UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

OFFICE OF THE SECRETARY

CERTIFICATION

I hereby certify that I am employed by the United States Nuclear Regulatory Commission (NRC), that I am the Acting Chief of the Docketing and Service Branch of the Office of the Secretary and as such I am the official custodian of the adjudicatory docket maintained by the Secretary of the Commission in the discharge of his responsibilities under 10 CFR Sec. 2.702. The official NRC adjudicatory docket includes the document described below, a copy of which is attached. I further certify that the attached document is a true and correct copy and is kept by the Docketing and Service Branch of the Office of the Secretary in the regular course of business.

Transcript of hearing before the Atomic Safety and Licensing Board, including attachments, dated November 12, 1975, docketed November 14, 1975 and containing pages 462-575. The transcript covers a portion of the hearing held by the Licensing Board in the South Texas proceeding (Docket No. STN 50-498/499-OL) in Bay City, Texas on Wednesday, November 12, 1975.

Emile L. Julian — 7/18/89
Emile L. Julian — Date

I hereby certify that the person whose signature appears above is the official custodian of this information on file in the Office of the Secretary to which certification is made and was official custodian at the time of executing the above certificate.

John C. Hoyle
John C. Hoyle, Assistant Secretary
Office of the Secretary of the Commission

July 18, 1989
Date

Attachment: As stated

NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

HOUSTON LIGHTING AND POWER CO.,
et al.

(South Texas Project,
Units 1 and 2)

Docket Nos. STN 50-498
STN 50-499

Place - Bay City, Texas

Date - Wednesday, 12 November 1975

Pages 462 - 575

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the Matter of: :

HOUSTON LIGHTING AND POWER CO., : Docket Nos. STN 50-498
et al. : STN 50-499

(South Texas Project, Units 1 and :
2) :

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Oasis Motor Hotel
Highway 35 West
Bay City, Texas

Wednesday, 12 November 1975

Hearing in the above-entitled matter was convened, pursuant to notice, at 10:00 a.m.

BEFORE:

MRS. ELIZABETH S. BOWERS, Chairperson
Atomic Safety and Licensing Board

FREDERICK J. SHON, Member

DR. CADET H. HAND, Member

APPEARANCES:

MELBERT SCHWARZ and GREGORY COPELAND, Esqs., Baker and Botts, 3000 One Shell Plaza, Houston, Texas 77002; and JACK R. NEWMAN, MAURICE AXELRAD and J. A. BOUKNIGHT, JR., Esqs., Lowenstein, Newman, Reis and Axelrad, 1025 Connecticut Avenue, N. W., Washington, D. C. 20036; on behalf of the Applicant, Houston Lighting & Power.

ROBERT L. PENDERGRAFT and PAUL G. GOSSELINK, Esqs., Office of the Attorney General, Supreme Court Building, Austin, Texas 78711; on behalf of the State of Texas.

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APPEARANCES: (continued)

IVER STRIDIRON and ALBERT V. CARR, Esqs., Office of the Executive Legal Director, Nuclear Regulatory Commission, Washington, D. C.; on behalf of the Nuclear Regulatory Staff.

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C O N T E N T S

E X H I B I T S

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P R O C E E D I N G S

MRS. BOWERS: On July 19, 1974, the Commission published in the Federal Register 39 FR 26472, a Notice of Hearing on an application for a construction permit. A prehearing conference was held on February 6, 1975, and an evidentiary hearing on environmental issues and safety issues related to site suitability was held on April 22 and 1975.

After the hearing the Regulatory Staff requested that the Board defer its decision until the Staff could issue its position on the applicability to the South Texas Project, a new Commission regulation on "as low as practicable" radiological releases.

The record was later reopened to receive the new information and the decision was issued on August 7, 1975. That partial initial decision authorized the issuance of a limited work authorization to the applicant. This meant that the Applicant could proceed at its own risk to perform certain preliminary work at the site.

On October 24, 1975, the Board issued the notice for the evidentiary hearing on health and safety issues. I read those issues at the prehearing conference on February 6, 1975, but since some time has passed, I will repeat them quickly now:

We must determinine, one, whether, in accordance with

the provisions of 10 CFR 50.35 a, small a, the Applicants have described the proposed design of the facilities, including but not limited to the principal architectural and engineering criteria for the design, and have identified the major features or components incorporated therein for the protection of the health and safety of the public; b, such further technical or design information as may be required to complete the safety analysis and which can reasonable be left for later consideration, will be supplied in the Final Safety Analysis Report; c, safety features or components, if any, which require research and development have been described by the Applicants and the Applicants have identified and there will be conducted a research and development program recently designed to solve any safety questions associated with such features or components; and, d, on the basis of the foregoing there is reasonable assurance that, (1) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of construction of the proposed facilities; and (2), taking into consideration the criteria contained in 10 CFR Part 100, the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public.

Number 2, whether the Applicants are technically qualified to design nd construct the proposed facility.

Number 3, whether the Applicants are financially qualified to design and construct the proposed facility; and

Last, number 4, whether the issuance of permits for construction of the facility will be inimical to the common advantage and security or to the health and safety of the public.

The notice stated that the public is invited and the limited appearance statements will be accepted. And oral presentations will be limited to five minutes, but written statements without limitation on length, may be inserted in the docket.

We will call for limited appearances shortly.

I have introduced the Board on two prior occasions, but some of you may be attending for the first time today.

I am Elizabeth Bowers. I am a lawyer. I am a member of the Kansas Bar and for the last 24 years I have been involved in federal administrative hearings. The first 15 years as a trial attorney, and since then as a presiding officer under various titles.

On my left is Mr. Frederick J. Shon. His education and experience has been in the field of nuclear reactors. Prior to joining this panel on a full-time basis, he was the Assistant Director for Nuclear Facilities, Division of Operation Savety, U.S. Atomic Energy Commission. I think I failed to mention that his background, his

educational background, is both in physics and in engineering.

On my right is Dr. Cadet H. Hand, who is the Director of the Bodega Bay Marine Laboratory for the University of California at Berkeley. I am going to tell a little secret that I was able to find out from Dr. Hand that I think you might be interested in. One of the reasons that Emperor Hirohito wanted to visit America was to meet Dr. Hand, who he has been corresponding with for many years in the area of marine biology. So the Emperor invited Dr. Hand to San Francisco and they exchanged gifts and had an hour's discussion through an interpreter on marine biology, which I think is a very interesting thing.

DR. HAND: We didn't say a word about nuclear reactors or bombs.

MRS. BOWERS: I would like to now call for appearances of the parties.

Is the Applicant present?

MR. SCHWARZ: Yes, Mrs. Bowers. With the Board's permission, I would suggest I remain seated with reference to the use of the microphone.

MRS. BOWERS: Fine.

MR. SCHWARZ: Mrs. Bowers and Members of the Board, my name is Melbert D. Schwarz. I am appearing on behalf of the Applicant, Houston Lighting and Power Company, Project

Manager for the South Texas Project. The participants in the project are the Public Service Board of San Antonio, Central Texas Power and Light Company, City of Austin, Texas, and the Applicant.

I am with the Houston firm of Baker & Botts, located at 3000 One Shell Plaza, Houston, Texas. Telephone 713 229-1234. Appearing with me today are Gregory Copeland. His telephone number is 713 229-1301. Same address.

Also appearing on behalf of the Applicant are Mr. Jack R. Newman, Mr. Maurice Axelrad and Mr. J.A. Bouknight, Jr., of the Washington firm of Lowenstein, Newman, Reis and Axelrad. Messrs. Newman, Axelrad and Bouknight have as their address, 1025 Connecticut Avenue, Northwest, Washington, D. C. 20036 and their telephone number is 202 833-8371.

Each of us have filed a formal appearance in this proceeding.

MRS. BOWERS: Thank you, Mr. Schwarz.

Is the State of Texas represented today?

MR. PENDERGRAFT: May it please the Board, Mrs. Bowers, my name is Robert L. Pendergraft. To my left is my co-counsel, Mr. Paul G. Gosselink. We are from the Office of the Attorney General, State of Texas, Supreme Court Building, Austin, Texas 78711. Area Code 512 475-4143.

MRS. BOWERS: Thank you, Mr. Pendergraft.

Is the Nuclear Regulatory Commission Staff present?

MR. STRIDIRON: Yes. I am Iver Stridiron. On my left is Albert Carr. Together we represent the Staff of the Nuclear Regulatory Commission.

MRS. BOWERS: The Applicant distributed a proposed agenda just prior to the commencemtn of this proceeding. The Board has reviewed it andfinds it satisfactory.

Mr. Pendergraft, have you had a chance to look over it?

MR. PENDERGRAFT: Yes, we have. It is satisfactory with the State.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: It is also satisfactory with the Staff.

MRS. BOWERS: Number 3 on the agenda: opening statements.

Mr. Schwarz, do you have an opening statement?

MR. SCHWARZ: Yes. We do, Mrs. Bowers.

On behalf of the participants in the South Texas Project, we would like to welcome the Board to South Texas again.

My opening statement is directed at some suggested procedures for conduct of the hearing, and a general overview of the direct case which will be presented by the Applicant.

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Our direct case will essentially be in written form, as required by the Commission's rules, the testimony comprising the Applicant's direct case has been furnished previously in writing to the Board and to the parties. On November 4th, the Board issued nine quesitons to the Applicant and to the Staff, advising that the Board would expect the parties to present witnesses who would be responsive to these questions.

Applicant transmitted under cover of a letter dated November 5, 1975, to the Board and parties, a book of prepared testimony. The book included the qualifications of each of Applicant's primary witnesses, including those witnesses who will sit on the panel of technical experts presented by the Applicant for responses to the questions previously submitted by the Board and other questions that the Board may have. It shall rely on these materials and these witnesses in the presentation of our direct case.

As a matter of procedure, subject to the Board's approval, of course, we propose the identification, swearing and qualification of each of Applicant's primary witnesses. At that time, we propose to identify Applicant's exhibits.

As I have already indicated, the primary testimony in support of the Applicant's direct case has been submitted to the Board and the parties in writing.

In the interest of providing a better overall

understanding for those of our audience who have not had an opportunity to read these materials, we shall ask each of our witnesses to provide a brief oral summary of his prepared, substantive testimony.

In conjunction with this summary, the appropriate witness will provide the Applicant's response to the questions submitted by the Board on November 4.

Our direct case will begin with the testimony of Mr. George W. Oprea, Jr., Executive Vice-President of Houston Lighting and power Company, Project Manager. Mr. Oprea will testify generally concerning the background of the South Texas Project, financial qualifications of the participants, national security considerations, the organization of the Applicant itself, and the undertaking of the four participants in the project and of the Applicant, as project manager.

Mr. Oprea will also sponsor the Application. Mr. Oprea will not be a part of our technical panel, and we suggest that the Board may care to ask questions of Mr. Oprea concerning his testimony and perhaps the parties cross-examine Mr. Oprea, if they have any cross-examination, at the conclusion of his testimony. That is the discretion of the Board and the parties.

It is our intention to present a panel of witnesses, then, comprised of Dr. J. R. Sumpter, Mr. D. G. Barker,

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Mr. R. D. Gauncy, Mr. R. J. Klapper and Mr. D.R. Betterton, all of Houston Lighting and Power Company, and Dr. Douglas W. Peacock of Westinghouse Electric Corporation, Dr. Walter A. Rodger of Applicant's consultants, Nuclear Safety Associates, Mr. John T. Mooney of the architect-engineers and constructors, Brown and Root, Inc., and Mr. E. Douglas Schwantes, Jr., of Applicant's consultants, Woodward-Clyde.

Dr. Sumpter, who is manager for Houston Lighting and Power Company will address the safety analysis for the South Texas project and the technical qualifications of the Applicant and architect-engineer and constructor.

