September 9, 1980

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of HOUSTON LIGHTING & POWER COMPANY (Allens Creek Nuclear Generating Station, Unit No. 1)	§ § § § § § § §	Docket No. 50-466

APPLICANT'S FURTHER ANSWERS TO TEXPIRG'S
SIXTEENTH INTERROGATORIES

The following are Applicant Houston Lighting & Power Company's further answers to TexPirg's sixteenth interrogatories:

Interrogatory No. 1(e)

How do the future prices of natural gas compare to that of nuclear and coal?

Answer

Fuel cost ratios have been revised as follows to reflect our latest cost estimates:

Year	Gas/Coal*	Gas/Nuclear*
1985	1.7	10.1
1990	3.0	12.4
1995	3.6	14.3
2000	3.6	13.2

* Based on $ per million BTU

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These cost estimates are prepared by the Fuel Resources Department of Houston Lighting & Power taking into account such factors as existing contracts, discussions with present and potential fuel suppliers, published statistical indices, professional judgment, and recent cost trends.

CONTENTION NO. 31 - TECHNICAL QUALIFICATIONS

Interrogatory No. 2

Do you maintain that Ebasco would carry out a better quality assurance program than Brown and Root? Why or why not.

Answer

No. Applicant expects both contractors to have equally satisfactory quality assurance programs.

Interrogatory No. 6

How many of the applicants (sic) direct employees have a Ph.D. degree in either a science or engineering field? For each give their name, position with applicant, years experience since receiving Ph.D., summary of present duties, university degree (Ph.D) received from, and undergraduate grade point average. Which have degrees in nuclear physics or nuclear engineering?

Answer

The following HL&P employees have a Ph.D. degree in either a science or engineering field and are involved in some way with HL&P nuclear power plants:

Richard Beaubouef

Position: Principal Engineer
Availability/Reliability/Engineering Division

Years Since Receiving Ph.D.: 13

Statement of Duties: Dr. Beaubouef is in charge of engineering support for economic levels of power plant availability both for operating units and new unit design.

Received Degree from: Rice University

Undergraduate Grade Point Ratio: 3.75/4.00

Degrees in Nuclear Physics/Nuclear Engineering: None

James R. Sumpter

Position: Manager - Nuclear Department

Years Since Receiving Ph.D.: 10

Statement of Duties: Dr. Sumpter is responsible for nuclear engineering, nuclear safety, nuclear licensing, and radiation aspects of HL&P nuclear plants.

Received Degree from: Texas A&M University

Undergraduate Grade Point Ratio: 3.01/4.00

Degrees in Nuclear Physics/Nuclear Engineering:
M.S. - Nuclear Engineering
Ph.D. - Nuclear Engineering

Frank Schlicht

Position: Principal Scientist

Years Since Receiving Ph.D.: 11

Statement of Duties: Dr. Schlicht is responsible for all ecological research and monitoring conducted by HL&P.

Received Degree from: Texas A&M

Undergraduate Grade Point Ratio: Not available.

Degrees in Nuclear Physics/Nuclear Engineering: None

Jim D. Guy

Position: Manager Corporate Planning

Years Since Receiving Ph.D.: 11

Statement of Duties: Dr. Guy manages corporate planning which is involved with long range strategic planning.

Received Degree from: Texas A&M

Undergraduate Grade Point Ratio: 2.6/3.00

Degrees in Nuclear Physics/Nuclear Engineering: None

Larry A. Smith

Position: Senior Health-Physicist

Years Since Receiving Ph.D.: 5

Statement of Duties: Dr. Smith is responsible for the As-Low-As-Reasonably-Achievable (ALARA) design review for Allens Creek.

Received Degree from: University of Missouri at Columbia

Undergraduate Grade Point Ratio: 3.65/4.0

Degrees in Nuclear Physics/Nuclear Engineering:
M.S. - Nuclear Engineering
Ph.D. - Nuclear Engineering

Don Beeth

Position: Director Nuclear Information

Years Since Receiving Ph.D.: 9

Statement of Duties: Communications with media and the public on the Company's nuclear plants and other advanced technology projects.

