratio of a small change in heat input per unit time to the corresponding change in power output. Usually, it is expressed in British thermal units per kilowatthour.

704. Incremental Generating Cost. For a source at any particular value of generation, the ratio of the additional cost incurred in producing an increment of generation to the magnitude of that increment of generation. All variable costs should be taken into account including maintenance.

705. Incremental Transmission Loss. That fraction of power loss incurred by transmitting a small increment of power from a point to another designated point. One of these points may be a mathematical equivalent (rather than physical), such as the composite system load.

706. Incremental Cost of Delivered Power. For a source, the additional per unit cost that would be incurred in supplying another increment of power from that source to the composite system load.

707. Incremental Cost of Reference Power. For a source, the additional per unit cost that would be incurred in supplying another increment of power from that source to a designated reference point on a transmission system.

708. Penalty Factor. A factor which, when multiplied by the incremental cost of power at a particular source, produces the incremental cost of delivered power from that source.

Mathematically, it is[5]

$$\frac{1}{(1 - \text{incremental transmission loss})}.$$

709. Incremental Delivered Power. The fraction of an increment in power from a particular source that is delivered to any specified point such as the composite system load, usually expressed in percent.

710. Transmission Loss Coefficients. Mathematically derived constants to be combined with source powers to provide incremental transmission losses from each source to the composite system load. These coefficients may also be used to calculate total system transmission losses.

711. Incremental Worth of Power. At a designated point on a transmission system, the additional per unit cost that would be incurred in supplying another increment of power from any variable source of a system in economic balance to such designated point.

When the designated point is the composite system load, the incremental worth of power is commonly called "lambda" (or Lagrangian multiplier).

712. Nonconforming Load. A customer load, the characteristics of which are such as to require special treatment in deriving incremental transmission losses.

713. Voltage Phase Angle Method of Economic Dispatch. The actual measured phase angle difference between the station bus and a reference bus in the determination of incremental transmission losses.

714. Automatic Dispatching System. A controlling means for maintaining the area control error or station control error at zero by automatically loading generating sources, and it also may include facilities to load the sources in accordance with a predetermined loading criterion.

715. Cost of Incremental Fuel. The ultimate replacement cost of the fuel, usually expressed in cents per million British thermal units, that would be consumed to supply an additional increment of generation.

716. Incremental Fuel Cost of Generation. For any particular source, the cost, usually expressed in mills per kilowatthour, that would be expended for fuel in order to produce an additional increment of generation at any particular source.

717. Incremental Maintenance Cost. For any particular source, the additional cost for maintenance that will ultimately be incurred as a result of increasing generation by an additional increment.

800. INDEX OF NONSTANDARD TERMS

Nonstandard Terms	Standard Terms
Area requirement	Refer to area control error (125)
Base frequency	Scheduled frequency (116)
"B" or transmission loss constants	Transmission loss coefficients (710)
Economic loading	Incremental loading (701)
	Economic dispatch (702)
Feedback control system	Closed-loop control system (307)
Flat frequency control	Constant frequency control (301)
Flat tieline control	Constant net interchange control (304)
Fringe control action	Proportional control action (306)
Holding load	Base load control (303)
Incremental production cost	Incremental generating cost (704)
Load frequency control	Automatic generation control (135)
Load setter	Schedule setter or set point device (413)
Mandatory control	Command control (312)
Sensitivity in measurement or control	Refer to dead band (605)
Speed droop	Steady-state speed regulation (209)

[5] Expressed as a decimal.

600. ALPHABETICAL LIST OF TERMS

Note: Nonstandard terms are denoted by (NS).

A

B

C

D

E

F

G

H

I

L

M

N

P

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
HOUSTON LIGHTING & POWER COMPANY	)	NRC Docket Nos. 50-498A
PUBLIC SERVICE BOARD OF SAN ANTONIO	)	50-499A
CITY OF AUSTIN	)	
CENTRAL POWER AND LIGHT COMPANY	)	
(South Texas Project, Unit Nos. 1 and 2)	)	
	)	
TEXAS UTILITIES GENERATING COMPANY, et al.	)	NRC Docket Nos. 50-445A
	)	50-446A
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of NRC STAFF'S THIRD SET OF INTERROGATORIES AND REQUESTS FOR PRODUCTION OF DOCUMENTS TO HOUSTON LIGHTING AND POWER CO. AND TEXAS UTILIITIES GENERATING CO., ET AL. in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 26th day of November 1979.

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