Dr. Sumpter will also sponsor the Preliminary Safety Analysis Report.

Dr. Peacock, who is Manager, Reactor Protection in the Pressurized Water Reactor Systems Division in the Westinghouse Electric Corporation, will discuss the RESAR-41 design and will sponsor the RESAR-41 Safety Analysis Report.

Dr. Peacock will also provide the Applicant's response to the first five written questions submitted by the Board. That is, through 5-A.

Mr. Barker, Manager of Quality Assurance Department or Houston Lighting and power Company, will present testimony on the quality assurance programs of the Applicant and the architect-engineering and constructor.

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Dr. Rodger of Nuclear Safety Associates, Applicant's consultant, will address the issue of compliance with Appendix I.

While we perceive that the last of the written questions submitted by the Board is essentially directed to the Staff, Dr. Rodger also will provide Applicant's response to this written question.

Mr. Gauny, Physicist for Housting Lighting and Power Company, will present testimony on occupational exposure at the South Texas Project plant.

Mr. Klapper, supervising engineer of Nuclear Safeguards and Licensing for Houston Lighting and Power Company, will address the matters concerning interface between the South Texas Project and the RESAR-41 reference design.

Mr. Betterton, Manager of the Environmental Protection Department for Houston Lighting and Power Company, will provide testimony concerning the monitoring program established to measure the settlement of facility structures and to measure regional ground surface subsidence.

Finally, Mr. Mooney, Engineering Project Manager assigned to the South Texas Project by the architect-engineer, Brown and Root, will verbally submit the Applicant's response to Question 5-B, 6 and 7, submitted by the Board.

Each of these witnesses, along with Mr. Schwantes,

of our consultant, Woodward-Clyde Consultants, will serve on a panel of experts which we shall present to respond to such questions as the Board or parties may have during the course of the hearing.

Mr. Mooney will also be available to answer questions on plant design and engineering, while Mr. Schwantes will be available to cover matters covering geotectonic evaluation of the site.

Mr. Klapper will act as moderator of this panel.

We believe that collectively our panel will be able to respond to all of the Board's questions on health and safety issues.

And at that time provide a reasonably balanced representation of the discipline and organizations whose work is reflected in the Preliminary Safety Analysis Report and in RESAR-41. As such, we believe that they will be in a position to respond to the Board's questions.

Nevertheless, these panel members are backed by additional witnessesin our audiences, should the questions require supplemental information not readily available from the primary panel.

We would suggest, however, that prior to the presentation of this panel of technical experts for the purpose of responding to questions or cross-examination, the Staff's direct case be placed in evidence, reserving the

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questions in cross-examination under both direct cases on health and safety matters, which have been received in evidence. It is our thought by following this procedure, the Board will be in the position to address questions to those members of either the Applicant or Staff's panel best able to supply the information sought by the Board.

Finally, I note that we recognize the importance of limited appearances.

We shall be prepared to respond to such appearances with sworn testimony on a schedule established by the Board, with due regard for the conveneince of those people who have taken the time and effort to appear.

On behalf of the South Texas Project participants, I wish to state that we welcome this opportunity to provide information to this Board and to assist this Board in developing the sound record necessary to execution of the responsibilityes which have been assigned to it by the Nuclear Regulatory Commission.

Thank you.

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MRS. BOWERS: Thank you, Mr. Schwarz.

Mr. Pendergraft, an opening statement?

MR. PENDERGRAFT: Only to say that on behalf of the Attorney General I welcome all of you all back to Texas again. It's good to see you again. Other than that, we will waive our opening statement.

MRS. BOWERS: Mr. Pendergraft, you look different. You lost your beard. Didn't you have a beard?

MR. PENDERGRAFT: It's still there. It's just a lot shorter.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: Yes, Mrs. Bowers, we do have an opening statement. The NRC Staff proposes to present our evidence through a panel of witnesses as we did earlier during the earlier evidentiary hearing. The panel we propose to offer is seated at my left and I would ask each member to rise as I introduce him.

Alexander Dromerick. Joe Boegli. Robert Waterfield. These gentlemen already participated during the environmental part of the statement and their statement of qualifications are part of the record.

The following members have not been sworn and at the appropriate time I will move they be sworn. Gordon Chipman, Marvin Dunenfeld, Ronald Gamble, and Jai Rajan.

Thank you, gentlemen. We will also introduce two

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pieces of evidence during the hearing. These are the Staff safety evaluation report and supplement to the SER. These documents will be sponsored by Mr. Dromerick, the licensing manager for this Commission.

Testimony in response to 10 CFR Part 50 will be sponsored in part by Mr. Boegli and Mr. Waterfield.

Mr. Fairobent, who sponsors this document, cannot be here today because of a previous appointment in another proceeding. Therefore, with leave of the Board, Mr. Dromerick again in his capacity as project manager, will sponsor Mr. Fairobent's testimony as well as his statement of professional qualifications.

In addition, the Staff prepared responses to written questions from this Board and Mr. Dromerick will sponsor these responses as one document.

We also have available today witnesses who can respond to any further questions by the Board or questions from the other parties.

Each of the documents I mentioned earlier have been served on the Board and the other parties, and the reporter has been supplied with the appropriate number of these documents.

That concludes my opening statement.

MRS. BOWERS: Thank you, Mr. Stridiron.

The next item on the agenda is to call for limited

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appearance statements.

Now, I brought the folder with me I had here last April, because there were several people who had written the Board requesting permission to make limited appearance statements, who did not appear at that environmental and safety-related and site suitability hearing.

So let me first start by calling those names.

Susie Novosad. Is she here, please?

Arthur L. Guess.

Roy H. Roussel.

H. W. Stickland.

John H. Wilson.

Bert C. Steves.

Well, then, are there people here today who would be interested in making a limited appearance statement? If so, please raise your hand.

The record will show no hands raised.

I think I saw the Mayor of Bay City come in a few minutes ago. Isn't he the one that told us he had a temporary job for 28 years?

MAYOR GUSMAN: Got two more to add to that now.

MRS. BOWERS: Mr. Schwarz, would you like to proceed of would you like a brief recess?

MR. SCHWARZ: We are ready to proceed, Mrs. Bowers.

Mrs. Bowers, I ask that the following persons be

sworn as Applicant's witnesses in this proceeding. It might be well if each stand as his name is called. This might help in identifying each witness.

Mr. George W. Oprea, Jr. Dr. James R. Sumpter. Mr. D. G. Barker. Mr. R. D. Gauny. Mr. R. J. Clapper. Mr. D. R. Betterton.

All of these gentlemen are of Houston Lighting and Power Company.

Dr. Douglas W. Peacock of Westinghouse Corporation.

Dr. Walton A. Rodger of Nuclear Safety Associates.

Mr. J. T. Mooney of Brown & Root, and Mr. E. Schwantes of Woodward Line.

Mrs. Bowers, some of these witnesses were sworn before and their qualifications were placed in evidence.

However, with the thought of having a complete record, both of the prior hearing and at this hearing, we have submitted their qualifications again, in the booklet that was furnished.

MRS. BOWERS: You are asking now that they be sworn? Is that right?

MR. SCHWARZ: Yes.

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Whereupon,

GEORGE W. OPREA, JR.
JAMES R. SUMPTER,
D. G. BARKER,
R. D. GAUNY,
R. J. KLAPPER
D. R. BETTERTON,
DOUGLAS W. PEACOCK,
WALTON A. RODGER,
J. T. MOONEY
and
E. DOUGLAS SCHWANTES, JR.

XXXXXX were called as witnesses and, having been first duly sworn, were examined and testified as follows:

BY MR. SCHWARZ:

Q Have each of you prepared a statement of your education and professional qualifications for introduction in this evidence?

(Chorus of yeses.)

MR. SCHWARZ: Statements of education and professional qualifications for each of these witnesses were included in the book of prepared testiomny submitted to the Board on September 5. Mr. Oprea's qualifications are set forth on tab 4. Dr. Peacock's under tab 6, Mr. Barker's under tab y, Dr. Rodger under tab 8, Mr. Gauny's under tab 9,

Mr. Clapper's under tab 10, Mr. Betterton's under tab 11, Mr. Mooney's under tab 12, and Mr. Schwantes' under tab 13.

BY MR. SCHWARZ:

Q. I ask each of you, were each respective statement of educational and professional qualifications prepared by you or under your supervision?

(Chorus of yeses.)

Q. Do any of you have any corrections or modifications or additions to those statements?

(No response.)

Q. Are each of these statements correct and true to the knowledge of your belief?

(Chorus of yeses.)

Q. Do each of you adopt your statement and qualifications --

(Chorus of yeses.)

MR. SCHWARZ: I ask that George W. Oprea, Jr., James R. Sumpter, D. G. Barker, R. D. Gauny, R. J. Clapper, D. R. Betterton, Douglas W. Peacock, Walton A. Rodger, J. T. Mooney, and E. Douglas Schwantes, Jr., appearing under tabs 4 through 13 of the prepared testimony submitted to the Board be incorporated into the record as though read. I have furnished sufficient copies to the reporter.

MRS. BOWERS: Thank you. Mr. Pendergraft, any objection?

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MR. PENDERGRAFT: The State has no objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: The qualifications identified will be physically inserted in the transcript as if read.

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS

George W. Oprea, Jr.
Executive Vice President
Houston Lighting & Power Company

My name is George W. Oprea, Jr. I am Executive Vice President of Houston Lighting & Power Company. In this capacity I am responsible for overall administration of the Engineering Department, Transmission & Distribution Department, Energy Production Department, Power Plant Engineering & Construction Department, Energy Control and Dispatching Department, Quality Assurance Department, and Environmental and Inter-Utility Affairs Department.

I am a 1952 graduate of Rice University and hold a Bachelor of Arts and Bachelor of Science degree in Electrical Engineering. I joined Houston Lighting & Power Company that year in the Distribution Planning Section of the Engineering Department. I later worked in Computer Applications Engineering for System Planning, and in March, 1965, was named Superintendent of the Engineering Planning Division. I became the Energy Control Center Project Manager in March, 1967, Manager, Energy Control & Dispatching Department in June, 1970, and Manager, Energy Control and Nuclear Program in April, 1971. In November, 1971, I was elected Vice President-Operations, and in January, 1973, I was elected a Group Vice President. In December, 1974, I was elected Executive Vice President and assumed my

present duties.

I am a registered professional engineer in Texas, a senior member of the Institute of Electrical and Electronic Engineers and former member of the Computer Applications Subcommittee, a past Director and Past President of the Engineers Council of Houston, a member of the Association of Computing Machinery and of the Society of Information Display, a past member and Vice Chairman of Edison Electric Institute Computer Task Force, a member of the Houston Chamber of Commerce, the Atomic Industrial Forum, the American Nuclear Society, the Edison Electric Institute Executive Advisory Committee on Nuclear Power and the Texas A&M Research Foundation. I am a retired Captain in the Naval Reserve.

My responsibilities in connection with the South Texas Project include general supervision of the project management team which reports to me through the General Manager, Power Plant Engineering & Construction Department, thus assuring planned coordination of related support activities including environmental planning. The corporate quality assurance department reports directly to me. I have also been a member or alternate member of the South Texas Project Management Committee and the forerunners of that committee since

the commencement of studies on the feasibility of this Project in 1971. In these capacities I have been involved in the overall planning for the Project.

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS

James R. Sumpter
Manager-Nuclear Division, Power Plant
Engineering and Construction Department
Houston Lighting & Power Company

My name is James R. Sumpter. My business address is 611 Walker, Houston, Texas 77001. I am Manager - Nuclear Division of the Power Plant Engineering and Construction Department for Houston Lighting & Power Company. I joined the Company in August, 1972, and am responsible for the nuclear system design, engineering, safety analysis, licensing, and fuel management for all Houston Lighting & Power Company's nuclear power plants including the South Texas Project Nuclear Generating Station, for which that Company acts as Project Manager. I was also involved in the decisions concerning fuel supply for that Project.