Received Degree from: University of Houston

Undergraduate Grade Point Ratio: 3.75/4.0

Degrees in Nuclear Physics/Nuclear Engineering:
Ph.D. - Physics

Interrogatory No. 10

What % of the increased cost of the S. Texas project do you think was caused by (a) intervenors, (b) increased costs of NRC regulations changes, (c) miscalculation of original estimates, (d) technical incompetence of applicant, and other causes? Please detail the basis of each part of the answer. For example in (b), list each of the regulation changes, the data of change, and increased cost to S. Texas from such change.

Answer

Any cost attributable to (a) intervenors would be legal fees and these are, in comparison to total costs, de minimis.

HL&P is unable at this time to quantify the additional costs associated with each regulatory change incurred since the start of the project. A very limited study of the cost impact of regulatory changes through the end of 1978 estimated a figure of not less than $100 million. A copy of this study is available for inspection in the Company's office at 4100 Clinton Drive, Houston, Texas.

The key to understanding the cost estimate increase on STP is to understand the increase in the project work requirements and the resulting impact on project cost parameters. All project costs are directly or indirectly a function of the permanent material quantities and configurational complexity. A quantitative indicator of configurational complexity is the engineering design manhour estimate.

The quantity increases indicate an approximate increase of 95 percent, or almost double the 1973 Conceptual Estimate quantities. The engineering work in 1973, based on the 1979 manhour estimate, was less than 1 percent complete; therefore, drawing takeoffs were not possible. Very little applicable information was available from the industry; i.e., those plants far enough along in design and construction to have reliable data were of an earlier generation and consequently were much smaller, and did not have to meet the more stringent regulatory criteria imposed on later generation plants such as STP. Those plants of the same generation as STP had not progressed far enough in design and construction to provide reliable data. As the STP plant design evolved, material quantities and design complexity increased. This was compounded by the increases in regulatory requirements imposed on the plant design configuration. The net result of these factors was a multifold increase in the project in terms of quantities and configurational complexity.

One of the most significant, if not the largest, cost impact caused by increased work requirements resulting in a schedule extension is on the cost of inflation. More materials, more labor and more overhead mean more escalation costs. If a schedule extension is also involved, then increased escalation is compounded over a longer period of time.

An extended schedule also means that the project is exposed to external uncontrollable risks with potential cost impact such as Force Majure, added regulatory requirements, etc., over a longer period of time.

In summary, the cost estimate increase on STP is traceable to the increased work requirements. The increased work requirements results from increased regulatory requirements and an initial low estimate of materials, labor manhours and engineering manhours because of the unavailability of relevant estimating information. Accordingly, none of the increased cost of the project above that which would otherwise have been the case is directly attributable to a "miscalculation of original estimates" per se.

The Applicant has encountered no "technical incompetence" on the project; therefore, there is no cost increase attributable to this cause.

Interrogatory No. 11

What specific changes has the applicant made to increase its technical competence as a result of the NRC report and fine concerning quality control at South Texas?

Answer

The changes made by Applicant due to the NRC report and fine concerning quality control at South Texas are delineated in the following filings:

(1) Reply to NRC Notice of Violation dated April 30, 1980;

(2) Answer to NRC Notice of Proposed Imposition of Civil Penalties ($100,000 penalty) dated April 30, 1980; and

(3) Answer to NRC Order to Show Cause dated April 30, 1980.

These documents are available for review at the Energy Development Complex or at the offices of Baker & Botts.

CONTENTION NO. 28 - CONTROL ROOM DESIGN

Interrogatory No. 1

Detail the major ways that the control room layout and design differs from that of TMI. Explain why these differences made it easier for the operators to control the plant under all accident conditions.