I received a Bachelor of Science degree in Engineering Science from the Pennsylvania State University in 1965, a Master of Science degree in Nuclear Engineering from the University of Michigan in 1967 and a Ph.D. in Nuclear Engineering from Texas A & M University in 1970. My dissertation was concerned with the study of xenon oscillations during power reactor transient operation.

In the summers of 1964 and 1965 I was employed at the Bettis Atomic Power Laboratory in the mechanical and nuclear design of naval reactors. In the summer of 1967, I was employed at the Los Alamos Scientific

Laboratory as a research physicist concerned with the theoretical and experimental study of critical assembly designs. Intermittently from 1968-1972, I was employed part-time teaching radioisotope laboratory and mathematics courses at local high schools and colleges.

From 1970-1972 I was employed as a Nuclear Analyst with Sargent & Lundy Engineers. I had responsibilities involving radwaste systems design, health physics, shielding, radiation monitoring system design, equipment procurement, overall plant engineering design and the associated licensing for several nuclear power stations.

I am a member of the American Nuclear Society, Sigma Pi Sigma, the Sierra Club and am Secretary of ANSI/N45-8.1, a subcommittee of ANSI/N45-8, Nuclear Power Plant Air Cleaning Components and Units.

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS

D. G. Barker
Manager, Quality Assurance Department
Houston Lighting & Power Company

My name is D. G. Barker. My business address is 611 Walker, Houston, Texas 77001. I am the Manager, Quality Assurance Department, responsible for the development, implementation, management, and surveillance of the Corporate Quality Assurance Program and the South Texas Project Quality Assurance Plan. I report directly to Mr. G. W. Oprea, Jr., Executive Vice President.

I graduated from Texas A & M University in 1967 with a Bachelor of Science degree in Mechanical Engineering and in 1968 received a Masters of Engineering degree in Nuclear Engineering. While working on a BS degree, I was employed by Union Carbide Corporation, from 1965 to 1966, as a Mechanical Engineer in the Engineering Machinery Group. My responsibilities were in the areas of maintenance design, vibration analysis, and economic analysis on process equipment.

From 1966 to 1968, I was employed as a Research Assistant and later as a Coordinating Engineer at the Nuclear Science Center under the Texas Engineering Experiment Station of the Texas A & M University System. There I performed work in the analysis, design, fabrication and testing of equipment used in the Triga Reactor Conversion. I also performed work in licensing, flux

measurements, activation analysis, health physics, programming, gamma ray spectroscopy, and high energy gamma ray attenuation.

In 1968, I joined the Nuclear Division of Todd Shipyards Corporation as a Nuclear Engineer. In this position, I performed analysis and calculations in reactor physics, shielding, thermal hydraulics, mechanical design and vibrations in support of the N. S. SAVANNAH Program. Other duties performed included material evaluation, design review, physics testing, refueling and operations technical support. Later I was assigned as Project Engineer for the N. S. SAVANNAH Core II where I was responsible for the supervision and coordination of the efforts of engineers, technicians, subcontractors and vendors involved in the evaluation of the nuclear and mechanical adequacy of the N. S. SAVANNAH Core II which included the redesign of the fuel assembly, material procurement, the design of modification fixtures, writing of procedures and test specifications, establishing quality assurance requirements, design and operation of fuel assembly testing facilities and administrative and management functions.

From 1971 to 1972, I worked at the H. B. Zachry Company as a Quality Assurance Supervisor assisting

in the establishment of the company's Quality Assurance Program. In this capacity, I wrote sections of the H. B. Zachry Company Quality Assurance Manual, performed vendor audits and construction planning. Other duties in the office and in the field on power plant projects included estimating, job planning, engineering, cost accounting, welding engineering and preparation of job progress reports.

In 1972, I joined Houston Lighting & Power Company as a Nuclear Engineer and in 1973, I was appointed Manager of the Quality Assurance Department.

I am a registered Professional Engineer in Texas. I am a member of the American Nuclear Society and the American Society of Mechanical Engineers.

Educational and Professional Qualifications

R. D. Gauny
Health Physicist - Nuclear Division,
Houston Lighting & Power Company

My name is R. D. Gauny. My business address is 611 Walker, Houston, Texas 77001. I am the Health Physicist in the Nuclear Division of the Power Plant Engineering and Construction Department of Houston Lighting & Power Company. I joined the Company in June, 1974, and am responsible for health physics and security for the South Texas Project Nuclear Generating Station, for which Houston Lighting & Power Company acts as Project Manager.

I graduated in 1967 from San Antonio College, San Antonio, Texas, with an Associate of Science Degree in Physics and Mathematics. From 1967 to 1969, I worked for the National Science Foundation in an effort to find and identify new sub-atomic particles. During this same period, I conducted a Physics Laboratory for Our Lady of the Lake College in San Antonio, Texas. In 1969, I obtained my Bachelor of Science in Physics and Mathematics from Trinity University, San Antonio, Texas. In 1971, I graduated with my Master of Science Degree in Bio-physics (Health Physics specialization) at Texas A & M University under a United States Public Health Service Traineeship. Under this traineeship extensive experience was obtained in the use of the Texas A & M Nuclear Reactors, Cyclotron and Cobalt-60

irradiation facilities. In-depth studies were conducted in radiation theory, instrumentation, shielding, isotope technology, radiation biology, radiation chemistry, and federal and state regulations.

During 1971 and 1972, I managed the Instrumentation and Material Accountability Branch at Charleston Naval Shipyard. As Branch Head, I assumed the responsibility for the proper accountability and disposition of radioactive material related to the Navy Nuclear Propulsion Program. In this capacity, I developed standard operating procedures to control the functions of the group and assure compliance with naval rules and regulations.

I joined Stone & Webster Engineering Corporation in July 1972 as an Engineer in the Materials Engineering Division. In October 1972, I was made the Assistant Radiological Safety Officer for the corporation. In May 1973 I was appointed Corporate Radiological Safety Officer for U.S. operations. I organized the record keeping, training and auditing practices of the Radiological Safety Office and developed field work practices and procedures to protect the personnel and to assure compliance with state and federal regulations. I developed a three-volume Radio-

logical Safety Manual detailing corporate policy, work practices, record keeping procedures, and equipment specifications. I also organized the Radiological Safety Office system to utilize the computer for record management.

In June of 1974, I joined Houston Lighting & Power Company in the capacity of Health Physicist. I have visited the sites and/or worked with twenty-seven planned or operating commerical nuclear reactors at fifteen sites, four navy nuclear plants, two test reactors, and the navy training facility at Knolls Atomic Power Laboratory. I am a member of the Health Physics Society, the American Nuclear Society and the National Physics Honor Society.

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS

R. J. Klapper
Supervising Engineer, Nuclear Safeguards & Licensing
Houston Lighting & Power Company

My name is R. J. Klapper. My business address is 611 Walker, Houston, Texas 77001. I am the Supervising Engineer of Nuclear Safeguards and Licensing in Houston Lighting & Power Company.

I graduated from Texas A&M University in 1971 with a Bachelor of Science degree in Nuclear Engineering and in 1972 received a Master of Engineering in Nuclear Engineering.

During the summer of 1970, I worked for the Tennessee Valley Authority in their Nuclear Engineering Branch. There I worked on nuclear steam supply system evaluations and off-gas systems.

In August of 1972, I joined Houston Lighting & Power Company and worked in the engineering design section of the Nuclear Program. During this period, I worked on bid evaluations and engineering design review.

In February of 1973, I was transferred to the Nuclear Safeguards and Licensing Section of the Nuclear Department. In this position, I was responsible for the licensing of the Allens Creek Nuclear Generating Station. During this time I attended the General Electric BWR Design Orientation course.

In August of 1974, I was promoted to Project Engineer working on the South Texas Project. In this

position I was primarily responsible for the coordination of the Engineering review in the areas of civil engineering, mechanical/nuclear engineering and licensing. I was also a member of the South Texas Project group responsible for the coordination of site activities.

In March 1975, I was promoted to Supervising Engineer - Nuclear Safeguards and Licensing.

EDUCATIONAL & PROFESSIONAL QUALIFICATIONS

Donald R. Betterton
Manager, Environmental Protection Department
Houston Lighting & Power Company

My name is Donald R. Betterton. I am Manager of the Environmental Protection Department of Houston Lighting & Power Company. In this capacity I am responsible for collection and evaluation of the various technical considerations associated with the environment. These considerations involve the areas of site selection criteria, radioactive dispersion, thermal effects, air and water quality considerations and environmental surveillance, including meteorological monitoring, geophysical testing, hydrological evaluations, and all offsite operational effects of the nuclear power plant. In connection with the South Texas Project, I had managerial responsibility on the Project Manager's Staff for the preparation of the Environmental Report and environmental considerations required in support of its Safety Analysis Report. My responsibility also includes acquisition of all local, state and federal permits and approvals exclusive of NRC licensing. I report to the Vice President, Environmental and Inter-Utility Affairs of Houston Lighting & Power Company.

I graduated from the University of Houston in 1970 with a BS in Civil Engineering. In 1958 I joined Houston Lighting & Power Company as an Engineering Assistant in the Surveying Section of the Engineering

Department. In this capacity I performed various calculations required for horizontal and vertical control in connection with design and construction of roads, railroads, canals, substations, power plants, etc. I utilized computers to solve multiple three-point problems for control of the Houston Lighting & Power planimetric mapping system and least squares adjustment of Houston Lighting & Power Company supplemental traverses in the Houston area.

In February of 1963, I was transferred to the Civil Engineering Division where I became involved in the design of transmission towers and foundations. During this period I assisted in the analysis and design of several 138 kv transmission line structures. I also worked on foundation analysis and design including straight shaft, underream, multiplier, and pile foundations required for transmission structures.

In 1966 I was assigned to the Design Engineering Division and became responsible for design of paving and drainage facilities for all Houston Lighting & Power Company substations. I was also responsible for the Standards Section where I designed substation structures and components to be utilized as standard structures.

In 1968 I was given special assignment in the environmental area which included hydraulic, biological, and thermal effects of power plant cooling water discharges. I was appointed Supervisor of Environmental Protection in 1970 and Manager of Environmental Protection in 1972.

I am a member of the Texas Society of Professional Engineers, Houston Engineering and Scientific Society, and Texas Water Pollution Control Association.

PROFESSIONAL QUALIFICATIONS

Douglas W. Peacock
Pressurized Water Reactor Systems Division
Westinghouse Electric Corporation

My name is Douglas W. Peacock. My business address is P. O. Box 355, Pittsburgh, Pennsylvania 15230. I am employed by Westinghouse as Manager, Reactor Protection in the Pressurized Water Reactor Systems Division and I have served in this capacity since 1972. I am responsible for the functional adequacy of reactor protection systems. In this capacity I have been active in the regulatory review process for the RESAR-41 Preliminary Design Approval, the South Texas Project Nuclear Generating Station, and other RESAR-41 projects.

I graduated from Washington State University with a B.S. degree in Chemical Engineering in 1962, and graduated from the University of Illinois with a Ph.D. degree in Physical Chemistry in 1966.

Following my academic training, I joined Douglas United Nuclear Company, a prime contractor to the Atomic Energy Commission responsible for the operation of the Hanford reactors and fuel fabrication facilities. Between 1966 and 1969, I held various engineering assignments involving analysis of reactor operation and special materials production programs. During 1969 and 1970, I assumed technical management positions with responsibility for fuel development programs, safety analysis and licensing studies, and

safety research and development activities related to the Hanford N Reactor. In 1971, as Manager, Process Technology, I had an overall responsibility for process technical support functions and operational safety aspects of the Hanford N Reactor and Fuel Fabrication facilities. Since 1972, I have been employed by Westinghouse in various safety and licensing management positions. In this capacity I have been responsible for establishing safety criteria, conducting safety evaluations of system and component design, preparing documentation for safety analysis reports, providing safety system performance requirements, developing analytical methods for safety analysis, and representing Westinghouse before regulatory organizations in the licensing process of numerous power reactors and regulatory review of generic technical matters.

I have made contributions to public and industry discussions on nuclear power technology and I have lectured in the Nuclear Power Reactor Safety Program at Massachusetts Institute of Technology. I am a member of the American Nuclear Society.

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS

Walton A. Rodger
Nuclear Safety Associates

My name is Walton A. Rodger. I am a partner in the nuclear consulting firm Nuclear Safety Associates, Bethesda, Maryland, and have held this position for the past ten years. The four years prior to that I was Vice President of Nuclear Fuel Services, Inc., serving as its Technical Director and later as General Manager of its West Valley plant. In the latter position I was responsible for the construction, startup, and licensing of the world's first privately owned nuclear fuel reprocessing plant.

From 1960 to 1962, I was a partner in the nuclear consulting firm of McLain Rodger Associates. Before entering the consulting field, I spent 13 years at Argonne National Laboratory, four at Oak Ridge National Laboratory, and one at the Metallurgical Laboratory of the University of Chicago. At all three I was active in the development of all of the various processes which have been considered for use in reprocessing of nuclear fuel. I also did a great deal of work in the field of radioactive waste management. At Argonne I was Associate Director of the Chemical Engineering Division. My total experience in the nuclear field has covered 33 years.

I was graduated in both Chemical and Metallurgi-

cal Engineering from the University of Michigan in 1939. I obtained my Master's Degree in Chemical Engineering from the same institution in 1940. My Doctorate in Chemical Engineering was awarded by the Illinois Institute of Technology in 1956.

I am the author of sections of several nuclear handbooks and have published more than two dozen papers in the nuclear field, largely on reprocessing and waste disposal. I am a member of AICHE, and in 1960 was Chairman of the Nuclear Engineering Division of the Institute. I am also a member of American Nuclear Society and Atomic Industrial Forum. I am past chairman of the ANSI Committee N-48 which is developing standards for the disposal of solid nuclear waste. In 1959, I served as Technical Consultant to the Joint Committee on Atomic Energy of the 86th Congress at the Hearings on Industrial Radioactive Waste Disposal. For the past two years I have served as a principal witness for the Consolidated Utility Group in the As Low As Practicable Rule Making Hearing (RM-50-2). In this capacity I have done extensive cost-benefit studies on LWR radwaste systems.

EDUCATIONAL & PROFESSIONAL QUALIFICATIONS

John T. Mooney
Engineering Project Manager
Brown & Root, Inc.

My name is John T. Mooney. My business address is 5100 Clinton Drive, Houston, Texas. I am employed by Brown & Root, Inc. and serve as the Engineering Project Manager assigned to the South Texas Project. In this position I am responsible at Brown & Root for the overall engineering and design of the South Texas Project Nuclear Generating Station, including plant structures, systems, site development and cooling facilities.

In 1953 I received my Bachelor's degree in chemical engineering from Villanova University. After graduation, I was employed by Goodyear Atomic Corporation in connection with the start-up and operation of the gaseous diffusion enrichment facility at Portsmouth, Ohio.

Previously, I have had responsible engineering assignments for another architect-engineer firm in the design of the Indian Point Units 2 and 3 of Consolidated Edison Company and Brunswick Units 1 and 2 of Carolina Power and Light Company. My previous experience also includes seven years at Bettis Atomic Power Laboratory in the design of power plant mechanical apparatus and plant start-up activities for the Naval Nuclear Propulsion Program.

I am a registered Professional Engineer in Pennsylvania, North Carolina and Tennessee.

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS

E. Douglas Schwantes, Jr.
Senior Project Engineer
Woodward-Clyde Consultants

My name is E. Douglas Schwantes, Jr. I am employed by Woodward-Clyde Consultants of Oakland, California, as Senior Project Engineer. I joined Woodward-Clyde Consultants in 1972, and I am their project manager for the South Texas Project, responsible for coordinating all aspects of the geotechnic investigation in connection with the licensing and design of that nuclear generating facility. In this capacity I have assisted in the preparation of the geotechnical sections of the Preliminary Safety Analysis Report and other documents.

In 1960 I received a Bachelor of Science degree in Civil Engineering from the University of Illinois, and, following a period of employment, I received the Master of Science degree in Civil Engineering from the same university in 1965.

From 1960 to 1962 I served as a Lieutenant, junior grade, with the U.S. Coast and Geodetic Survey in Washington, D.C. In 1963 I was employed as a Civil Engineer by Slope Indicator Company, Division of Shannon & Wilson, Inc., Seattle, Washington. In 1965 I worked as a Soils Engineer for Harza Engineering Company, Chicago, Illinois, and from 1965 through 1972 I was employed as Project Engineer by Shannon & Wilson, Inc.

in Seattle, Washington.

I am a Registered Professional Engineer in the states of California, Illinois and Washington and hold membership in the American Society of Civil Engineers and the Association of Engineering Geologists. My publications include the following:

"Features of construction in landslide areas," Proceedings, Northwest Road and Street Conference, University of Washington, 1967.

"Landslide stabilization with slit-trench buttresses" with R. A. Adolfson, paper presented at the 17th Annual Conference on Soil Mechanics and Foundation Engineering, University of Minnesota, Minneapolis, 1970.

"The Baldwin Hills Reservoir failure in retrospect," with A. Casagrande and S. D. Wilson, Proceedings of the ASCE Specialty Conference on the Performance of Earth and Earth-Supported Structures, Purdue University, June, 1972.

In my professional experience I have been associated with many foundation engineering projects for industrial, commercial and residential sites, retaining structures, waterfront development, highway construction, dams, and landslide stabilization.

Some of the more significant of these include: the soil and foundation investigations for the Hanford No. 2 Nuclear Power Station near Richland, Washington; the foundation investigation and initial shoring studies for the 50-story Seattle First National Bank Building; the 24-story Pacific Northwest Bell Telephone Building in Seattle; a post-failure study of the soil conditions and design of the Baldwin Hills Reservoir in Los Angeles; design of remedial work to stabilize landslides in the Tukwila Interchange in Seattle; and stabilization of a major landslide in a confined area of Minneapolis, Minnesota, by use of an unusual system of slit-trench buttresses.

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MR. SCHWARZ: Thank you. We will move to identify exhibits now, so with leave of the Board I would ask that the witnesses be seated.

MRS. BOWERS: Fine.

MR. SCHWARZ: Mrs. Bowers, we have been in contact with the reporter and our exhibits have been delivered to him. I would ask that the Board approve the marking of the exhibits at this time. For ease of reference, tentative identification numbers consistent with those proposed in our submittal to the Board on November 4 have been placed on each exhibit. That is, the application as amended by amendments 1 through 3, as Applicant's Exhibit No. 7.

The preliminary safety analysis report, as amended by amendment 1 through 33, Applicant's Exhibit No. 8, and the RESAR-14 reference safety analysis report as amended by amendment 1 through 9 -- one through 19. I beg your pardon, Applicant's Exhibit No. 9.

If it is agreeable we would like to have those exhibits marked -- excuse me one second. I would like to correct that. The preliminary safety analysis report which we have for introduction as Applicant's Exhibit No. 8 includes amendments 1 through 34.

MRS. BOWERS: The proposed exhibits will be marked for identification as you indicated, 7, 8, and 9.

MR. SCHWARZ: Thank you.

(The documents referred to were marked Applicant's Exhibits 7, 8, and 9 for identification.)

MR. SCHWARZ: We would now call Mr. George W. Oprea, Jr., executive vice president of Houston Lighting and Power Company. He has been previously sworn.

BY MR. SCHWARZ:

Q. Do you have before you a document entitled Testimony of George W. Oprea, Jr., reopening statement on behalf of the South Texas Project Participants?

A. (Witness Oprea.) Yes.

Q. This document will be found under tab 14.

Was this document prepared by you or under your supervision?

A. Yes, it was.

Q. Is this document true and correct to the best of your knowledge and belief?

A. It is.

Q. Do you adopt the document entitled Testimony of George W. Oprea, Jr., reopening statement on behalf of the South Texas Project Participants and the Project Manager as your testimony in this proceeding?

A. I do.

MR. SCHWARZ: Mrs. Bowers, I ask that the 10page

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document identified by Mr. Oprea be incoporated in the record as though read. Copies have been furnished to the reporter.

MRS. BOWERS: Any comment, Mr. Pendergraft?

MR. PENDERGRAFT: The State has no objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: The Staff has no objection.

MRS. BOWERS: The prepared testimony will be physically incorporated into the transcript as if read.

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(The testimony follows.)

I. Introduction.

My name is George W. Oprea, Jr. I am Executive Vice President of Houston Lighting & Power Company, and I am responsible for that Company's nuclear program. A resume of my educational and professional qualifications has previously been received in evidence.

I wish to take this opportunity to welcome you again to South Texas.

The purpose of my testimony is to describe briefly the background for the South Texas Project and, in a general way, the undertakings of the Participants in support of the Project. These Participants are the City Public Service Board of the City of San Antonio, Central Power and Light Company, the City of Austin and Houston Lighting & Power Company. I shall also address the undertakings of Houston Lighting & Power Company, as Project Manager, in establishing its own capability to support the design, construction and safe operation of the South Texas Project Nuclear Generating Station. In addition, I shall sponsor the formal Application.

II. Application.

The Application for Construction Permits and Operating Licenses, as amended by Amendments 1 through 3, Applicant's Exhibit No. 7, was prepared under my

supervision by representatives of all Participants. The statements contained in the Application, as so amended, are true and correct to the best of my knowledge and belief.

Amendments 2 and 3 to the Application, which were filed on October 20, 1975, and October 30, 1975, respectively, brought up to date the information previously contained in the Application. They provided the current cost estimates for the South Texas Project Units 1 and 2, more current information as to the financial qualifications of the Participants, the currently planned net generating capability of the Participants, and miscellaneous information, such as memberships of Boards of Directors and principal officers. The Application, as amended, fully documents the financial qualification of the Participants to design and construct South Texas Projects Units 1 and 2.

III. Background for the South Texas Project.

The areas served by the four Participants in the Project encompass about the southern one-third of the State. According to the last census, these areas include four of the eight largest metropolitan areas in the State. It is each Participant's responsibility to provide the electricity which is needed to support the

growth and the living standards of the citizens of the area it serves. Moreover, the Participants are responsible for providing this electricity at a reasonable cost and in a manner that protects the environment as well as the health and safety of those persons in the vicinity of the proposed facility. I believe that each of the Participants has been successful in meeting its customers' needs and in being a good neighbor to those who live in the vicinity of its generating facilities. We are proud of this record and intend to perpetuate it.

The currently planned net generating capability of the four Participants in the Project through the year 1984, is shown in graphic form in amended Exhibit III to the Application. By comparing this projected capability with that included in the Application as originally filed in 1974, one notes certain reduction in the facilities planned by each of the Participants.

Since the hearing on environmental and site suitability matters the only significant reduction results from Houston Lighting & Power Company's recent decision to postpone indefinitely the construction of its Allens Creek Nuclear Generating Station, planned for a site in Austin County, Texas. None of the

Participants in the South Texas Project, other than Houston Lighting & Power Company is involved in the Allens Creek project. Therefore, the deferral of that project does not affect the plans of the other Participants in the South Texas Project.