Answer

The major findings of the Kemeny Commission report on control room design at TMI are:

(1) Emergency systems controls are not arranged in an orderly manner with all controls and process indications located in one section.

(2) The TMI-2 control room alarm system provides audible and visual indication for most of the more than 1,500 plant alarm conditions.

(3) A single "acknowledge" button silences all of the alarms, making it likely operators could not comprehend the significance of all alarm conditions.

(4) The control room alarm annuciators are not arranged in a logical fashion. Annuciators associated with specific systems are distributed in a seemingly random fashion.

(5) Some audible alarms are associated with annuciators that are on the back sides of panels and cannot be seen by an operator standing in front of the related control panel.

(6) The existence of a large number of alarm conditions during normal operation tends to mask the alarm received during an emergency.

(7) During normal operation, indicator lights will be red, green, white, or amber, and it is not possible at a glance, to detect an off-normal condition.

(8) The meaning of a given light color is not consistent among all of the panels in the control room.

(9) Computer aids for the analysis of system status were not utilized at TMI-2.

The Allens Creek Control Room design compares favorably with these findings. The ACNGS control room uses a General Electric design called Nuclenet. As explained on PSAR p. 7.5-1, this design provides an optimized operator/plant interface through the reduction of panel sizes and the logical grouping and simplification of controls and information displays. Where appropriate, considerable reduction in console (control panel) size is accomplished by simplifying controls and presenting normal plant operating data and supporting graphic displays on computer-controlled color Cathode Ray Tubes (CRT's). Wherever the status or action of safety systems or safety-related information is concerned, additional hard-wired, conventional display and/or indicating devices are used. The design stresses that the presentation of plant information to the operator be done in such a manner that efficient operation is enhanced. Furthermore, alarms will be prioritized so that their annuciation or acknowledgment will not be the same for all alarms. Colors of indicating lights will be standardized and it will be possible for the cperator to see from his station all indications that will show plant status. These features make the ACNGS control room much more functional under accident conditions and should minimize operator error.

CONTENTION NO. 39 - REACTOR VESSEL

Interrogatory No. 6

Are there requirements or plans to test the pressure capacity of the ACNGS by actually applying overpression to the actual reactor vessel at various times during its operating life?

Answer

In accordance with Regulatory Guide 1.68, preoperational tests will include a hydrostatic pressure test of the reactor coolant p essure boundary including the vessel. After operation, hydrostatic tests will be conducted at approximately ten-year intervals. These tests will be at pressures greater than normal operating pressure.

CONTENTION NO. 41 - OVERPRESSURE IN VESSEL

Interrogatory No. 3

Specify why it would be impossible to have a common mode failure of the relief valves such that less than half would operate in the relief mode at the pressure-relief set point.

Answer

The design of the relief valve in the safety mode for ACNGS is extremely simple: plug valve held in place only by a spring. When pressure under the valve exceeds spring pressure, the valve will open. The extreme simplicity of design, having one moving part, makes the probability that more than half would not open during an overpressure event virtually zero.

Interrogatory No. 4

What is the time delay of the ACNGS pressure sensing system? Valve Assembly? What is the accuracy of these times? What is the range of times associated with the slowest to fastest valves? Slowest to fastest sensing system?

Answer

As explained on p. 5.2-11 of the PSAR, for the limiting overpressure transient (MSIV closure with high flux scram), the analysis assumes that one of the 1105 psig set point safety/relief valves fails and that 50 percent of the remaining valves in each set point group open in their power-actuated, relief mode. In this mode, the valves are opened by a pneumatic operator. The other 50 percent fail to open in the relief mode, and are assumed to open (if needed) in their self-actuated, spring mode. In the spring mode, the reactor pressure acts to lift the relief valve against a spring. Obviously, if all of the valves open in their power-actuated, relief mode, a less severe transient pressure spike is produced than predicted by analysis because the delay time to open the valves would be shorter. Hence, with regard to the overpressure protection analysis, the delay times are conservatively assumed.

Figure 5.2-7 (Attachment 1) shows the delay times assumed in analysis.

Interrogatory No. 5

What is the rate of change of pressure with time near the 1300 psi level of the transit under the conditions assumed? What would the resulting pressure be if it is assumed that all relief valves were delayed by (a) 0.1 sec. and (b) 1.0 sec. in opening past the times assumed in the anlysis?

Answer

Figure 5.2-1 of the PSAR (Attachment 2) shows pressure as a function of time for the design basis overpressure event (MSIV closure with high flux scram). For interpreting this figure, rated pressure for ACNGS is 1045 psig.

In the design basis overpressure analysis (MSIV closure) one safety/relief valve is assumed not to open, half the remaining valves are assumed to open in the spring relief mode, and scram is assumed to not occur from MSIV closure even though a redundant, safety class position indication system would generate a scram signal as the Main Steam Isolation Valves close. Instead, scram is assumed delayed until a high flux signal occurs. Under these assumptions, considerable delay beyond that normally expected has been factored into the analysis. Obviously, still more delay could be postulated. However, such additional delay would be unreasonable in light of the conditions already assumed.

Interrogatory No. 6

What basis does applicant supply to justify their (sic) claim that the safety/relief valve opening set points are assumed at a conservatively high level?

Answer

The commitment to pertinent ASME code requirements is found on pp. 3.9-5,6 and 5.2-13b, 14 and 16.1/16.2-12 of the ACNGS PSAR.

The ASME code provides for a 10 percent allowance above design pressure for pressure transients for upset conditions and a 20 percent allowance above design pressure for emergency conditions. This provides for respective design, upset, and emergency limits for ACNGS of 150 psig, 1375 psig, and 1500 psig. See also the answer to Interrogatory No. 7, below.

Interrogatory No. 7

What is the basis for allowing the ACNGS overpressure capacity to be greater than the reactor coolant pressure boundary design pressure? Where is the large safety factor here?

Answer

The use of 1375 psig for a pressure limit for upset conditions is documented on p. 16.1/16.2-12 of the ACNGS PSAR. The definition of upset condition, found on p. 3.2-14a of the PSAR states:

Upset Condition

> Any deviations from Normal Conditions anticipated to occur often enough that design should include a capability to withstand the conditions without operational impairment. The Upset Conditions include those transients which result from any single operator error or control malfunction, transients caused by a fault in a system component requiring its isolation from the system, and transients due to loss of load or power, or an operating basis earthquake.

The code has safety margins already in the design procedures. These safety margins are based on the properties of the materials such as yield strength and ultimate (tensile) strength. The pressure limits in the code for normal, upset, emergency, and faulted conditions being multiples (1.1, 1.2, 1.5) of design pressure are used such that they do not cause design to greatly exceed S_y, yield strength. Design of ASME safety class components is done to either 1/3 of ultimate strength or 2/3 of yield strength. When design is done to S_m, allowable strength as defined in the ASME code, and then multiplied by 1.1, 1.2, 1.5 for upset, emergency, faulted conditions, the extreme value is only equal to yield if S_m = 2/3 yield (S_y) which is a typical design method. This shows that in the worst case, faulted, using 1.5 multiple, the yield strength is not exceeded. Even this remains well below the ultimate strength, S_u, the point at which the material will fail.

By using the code pressure limits for design of 1.1 S_m, 1.2 S_m, 1.5 S_m, the safety factor based on the mechanical properties of the material is at least 1/3 (33.33%) of S_u below ultimate strength, neglecting any added strength gained by strain hardening.

CONTENTIONS NO. 40 AND 53 - HYDROGEN EXPLOSION

Interrogatory No. 2

Do you believe that it would be impossible for a hydrogen explosion to take place in the vessel or containment of ACNGS? Why?

Answer

It is highly unlikely that a hydrogen explosion could take place in the pressure vessel because there is not a sufficient source of oxygen to sustain such an explosion.