From Houston Lighting & Power Company's standpoint, deferral of the Allens Creek project has made timely construction of the South Texas Project all the more important. This action further assures our ability to finance the remainder of our construction program, including Houston Lighting & Power Company's 30.8% share of the South Texas Project. As of December 31, 1974, Houston Lighting & Power Company's assets had a book value of $1,692,088,000. The Company's 1974 revenues were $486,837,000, all attributable to electric operations. The bonds of Houston Lighting & Power Company are rated AA by both Standard & Poor's Corporation and Moody's Investor Service, Inc.

The other Participants in the South Texas Project are likewise financially qualified to undertake their responsibilities with respect to the South Texas Project. Central Power and Light Company's assets were valued at $603,972,000 as of December 31, 1974, and Central's 1974 operating revenues were $223,595,000.

Central's bonds are also rated AA by both Standard & Poor's Corporation and Moody's Investor Service, Inc. Central is a wholly owned subsidiary of Central and South West Corporation. As of December 31, 1974 the consolidated balance sheet of Central and South West and its subsidiaries reflected assets of $1,788,708,000.

The City Public Service Board of San Antonio and the City of Austin are both municipally owned electric systems, serving metropolitan populations of about 1,300,000 and 335,000, respectively. In the fiscal year ended January 31, 1975 the City Public Service Board of San Antonio had electric system revenues of over $137,000,000. Its electric and gas system bonds are rated AA by both Moody's Investor Service, Inc. and Standard & Poor's Corporation. During the fiscal year ending September 30, 1974, the City of Austin had revenues from sales of electricity of over $57,000,000. Austin's revenue bonds enjoy a AA rating by both of those investment services.

Each of the Participants is mindful of its responsibility to provide adequate financial support to the Project. Each will finance its proportionate share of the Project, and, while the sources of funds will vary among the Participants, they will include funds on

hand, retained revenues, short term loans and commercial paper, and the sale of securities as required.

Less than one half of one percent of the common stock of Houston Lighting & Power Company and of Central and South West Corporation is owned by non-residents of the United States.

IV. Undertakings of the Participants.

As I indicated to this Board last April during the portion of this proceeding involving environmental and site suitability matters, the Participants in the Project approached this joint undertaking in a deliberate manner. In the latter part of 1971 a feasibility study was undertaken to determine the desirability of constructing and operating a jointly owned generating facility.

By the end of 1973 these Participants had entered into a formal agreement providing for a jointly owned and operated nuclear generating facility. Houston Lighting & Power Company was selected as Project Manager and charged with designing, licensing, constructing, maintaining and operating the Project facilities for the benefit of itself and the other Participants.

V. Undertaking of Project Manager.

Houston Lighting & Power Company fully

recognizes that as Project Manager it has the ultimate responsibility for the safe design, construction and operation of the South Texas Project Nuclear Generating Station. In order to discharge this responsbility, we commenced developing our in house nuclear capability in 1971. This involved additional training for some of our existing personnel and the hiring of a number of new employees who already had experience in the nuclear phase of the electric industry. I participated directly in assembling and organizing this in house capability which continues to report to me.

The Project Manager's Staff is complemented by a strong support team comprised of Brown & Root, Inc., the Architect-Engineer and Constructor for the Project, and Westinghouse Electric Corporation, the supplier of the nuclear steam supply systems and the fabricator of the fuel for each of Units 1 and 2. Brown & Root is known favorably to the Project Participants as a result of its experience as a designer and constructor of fossil fuel facilities and through its reputation in the engineering and construction of other large and complex facilities. Brown & Root brings to this Project substantial nuclear experience, both from the addition of personnel within its organization and

the use of experienced subcontractors such as NUS Corporation, Woodward-Clyde, Consultants and others.

Westinghouse Electric Corporation needs no introduction to the nuclear power industry. It is a recognized leader in this field. Dr. Sumpter will present a more detailed discussion of the technical qualifications of Houston Lighting & Power Company, Brown & Root and Westinghouse.

For many years, Houston Lighting & Power Company has recognized the need for, and has maintained, an extensive quality assurance program. In conjunction with the establishment of its nuclear program, the Company reorganized its quality assurance procedures. Mr. D. G. Barker, who joined the Company in 1972, now heads the Company's quality assurance program. He is also responsible for, and in charge of, the South Texas Project quality assurance plan. Mr. Barker will testify in more detail as to the quality assurance plan for the South Texas Project. Mr. Barker reports directly to me.

I am a member of the Board of Directors of Houston Lighting & Power Company and have direct access at all times to the Chief Executive Officer of the Company, Mr. J. G. Reese, who is also the Chairman of

our Board, and to the Chief Administrative Officer of the Company, Mr. D. D. Jordan, who is also our President.

I am a member of the Management Committee for the South Texas Project. The Management Committee was established under the provisions of the Participation Agreement which is set forth in Exhibit I to the Application. Houston Lighting & Power Company, as Project Manager, advises the Management Committee of activities and developments concerning the Project and consults with that Committee on a regular basis. On the other hand, the Participation Agreement charges Houston Lighting & Power Company with the safe design, construction and operation of the South Texas Project Nuclear Generating Station, and Houston Lighting & Power Company has accepted and is carrying out this responsibility.

VI. Conclusion.

In summary, we have established a team of the necessary talents to design, build and operate this plant in a manner that is environmentally acceptable and safe. I am proud of this team. Further, I assure you that not only I, but the entire management of Houston Lighting & Power Company, clearly recognize and accept the responsibility of designing, constructing and operating the South Texas Project Nuclear Generating

Station in a manner consistent with the health and safety of both the workers in the plant and those persons living or working in the vicinity of the plant. In carrying out these goals, we have received, and continue to receive, the full cooperation and support of all of the Participants in the Project.

TESTIMONY OF J. R. SUMPTER

Re: South Texas Project
Preliminary Safety Analysis Report

My name is J. R. Sumpter. I am Manager-Nuclear Division of the Power Plant Engineering and Construction Department of Houston Lighting & Power Company.

A resume of my educational and professional qualifications has previously been received in evidence. My responsibilities in connection with the South Texas Project include the design, engineering and fuel management of the nuclear system, radiation protection, licensing and safety analysis.

The Preliminary Safety Analysis Report, as amended by Amendments 1 through 34, and including Appendices A through F, Applicant's Exhibit No. 8 (PSAR), was compiled under my supervision and direction. Some of this material was prepared by Houston Lighting & Power Company employees; however, the major portion of the basic data was initiated and supplied by our Architect-Engineer and Constructor, Brown & Root, Inc., or by one or more of a number of consultants, including NUS Corporation, and Woodward-Clyde, Consultants, and EDS Nuclear, Incorporated. In all instances either I or one of the Houston Lighting & Power Company personnel in the Nuclear Division reviewed and approved this material prior to its incorporation into the PSAR.

I am familiar with the contents of the PSAR, as amended, and the statements contained therein are true and correct to the best of my knowledge and belief.

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BY MR. SCHWARTZ:

Q Mr. Oprea, would you please summarize your prepared testimony now?

A (Witness Oprea) Thank you. My name is George W. Oprea, Jr.

Do I need the microphone?

MRS. BOWERS: We can hear you, but I don't know whether people in the back can hear you or not.

WITNESS OPREA. My name is George W. Oprea, Jr, executive vice president of Houston Lighting & Power Company. I am responsible for the nuclear program.

A resume of my education and professional qualifications have been received in evidence previously. I, too on behalf of the South Texas participants, take this opportunity to welcome you to sunny south Texas.

My prepared testimony, which has been introduced in writtenform, describes the background and planning for the South Texas Project, by each of the four participants, The City Public Service Board of San Antonio, Central Power & Light Company, the City of Austin, and Houston Lighting & Power Company. All of the participants participated in the preparation of the formal application for construction permits and operating license for the two units at the project site. This application and three amendments were compiled under my supervision. It reflects the currently

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planned generating capabilities of the four participants through the year 1984, the fact that each participant is qualified to finance the design and construction of its interest in the South Texas Project facility, the fact that the bonds of each participant currenlty enjoy a double "A" rating by both Standard & Poor's and Moody's Investors' Service and the fact that the governing bodies or boards, and the officers of all of the participants, are citizens of the United States, with less than one-half of 1 percent of the common stock of Houston Light & Power, and Central & Southwest Corporation, the parent company of Central Power and Light Company, being owned by non-residents of the United States.

As project manager, Houston Lighting and Power Company recoganize that it had the ultimate responsibility for the safe design, construction and operation of the South Texas Project, nuclear generating station. Houston Lighting and Power Company commenced developing its in-house nuclear capability in 1971. I personally participated directly in assembling and organizing this capability, which continues to report to me.

Our own capability is complemented by a strong support team comprised of Brown and Root, our architect engineer and constructor. Westinghouse Electric Corporation, our nuclear steam supply system vendor and several

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consultants.

Dr. Sumpter, the manager of Houston Lighting and Power Company's nuclear division, will provide more detailed testimony as to the technicla qualifications of the project manager, that is Houston Lighting & Power Company, Brown and Root and Westinghouse.

Houston Lighting and Power Company ahs recognized the need for quality assurance program, not only in conjunction with the establishment of our nuclear program, but also in conjunction with its fossil fuel facilities. Mr. Parker, who heads our quality assurance department, will provide more detailed testimony as to the project quality assurance program. I might add, Mr. Parker reports directly to me. I am a member of the board of directors of Houston Lighting & Power Company , and have direct access at all times to Mr. J. G. Reese, the Chairman of our board and chief executive officer and Mr. Don D. Jcrson, president and chief administrative officer.

I am also manager of the management committee for the Texas Project, which committee is established under the project participation agreement.

In conclusion, let me assure you that we have established a team of the necessary talents to design, construct and operate this facility, in a manner that is safe, and environmentally acceptable. Not only I, but

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the managements with which I work, accept the responsibility of designing, constructing and operating the South Texas Project in a manner consistent with the health and safety of both the workers in the plant and those persons living and working in the vicinity of the plant.

In carrying out these goals, we have received and continue to receive the full cooperation and support of all of the participants in the project.

Thank you.

BY MR. SCHWARTZ:

Q Mr. Oprea, your prepared testimony indicates that the application for construction permits and operating licenses, as amended by amendments 1, 2 and 3, was prepared under your supervision. Is that correct?

A (Witness Oprea.) That is correct.

Q Is it, as so amended, true and correct to the best of your knowledge?

A Yes, it is.

MR. SCHWARTZ: Mrs. Bowers, I ask the application, so amended, Applicant's Exhibit Number 7, be received into evidence at this point.

MRS. BOWERS. Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection, Mrs. Bowers.

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MRS. BOWERS: Applicant's Exhibit Number 7 is received in evidence at this time.

(The document, heretofore marked Applicant's Exhibit Number 7 for identification, was received in evidence.)

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MR. SCHWARTZ: Thank you.

Mr. Oprea will not be a member of our technical panel, accordinlgy the board or parties may have questions, which they would care to present to Mr. Oprea at this time with respect to his testimony. Is that the wish of the board or the parties?

MRS. BOWERS: Mr. Pendergraft, do you have questions?

MR. PENDERGRAFT: No questions.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: The staff has no questions of Mr. Oprea.

MRS. BOWERS: Mr. Shon is modest. He says he has one minor thing.

MR. SHON: It is modest. Minor. Perhaps the question really should be addressed to the staff. I notice in one very small detail your testimony does not agree with a thing given to us by the staff. That is, the one detail is, the credit rating of the City Public Service Board of

San Antonio bonds, which, you say, is doub[illegible] "A" an[illegible] say is triple "A." Is there some confusion there? Are you not taking credit for everything you need?

WITNESS OPREA: Why don't you ask Howard Freeman.