Interrogatory No. 3

What is the minimum explosive force ro (sic) pressure within the (a) vessel and (b) containtment (sic) that it would take to cause a crack? Explain? What pressure would it take to also cause the concrete shell to shatter?

Answer

As explained above, since there is not a sufficient source of oxygen in the pressure vessel to sustain a hydrogen explosion, such an event is not evaluated. As for the containment portion of the interrogatory, the design pressure is 15 psig; however, the containment will probably tolerate at least twice design pressure before rupture. There is no means to say at what above design pressure point cracks would ultimately form. As to the "concrete shell," the reactor shield building is not designed as a pressure retaining structure. Hence, Applicant does not calculate pressure data for this structure.

Interrogatory No. 6

If a condition existed for a hydrogen explosion of sufficient force to crack the vessel, containment and concrete wall, would you recommend that the operating crew stay in the control room or leave fast?

Answer

Procedures would not call for the operating crew to leave the control room under the postulated scenario.

Respectfully submitted,

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ATTORNEYS FOR APPLICANT
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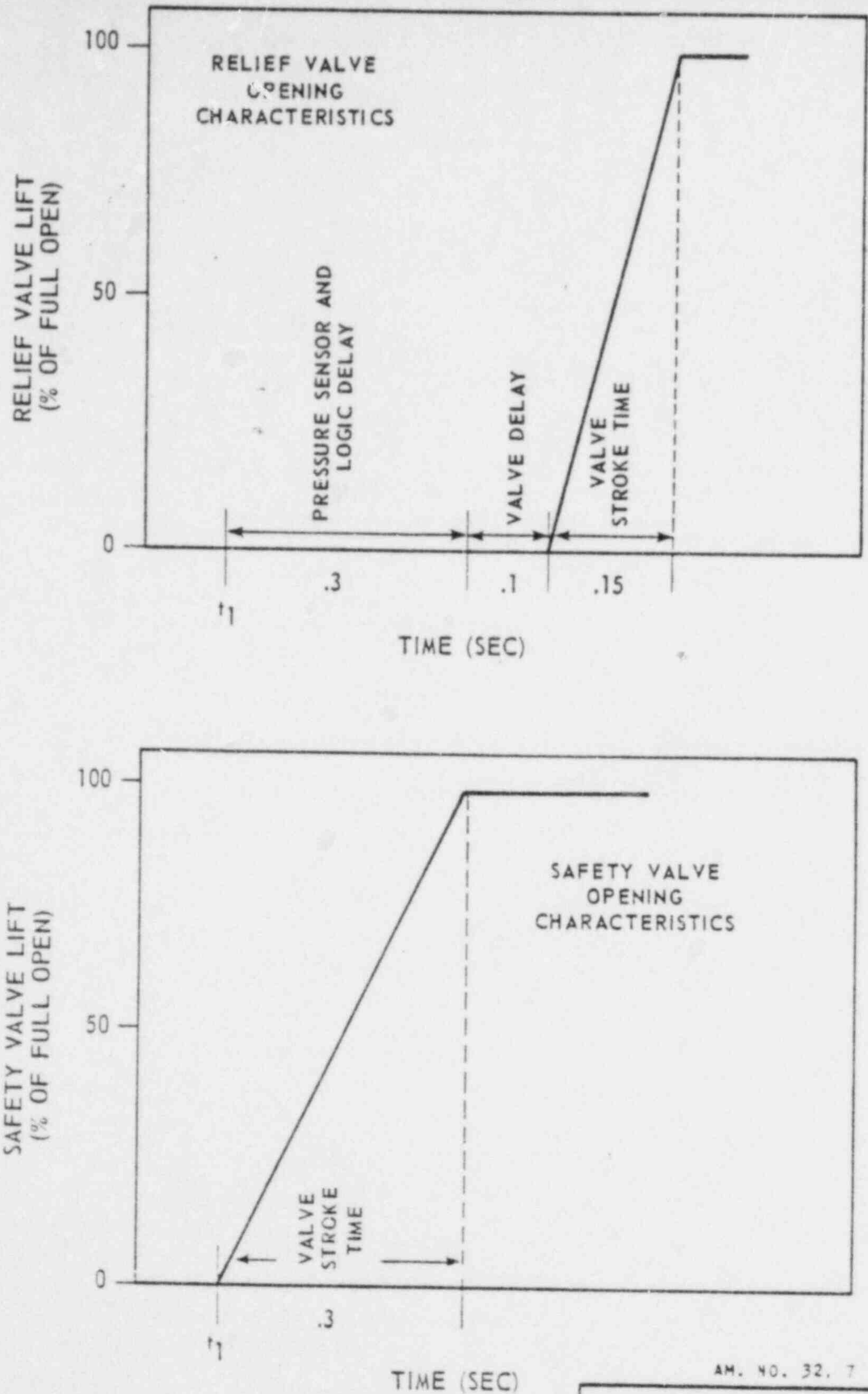
ATTACHMENT 1



t_1 - TIME AT WHICH PRESSURE EXCEEDS THE VALVE SET PRESSURE

AM. NO. 32, 7 18 75

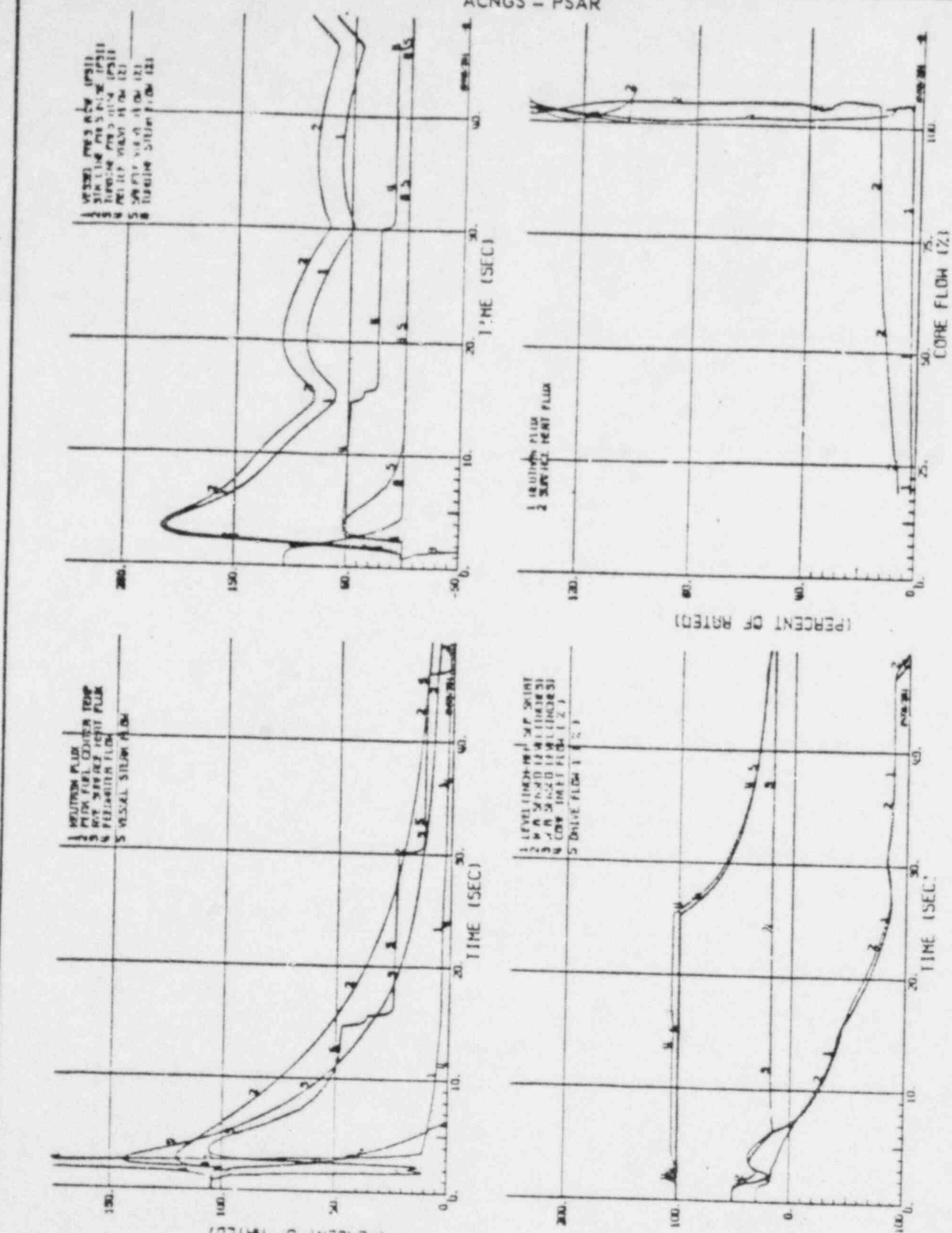
HOUSTON LIGHTING & POWER COMPANY
Allens Creek Nuclear Generating Station
Units 1 & 2