MR. SCHWARTZ: I think Mr. Howard Freeman of the Public Service Board could best answer that question if that is acceptable to the board.

MRS. BOWERS: I think he should be sworn.

Whereupon,

HOWARD FREEMAN

was called as a witness and, having been first duly sworn, was examined and testified as follows:

MRS. BOWERS: Please fully identify yourself.

MR. SCHWARTZ: He has a statement of qualifications along with the statement to present to the board.

MR. FREEMAN: My name is Howard Freeman, secretary-treaurer of the City Public Service Board of San Antonio, Texas. I hold a bachelor of business administration degree, from St. Mary's, San Antonio,as well as a master of business administration from St. Mary's. I have worked with the City Public Service Board since 1959 and have held various positions including superintendent of customer accounting, chief accountant and my current position of controller and secretary-treasurer.

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In answer to the question that was posed, the credit rating on San Antonio's bonds has been changed from triple "A" to double "A", when we recently issued subordinate loan bonds. Our most recent issue is a subordinate loan bond and was changed at this time. All the prior issues did work with first loan bonds and were graded as triple "A."

MR. SCHWARTZ: Mr. Freeman, the bonds that were originally issued as triple "A" bonds are still triple "A"? Is that correct?

MR. FREEMAN: Correct.

MR. SCHWARTZ: However, the last issue which was not a first loan bond, is rated double "A."

MR. FREEMAN. Correct.

MRS. BOWERS: The board has no further questions of this witness.

MR. SCHWARTZ: Thank you.

MR. STRIDIRON: I did have one question.

Do you have a date when this change in rating came about, and was it subsequent to the submittal to the staff?

MR. SCHWARTZ: It was shown in amendment 2 of the application, I believe, which was -- Mr. Freeman can answer it.

MR. FREEMAN: It was included in amendment 2.

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the l... [illegible] on October 9, but will be delivered next week.

MR. STRIDIRON: We have no further questions.

MRS. BOWERS: Do you have anything further, Mr. Stridiron?

MR. STRIDIRON: No further questions.

MRS. BOWERS: The board has no further questions of this witness.

MR. SCHWARTZ: I now call Dr. J. R. Sumpter, manager, nuclear division for Houstong Lighting & Power Company.

Dr. Sumpter, do you have before you a two-page documetn entitled "Testimony of J. R. Sumpter, Re: South Texas Project Preliminary Safety Analysis Report"?

DR. SUMPTER: I do.

DIRECT EXAMINATION

BY MR. SCHWARTZ:

Q This document will be found under tab 15. Was this document prepared by you or under your supervision?

A. (Witness Sumpter.) Yes. It was.

A Is the document true and correct to the best of your knowledge and belief?

A Yes. It is.

Q Do you adopt the document entitled "Testimony of J. R. Sumpter, Re: Wouth Texas Project, Preliminary

fm9

Safety Report" in this proceeding?

A Yes.

MR. SCHWARTZ: I ask the two-page document identified by Dr. Sumpter be incorporated in the record as though read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: State has no objection.

MRS. BOWERS: Mr. STridiron?

MR. STRIDIRON: No objection, Mrs. Bowers.

MRS. BOWERS: While I am checking the gentleman on this point, I am not sure I checked with each of you when it was proposed that the qualifications statements of the applicant's witnesses be physically inserted in the record. Any objection, Mr. Pendergraft?

MR. PENDERGRAFT: None.

MR. STRIDIRON: No objection.

MRS. BOWERS: The written testimony that you have fully identified will be physically inserted in the transcript as if read.

end 3

TESTIMONY OF J. R. SUMPTER

Re: South Texas Project
Preliminary Safety Analysis Report

My name is J. R. Sumpter. I am Manager-Nuclear Division of the Power Plant Engineering and Construction Department of Houston Lighting & Power Company.

A resume of my educational and professional qualifications has previously been received in evidence. My responsibilities in connection with the South Texas Project include the design, engineering and fuel management of the nuclear system, radiation protection, licensing and safety analysis.

The Preliminary Safety Analysis Report, as amended by Amendments 1 through 34, and including Appendices A through F, Applicant's Exhibit No. 8 (PSAR), was compiled under my supervision and direction. Some of this material was prepared by Houston Lighting & Power Company employees; however, the major portion of the basic data was initiated and supplied by our Architect-Engineer and Constructor, Brown & Root, Inc., or by one or more of a number of consultants, including NUS Corporation, and Woodward-Clyde, Consultants, and EDS Nuclear, Incorporated. In all instances either I or one of the Houston Lighting & Power Company personnel in the Nuclear Division reviewed and approved this material prior to its incorporation into the PSAR.

BY MR. SCHWARZ:

Q. Dr. Sumpter, the testimony you have just identified indicates the preliminary safety analysis report for the South Texas Project, Units 1 and 2 as amended by amendments 1 through 34 was prepared under your supervision by employees of Houston Lighting & Power Company, architect engineer, Brown and Root and by a number of consultants including NUS Corporation, Woodward-Clyde and EDS Nuclear; is that correct?

A. Yes.

Q. Is the preliminary safety analysis report as so amended true and correct to the best of your knowledge and belief?

A. Yes, it is.

MR. SCHWARZ: Mrs. Bowers, I ask that the preliminary safety analysis report for the South Texas Project, as so amended, Applicant's Exhibit No. 8, be received into evidence at this point.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection, Mrs. Bowers.

MRS. BOWERS: Applicant's Exhibit No. 8 is received in evidence.

(The document heretofore marked as Applicant's

Exhibit No. 8 for identification, is received in evidence.)

MR. SCHWARZ: Thank you.

Next I call Dr. Douglas W. Peacock, Manager of Reactor Protection, Nuclear Safety Department, Westinghouse Electric Corporation.

Whereupon,

DR. DOUGLAS W. PEACOCK

was called as a witness and, having been previously duly sworn, was examined and testified as follows:

XXXX

DIRECT EXAMINATION

BY MR. SCHWARZ:

Q. Dr. Peacock, do you have before you a six-page document entitled, "Testimony of Douglas W. Peacock, re: RESAR-41", to which is attached a two-page attachment?

A. Yes, I do.

MR. SCHWARZ: Mrs. Bowers, this document will be found under tab 16.

BY MR. SCHWARZ:

Q. Dr. Peacock, was this document prepared by you or under your supervision?

A. It was.

Q. Is the document true and correct to the best of your knowledge and belief?

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A. It is

Q. Do you adopt the document entitled, "Testimony of Douglas W. Peacock, re: RESAR-41" as your testimony in this proceeding?

A. I do.

MR. SCHWARZ: Mrs. Bowers, I ask that the six-page document with an attachment, identified by Dr. Peacock, be incorporated into the record as if read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: The testimony which you have identified will be physically incorporated into the transcript as if read.

MR. SCHWARZ: Thank you. We have furnished such copies to the Reporter.

XXXX (Document follows.)

TESTIMONY OF DOUGLAS W. PEACOCK
Re: RESAR-41

My name is Douglas W. Peacock. I am Manager of Reactor Protection, Nuclear Safety Department, Westinghouse Electric Corporation. A summary of my professional qualifications has been received previously in evidence.

The purpose of my testimony is to provide an explanation of what the RESAR-41 reference design involves and an explanation of how it evolved from earlier Westinghouse designs. I shall also sponsor the RESAR-41 Reference Safety Analysis Report, as amended by Amendments 1 through 19 (RESAR-41), Applicant's Exhibit No. 9.

I have participated in the over-all safety review of the Westinghouse design described in RESAR-41. Portions of RESAR-41 were prepared under my direction. I participated in the review and approval of those portions of RESAR-41 which were not prepared under my supervision, and for these reasons, I am familiar with RESAR-41 in its entirety. The statements contained in RESAR-41 are true and correct to the best of my knowledge and belief.

RESAR-41 is a standard safety analysis report for a Westinghouse nuclear steam supply system (NSSS) design which was filed on December 3, 1973, and docketed on March 11, 1974, by the Atomic Energy Commission,

predecessor to the Nuclear Regulatory Commission (NRC). This submittal was in the form of an application for a Preliminary Design Approval (PDA) to the NRC pursuant to Appendix O of 10 CFR Part 50.

The issuance of a PDA is contingent upon successful completion of a safety review by the NRC Regulatory Staff and the Advisory Committee on Reactor Safeguards, and is similar to the review given to conventional custom plant construction permit applications. A standard design receiving a PDA may then be referenced by utility applicants for construction permits without re-review by the NRC Staff with the exception of items not resolved during the PDA review phase, site related areas and interfaces, significant safety issues arising subsequent to the PDA, any proposed modifications of the standard design, or requirements arising from NRC rules or directives promulgated after the PDA.

RESAR-41, as supplemented through Amendment 19, describes the Westinghouse standard four-loop NSSS for a 3817 MW (thermal) pressurized water reactor. Its scope, as incorporated by the South Texas Project Preliminary Safety Analysis Report (PSAR), includes the Reactor, Reactor Coolant System, Emergency Core Cooling System, Emergency Boration System, and various other

safety and associated systems including instrumentation and controls for the various systems. The balance of plant structures, systems, components and power distribution systems are described in the Applicant's PSAR.

While the South Texas Project license application is the first application for a construction permit to reference RESAR-41, the standard plant described in RESAR-41 is similar in many respects to the RESAR-3 design [3425 MW (thermal)] which has been reviewed by the Commission on license applications for the Catawba plant (Docket Nos. 50-413 and 414), the Vogtle plant (Docket No. 50-424 through 427), the Millstone 3 plant (Docket No. 50-423), the Comanche Peak plant (Docket Nos. 50-445 and 446), the Seabrook plant (Docket Nos. 50-443 and 444), and the SNUPPS projects (Docket Nos. 50-482 through 487). The RESAR-41 design is an evolutionary step from the RESAR-3 plant design and represents design evolution of the Westinghouse nuclear technology. The principal design differences and similarities are summarized below.

The RESAR-41 reactor is similar to the RESAR-3 design except for an increase in active fuel length from 12 to 14 feet providing approximately a 15% increase in fuel loading and heat transfer area. In addition,

correspondingly longer control rods have been provided and the lower internals, of a design similar to the basic RESAR-3 design, have been modified to accommodate the longer fuel assemblies. The fuel design is also similar except that it incorporates nine grids per assembly rather than the eight grids in the RESAR-3 design. Similarly with the exceptions necessary to accommodate the differences relating to the increased system capacity and to accommodate the rapid refueling concept, the RESAR-41 Reactor Coolant System is basically similar to the RESAR-3 system. The reactor vessel is of the design used on RESAR-3 applications with the sole exception that the reactor vessel closure system has been changed to facilitate rapid refueling. The reactor coolant pump design is similar to the RESAR-3 pump but will have an increased capacity. To transfer the additional heat generated in the RESAR-41 reactor, the steam generators will have longer and a greater number of tubes thereby increasing the total heat transfer area. The RESAR-41 Residual Heat Removal System (RHRS), in providing greater flexibility and operability, utilizes three cooling trains with independent pumps not shared with the Emergency Core Cooling System (ECCS). The RHR pumps employed will be of the

vertical type rather than the horizontal pumps used in previous designs; however the components of the modified RHRS are of a proven technology.

The new Emergency Boration System (EBS), and the redesigned Safety Injection System (SIS) are the only fundamental modifications of the Engineered Safety Features. The SIS design utilizes three independent trains with complete separation from any function other than emergency core cooling. The system components are similar to previous designs with the exception that vertical pumps are employed rather than horizontal. The EBS, replacing the Boron Injection tank in the SIS used on RESAR-3 design, is provided to mitigate the consequences of steamline break accidents. Although a number of the EBS components differ from those utilized in the RESAR-3 design, all are of proven technology. The instrumentation and Control Systems for the Engineered Safety Features and other systems are substantially the same as previous designs with differences principally to accommodate various system modifications.