POWER ACTUATED AND SPRING ACTION VALVE LIFT CHARACTERISTICS

FIGURE 5.2-7

ATTACHMENT 2

ACNGS – PSAR



AM. NO. 42, (4/3/78)

HOUSTON LIGHTING & POWER COMPANY
Allens Creek Nuclear Generating Station
Unit 1

SAFETY VALVE SIZING ANALYSIS
(ALL MSIV CLOSURE, FLUX SCRAM)

FIGURE 5.2-1

STATE OF TEXAS §
§
COUNTY OF HARRIS §

BEFORE ME, THE UNDERSIGNED AUTHORITY, on this day personally appeared L.D. Richards, who upon his oath stated that he has answered interrogatories numbered 28-1, 31-2, 31-6, 31-11, 39-6, 40-2, 40-3, 40-6, 41-3, 41-4, 41-5, 41-6 and 41-7 of the foregoing Applicant's Further Answers to TexPIRG's Sixteenth Interrogatories in his capacity as Lead Engineer for Houston Lighting and Power Company, and all statements contained therein are true and correct to the best of his knowledge and belief.

Lonnie D. Richards
L.D. Richards

SUBSCRIBED AND SWORN TO BEFORE ME by the said L.D. Richards, on this 9th day of September, 1980.

Angela Nichols Smith
Notary Public in and for
Harris County, Texas

ANGELA NICHOLS SMITH
Notary Public in Harris County, Texas
My Commission Expires October 13, 1980

STATE OF TEXAS §
§
COUNTY OF HARRIS §

BEFORE ME, the undersigned authority, on this day personally appeared J. D. Guy, who upon his oath stated that he has answered each interrogatory with respect to Applicant's Further Answers to TexPirg's Sixteenth Interrogatories in his capacity as Manager of Corporate Planning for Houston Lighting & Power Company, and all statements contained therein are true and correct to the best of his knowledge and belief.

J. D. Guy

SUBSCRIBED AND SWORN TO BEFORE ME by the said J. D. Guy on this 24 day of September, 1980.

NOTARY PUBLIC IN AND FOR
HARRIS COUNTY, T E X A S

My Commission Expires: 5/19/81

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	§	
	§	
HOUSTON LIGHTING & POWER COMPANY	§	
	§	Docket No. 50-466
	§	
(Allens Creek Nuclear Generating Station, Unit No. 1)	§	
	§	
	§	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing Applicant's Further Answers to TexPirg's Sixteenth Interrogatories in the above-captioned proceeding were served on the following by deposit in the United States mail, postage prepaid, or by hand-delivery this 12th day of September, 1980.

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