A Spent Fuel Pool Cooling and Cleanup System is provided in the scope of RESAR-41. The remainder of the Auxiliary Systems, with the exception of the Fuel Handling System and the Chemical and Volume Control

System (CVCS) are substantially the same as the RESAR-3 designs. The Fuel Handling System has been modified to accommodate the rapid refueling provisions, and the CVCS, basically the RESAR-3 design, incorporates a number of modifications to achieve independence from the ECCS and the EBS.

An in-depth comparison of the relationship between RESAR-41 and RESAR-3 is presented in Tables 1.3-1 and 4.1-1 of RESAR-41. Additional insight to the similarities of the principal parameters and design features of RESAR-41 and RESAR-3 is presented in Attachment 1.

ATTACHMENT 1

Comparison of Principal Parameters and Design Features of RESAR-41 and RESAR-3

Parameter/Feature	RESAR-41	RESAR-3
Reactor Core Power Level (MWt)	3800	3411
Number of Loops	4	4
System Pressure, Nominal, psia	2250	2250
Total Thermal Flow Rate, lb/hr	144.7×10^6	142.2×10^6
Effective Coolant Flow Rate for Heat Transfer, lb/hr	138.2×10^6	135.8×10^6
Effective Coolant Flow Area for Heat Transfer, ft^2	51.1	51.1
Nominal Inlet Coolant Temperature °F	559.8	557.3
Coolant Temperature Average Rise in Core	66.8	62.3
Average Thermal Output, kw/ft	5.33	5.45
Heat Flux Hot Channel Factor, Fq	2.50	2.50
Maximum Thermal Output for Normal Operation, kw/ft	13.3	13.6
Number of Fuel Assemblies	193	193
UO_2 Rods per Assembly	264	264
Number of Grids per Assembly	9	8
Fuel Weight (as UO_2), lbs.	253,675	222,739
Fuel Rod Array	17x17	17x17
Clad Thickness, inches	0.0225	0.0225
Clad Material	Zircaloy-4	Zircaloy-4

Parameter/Feature	RESAR-41	RESAR-3
Rod Cluster Control Assembly Neutron Absorber, Full/Part Length	Ag-In-Cd	Ag-In-Cd
Number of Clusters, Full/Part Length	61/8	53/8
Number of Absorber Rods per Cluster	24	24
Core Diameter, in. (Equivalent)	132.7	132.7
Number of Safety Injection Trains	3	2
High Head Injection Pumps	3	2* + 2**
Design Flow Rate (each) gpm	800	150 425
Design Head, ft.	2850	5800 2500
Low Head Safety Injection Pumps	3	2
Design Flow Rate (each) gpm	1400	3000
Design Head, ft.	620	375
Emergency Boration System Injection Pumps	2	--
Design Flow Rates (each) gpm	450	--
Design Head, ft.	500	--

* Centrifugal Charging Pumps

** Safety Injection Pumps

BY MR. SCHWARZ:

Q. Dr. Peacock, would you please summerize your prepared testimony?

A. My name is Douglas W. Peacock, Manager of Reactor Protection for the Nuclear Safety Department of Westinghouse Electric Corporation.

The purpose of my testimony is to provide an explanation of what the RESAR-41 reference design involves, and an explanation of how it evolved from earlier Westinghouse designs.

I shall also sponsor the RESAR-41 reference safety analysis report as amended by amendments one through 19, to RESAR-41, which is the Applicant's Exhibit No. 9.

I have participated in the overall safety review of the Westinghouse design described in RESAR-41; portions of which were prepared under my direction. RESAR-41 is supplemented through amendment 19 describing the Westinghouse standard 4-loop nuclear steam supply system for a 3817 megawatt thermal pressurized water reactor. Its scope, as incorporated by the South Texas Project PSAR, includes the reactor, the reactor coolant system, the emergency core cooling system, the emergency boration system, and various other safety and associated systems.

The South Texas Project license application is a first application to reference RESAR-41. The standard plant

described in RESAR-41 is similar in many respects to the RESAR-3 design at 3425 megawatts thermal rating, which has been reviewed and licensed by the Commission on several other license applications. The RESAR-41 design is an evolutionary step from the RESAR-3 plant design and represents design evolution of Westinggouse nuclear technology.

The principal design differences and similarities are summarized in my prepared testimony in Tables 1.3-1 and 4.1-1 of RESAR-41.

Q. Dr. Peacock, your testimony indicates that you participated in the preparation and overall review and approval of RESAR-41 reference safety analysis report, as amended by amendments one through 19; is that correct?

A. That is correct.

Q. Is the RESAR-41 reference safety analysis report as so amended true and correct to the best of your knowledge and belief?

A. It is.

MR. SCHWARZ: Mrs. Bowers, I ask that the RESAR-41 reference safety analysis report as so amended, Applicant's Exhibit No. 9, be received into evidence at this point.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: We have no objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: Applicant's Exhibit No. 9 is received in evidence.

XXXX (The document heretofore marked as Applicant's Exhibit No. 9 for identification, is received in evidence.)

BY MR. SCHWARZ:

Q. Dr. Peacock, are you familiar with the list of questions furnished by the Board on November 4, 1975?

A. Yes, I am.

Q. The first of these questions reads: "The increased length of the 14-foot core renders itself slightly less stable to axial --" I'm sorry, I'm a lawyer not an engineer -- x-e-n-o-n, "xenon oscillation, especially late in the fuel cycle; RESAR-41 suggests that the part-length rods may be relied on to assure stability but the SER notes a departure from nuclear boiling problem associated with the use of PLRs and says that use of such rods in Westinghouse reactors is forbidden. Please discuss the alternate control strategy Westinghouse Mode A and its implications from the standpoints of operational flexibility and safety."

Would you please respond to that question?

A. The control banks, the part-length rods and the ex-core detectors are provided in our design for control

and monitoring of the [illegible] power [illegible]. Although the core does become [illegible] stable to axial-xenon oscillation as fuel groundup professes, free xenon oscillations are not allowed to occur except for special tests. Either the full-length or part-length rods are sufficient and can be used to dampen and control any axial-xenon oscillations.

As discussed in RESAR-41, the stability index at the end of cycle life is essentially the same in the 14-foot core as it is in the 12-foot cores that are now in operation. The long axials oscillation periods, approximately 24 hours, allows easy control of axial-xenon transients with part-length rods alone, and we see no adverse implications from the standpoint of operational flexibility and safety under Mode A operation.

To date, Westinghouse field reactors have not experienced any difficulty in meeting power distribution limits and in controling xenon transients in the Mode A type of operation.

MRS. BOWERS: Mr. Schwarz, the understanding was we would wait until later for Borad questions. And that is true also in this area.

MR. SCHWARZ: That was simply a suggestion, Mrs. Bowers, but Dr. Peacock will be back as part of the panel and that was our suggestion, but whatever the Board prefers, of course.

MRS. BOWERS: We will hold them until later t...

BY MR. SCHWARZ:

Q. Dr. Peacock, the next question reads: "The SER at page 4-12 states that the design limit peaking factor for the 14-foot core is 2.5; the SER supplement, at page 6-1, states that the analyses of ECCS performance assumed a peaking factor of only 2.45. Is the ECCS analyses conservative from this standpoint?"

Would you please respond to that question?

A. The design limit peaking factor used for ECCS analyses is 2.45. All analyses of ECCS performance were performed using the peaking factor of 2.45. The 2.50 value was a preliminary number developed early in the review of the RESAR-41 application, and has been superseded in subsequent amendments.

Q. Dr. Peacock, the next question noted that the SERs asserted that the higher value of peaking factor for the longer core is associated with the effect of the PLRs. The Board then asked two questions: "(a) If the PLRs are not used, will the limit still be 250?" And, "(b) If a lower limit is established, will control of peaking by simple axial offset observations still be possible at 100 percent power?"

Would you please respond to that?

A. For operation without the part-length rods the nuclear peaking factors in the 14-foot core would be in the

region of 2.1 to 2.2 of maximum values. This is illustrated in figure 4.3-2 of RESAR-41. The LOCA limit for operation with or without the part-length rods, however, would remain at 2.45, as discussed under the response to the previous question.

The control of peaking without the part-length rods has the additional margin noted above. If the limit -- if the LOCA limit were lowered to a value typical of Mode A operation, no problems in control are anticipated using the axial offset method of control.

Q. Dr. Peacock, the Board's fourth question reads: "The Board notes that one of the consequences of the new RESAR-41 refueling system is that fuel will be handled at a shutdown margin of only five percent. How does this margin compare with that generally allowed for fuel handling in reactors and critical facilities at present?"

A. The National Standards Institute standard in 18.2 specifies a value of the K effectiveness should not exceed a value of .95 in fuel storage systems, although no specific criterion is given for the reactor fueling operation.

A five percent margin is adequate and is consistent with what is generally allowed today for fuel handling operations at reactor facilities.

Q. Dr. Peacock, question 5A included a reference to the statement on page 15-8 of the SER, that a revision of

the dilution path flow alarms would be required in order to assure adequate warning of potential boron dilution."

It further observes that, "Supplement 1, at page A-8, suggests this will not be required, but locking out of valves and reliance on nuclear instrumentation will be substituted."

The Board asked two questions: "(a) Is this actually the plan?" And, "(b) How many minutes warning will the operator have of impending criticality if reliance is placed entirely on nuclear instrumentation for warning of such criticality when it occurs by the most rapid postulated reactivity addition mechanism during refueling?"

A. The present plan for the South Texas Project is to lock out certain valves in the chemical volume control system to preclude a potential for boron dilution during refueling. The only makeup water to the reactor coolant system is via the refueling water storage tank. This water is borated and sampled to insure adequate boration rpior to the release of the reactor coolant system, thus, reliance is not placed entirely on nuclear instrumentation, although it will be available to warn against an approach criticality.

MR. SCHWARZ: I would like to recall, at this time, Dr. Sumpter of Houston Lighting and Power Company.

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BY MR. SCHWARZ:

Q Dr. Sumpter, do you have before you a 9-page document with attachments entitled "Testimony of James R. Sumpter, Re: Technical Qualifications."

A (Witness Sumpter) Yes.

MR. SCHWARZ: This document may be found under Tab 17.

BY MR. SCHWARZ:

Q Dr. Sumpter, was this document prepared by you, or under your supervision?

A (Witness Sumpter) Yes, it was.

Q Is the document true and correct to the best of your knowledge and belief?

A Yes, it is.

Q Do you adopt the document entitled "Testimony of James R. Sumpter, Re: Technical Qualifications" as your testimony in this proceeding?

A I do.

MR. SCHWARZ: Mrs. Bowers, I ask the 9-page document with attachments just identified by Dr. Sumpter be incorporated into the record as though read. Copies have been furnished to the reporter.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: The document you just identified will be physically incorporated in the transcript as if read.

(The complete testimony follows.)

TESTIMONY OF JAMES R. SUMPTER

Re: Technical Qualifications

My name is James R. Sumpter. I am Manager - Nuclear Division of the Power Plant Engineering and Construction Department of Houston Lighting & Power Company.

A resume of my educational and professional qualifications has been previously received in evidence. My responsibilities in connection with the South Texas Project include the design, engineering, and fuel management of the nuclear system, and the radiation protection, licensing and safety analysis of the total plant.

The purpose of this testimony is to summarize the information regarding the technical qualifications of Houston Lighting & Power Company as Project Manager for the South Texas Project, as well as the information regarding the technical qualifications of our principal contractors.

More detailed information will be found in the Preliminary Safety Analysis Report for the South Texas Project, Section 13.1. You will also find additional specific information in the attachments to this testimony which I hereby incorporate.

Houston Lighting & Power Company is keenly aware of its special responsibilities assumed in undertaking the design, construction and operation of this nuclear power station.

The matter of nuclear staffing has been the subject of intensive consideration by our management. We have, in place, a staff fully competent to execute our design and construction responsibilities. Our plans include the addition of further engineering and operating personnel as required to assure the effective design, construction and operation of the South Texas Project.

Houston Lighting & Power Company is responsible for coordinating the overall design and construction effort required to achieve a complete facility which will provide safe, reliable and economic power. The principal tasks involved in this effort include the design control of the balance of plant and auxiliary systems; the design control of the nuclear system; cost control and scheduling functions; and finally, construction supervision.

These functions are performed in Houston Lighting & Power Company by our Power Plant Engineering and Construction Department (PPE&C) which is under the direct control of our Executive Vice President, George W. Oprea, Jr. PPE&C is, in turn, divided into four basic groups as follows:

(1) The Engineering group is responsible for

thereof with the NSSS design. We also review bidders lists, specifications, equipment selection and drawings which are subject to our approval.

Other departments with important functions connected with the South Texas Project include the Engineering Department, the Energy Production Department, the Environmental and Inter-Utility Affairs Department, and the Quality Assurance Department.

The Power Plant Engineering and Construction Department utilizes forty-three people with engineering degrees in support of the Project. Of these, two have doctoral degrees, thirteen have Masters degrees, and twenty-eight have Bachelors degrees.

The Energy Production Department has three people involved in the Project of which two have Bachelors degrees and one is a registered Professional Engineer.

The Engineering Department employs twelve people in support of the South Texas Project. Of these, two have Masters degrees, nine have Bachelors degrees, and one is a registered Professional Engineer.

The Environmental & Inter-Utility Affairs Department employs nine people in connection with the

South Texas Project, and of these nine one has a doctoral degree, five have Masters degrees, and three have Bachelors degrees.

The Quality Assurance Department, which is entirely separated from PPE&C includes 16 professional personnel working in support of the South Texas Project. Of these, three have Masters degrees and eight have Bachelors degrees, and six are registered Professional Engineers. A more detailed presentation regarding this function is presented in the testimony of Mr. Barker.

Attachment A to this testimony provides pertinent information regarding the technical qualifications of key South Texas Project personnel including their educational qualifications, experience and any specialized courses taken in the nuclear field.

Attachment B is an organizational chart showing the relationship of the organizational components having responsibilities for the Project.

Our architect-engineer-constructor is Brown & Root, one of the largest construction engineering companies in the world with over 48,000 employees on its permanent payroll. Brown & Root has been intensively involved in the design and construction of central station thermal power plants since 1954. In the past

21 years it has been responsible for the design and construction of 79 fossil fuel generating stations, with a combined capacity of over 27,000 megawatts, in sizes ranging from small industrial installations up to units of 870 megawatts each.

In the nuclear field, Brown & Root has been responsible for the construction of two 820 megawatt boiling water reactor plants for Carolina Power and Light Company's Brunswick Station.

It is presently engaged in similar work on behalf of Texas Utilities in the Comanche Peak Nuclear Power Plant project which consists of two 1150 megawatt Westinghouse pressurized water reactor systems.

Brown & Root's South Texas Project engineering team is headed by an engineering project management group including the engineering project manager, the assistant engineering project manager and the design coordinator. The 3 engineers in the group have a combined experience of 42 man-years in power plant engineering and construction and specifically 40 man-years of experience in nuclear projects.

Under the project management group are various support groups including licensing, documents and controls, and various specific engineering discipline

groups. For the South Texas Project, Brown & Root has drawn from its existing pool of fossil power plant experience and from its nuclear power talent and has supplemented these with experts from consulting engineering organizations.

The 19 key project personnel for the South Texas Project have a total of 163 man-years of nuclear experience. The 16 key supporting personnel assisting in the project have a total of another 224 man-years of nuclear experience derived from work in 33 nuclear projects. Attachment C to this testimony is an organizational chart showing Brown & Root's project organization for South Texas Project. Attachment D to this testimony is a table showing the names of 19 key project personnel for the South Texas Project together with a brief indication of their educational background and prior relevant experience.

In addition, several nationally known consulting organizations are making major contributions to the South Texas Project in their areas of special expertise. NUS is responsible for preparing the Environmental Report and for a number of design activities, including certain auxiliary systems; primary shielding analysis; containment analysis; accident analysis;

radiological effects analysis and licensing support. NUS engineering personnel now working on the South Texas Project have a total of 800 man-years of previous nuclear experience compiled in more than 80 nuclear projects. Woodward-Clyde Consultants (WCC) are responsible for the geology, seismology, soils engineering, groundwater hydrology and soil/structure interaction analysis for South Texas Project. WCC has gained experience from working on twenty previous nuclear projects. EDS Nuclear has responsibility for pipe stress analysis inside the containment and pipe break analysis. They also provide support to the project in the structural analysis area. EDS Nuclear has gained experience from eleven previous nuclear projects.

The NSSS supplier is Westinghouse Electric Corporation, one of the leading suppliers of nuclear systems in the entire world. As of October, 1975, 33 reactors of Westinghouse design are in operation in the United States and abroad and 114 are in planning and construction phases. Westinghouse's experience in the nuclear field dates back over 30 years. This history of experience is detailed in Section 1.4.3 of RESAR-41.

I should also mention, before closing, that training programs have been planned and instituted by

Houston Lighting & Power Company for a large number of personnel, including some not presently assigned to the South Texas Project. This approach to the training of engineering personnel in the fundamentals of nuclear engineering will provide us with a pool of trained personnel in the Company who can be assigned to the project on a timely basis. It also provides a balance between utility experience and nuclear training which we feel is desirable. Attachment A provides an indication of the key personnel participating in the training programs.

In summary, I believe we have assembled an unusually strong team within Houston Lighting & Power Company and our principal contractors to assure that the South Texas Project is well built and safely operated.

ATTACHMENT A

Tables

Of

HOUSTON LIGHTING & POWER COMPANY

PERSONNEL

TABLE 1

POWER PLANT ENGINEERING & CONSTRUCTION

NAME	TITLE	EDUCATION	ADDITIONAL TRAINING*	ENGINEERING EXPERIENCE
DEPARTMENT MANAGEMENT				
E. A. Turner	General Manager	BSCE	A,B	24 Years
W. M. Menger	Assistant General Manager	BSEE	A	25 Years
J. R. Ridgway, Jr.	Consulting Engineer	BSEE	B,C,D,E	35 Years
NUCLEAR DIVISION				
J. R. Sumpter	Manager	BS Engineering Science, MSNE, Ph.D.NE	C,E	11 Years (11 yrs. nuclear)
J. W. Hanson	Principal Engineer, Nuclear Engineering	BSME	B,C,E,F,G	10 Years (4 yrs. nuclear)
R. P. Murphy	Supervising Engineer, Nuclear Fuel Management	BS Math, MSNE	C,E,I	6 Years (6 yrs. nuclear)
R. J. Klapper	Supervising Engineer, Nuclear Safeguards & Licensing	BSNE, MSNE	C	4.5 Years (4.5 yrs. nuclear)
R. D. Gauny	Health Physicist	BS Physics Math, MS Biophysics		6 Years (6 yrs. nuclear)
A. J. Granger	Senior Engineer, Nuclear Engineering	BSEE, MSNE	C,E	5 Years (4.5 yrs. nuclear)
PROJECTS				
R. E. Fulghum	Manager	BSEE, MSEE		9 Years
M. T. Luke	Project Manager, STP	BSME		15 Years
J. R. Yeats	Supervising Engineer, Costs	BSME		27.5 Years
S. Veselka	Senior Engineer	BSEE		19 Years

TABLE 1 (CONT'D)

POWER PLANT ENGINEERING & CONSTRUCTION

NAME	TITLE	EDUCATION	ADDITIONAL TRAINING*	ENGINEERING EXPERIENCE
CONSTRUCTION				
E. M. Riddle	Manager	BSME		27 Years
F. D. Asbeck	Construction Supervisor	BSCE		8 Years
E. A. Pearson	Construction Supervisor	B Arch. Design & Construction		22 Years
ENGINEERING				
B. Sample	Manager	BSEE	D	33 Years
W. H. Morgan	Principal Engineer, Electrical	BSEE	E	28 Years
R. T. Beaubouef	Principal Engineer, Mechanical	BSME, Ph.D.ME	E,H	17 Years
R. D. Ellerman	Supervising Engineer, Electrical	BSME	B,E,H	8 Years
G. H. Griffin	Supervising Engineer, Electrical	BSEE	E,H	10.5 Years
K. L. Moore	Supervising Engineer, Mechanical	BSEE	H	13 Years
W. S. Weathers	Senior Engineer, Mechanical	BSEE		3.5 Years

TABLE 2

ENERGY PRODUCTION

NAME	TITLE	EDUCATION	ADDITIONAL TRAINING*	ENGINEERING EXPERIENCE
DEPARTMENT MANAGEMENT				
R. L. Evans	Vice President, Operations	BA, Math		23 Years
E. F. Hudgins	General Manager			39 Years
EQUIPMENT MAINENANCE				
H. G. Latham	Maintenance Manager		L,M	39 Years
PLANT OPERATION				
W. B. Little	Manager	BSME	B,C,E	19 Years

TABLE 3

ENGINEERING

NAME	TITLE	EDUCATION	ADDITIONAL TRAINING*	ENGINEERING EXPERIENCE
DEPARTMENT MANAGEMENT				
R. M. McCuistion	Vice President	BSEE		30 Years
ENGINEERING DESIGN & DEVELOPMENT				
K. L. Williams	Manager	BSEE, Math		15 Years
C. S. Kayser	Principal Engineer, Systems Division	Registered Professional Engineer		30 Years
E. L. Klawitter	Supervising Engineer, System Operations	BSEE, MSEE		10 Years
S. C. Schaeffer	Senior Engineer, System Operations	BSEE	B,E	6 Years
CIVIL ENGINEERING				
J. D. Greenwade	Manager	BSEE, MSEE		10 Years
T. L. Duoto	Principal Engineer, Civil Division	BSCE, Civil Tech	B	5 Years
H. P. Horelica	Supervising Engineer, Civil Design	MSCE	C	3 Years

TABLE 4

ENVIRONMENTAL PROTECTION

NAME	TITLE	EDUCATION	ADDITIONAL TRAINING*	ENGINEERING EXPERIENCE
DEPARTMENT MANAGEMENT				
D. E. Simmons	Vice President	BSEE		28 Years
D. R. Betterton	Manager	BSCE		12 Years
NUCLEAR QUALITY				
B. B. Aufill	Principal Engineer	BA Chemistry, MSME, J. D.	C,E,K	11 Years

TABLE 5

QUALITY ASSURANCE

NAME	TITLE	EDUCATION	ADDITIONAL TRAINING*	ENGINEERING EXPERIENCE
DEPARTMENT MANAGER				
D. G. Barker	Manager	BSME, MENE	A,E	10 Years
SOUTH TEXAS PROJECT				
R. A. Frazer	Supervising Engineer	BSChE	B,C,E,J	7 Years
PROJECT SERVICES				
W. N. Phillips	Supervisor	U. S. Navy Nuclear Power School		10 Years

* NOTE 1 Listed below are the titles of the training courses.

A. Nuclear Operators Short Course for Utility Management conducted by Babcock & Wilcox

B. Introduction to Nuclear Power produced by NUS

C. General Electric BWR Design Orientation

D. Nuclear Fundamentals conducted by GE

E. Nuclear Power Plant Design Criteria conducted by EDS Nuclear Inc.

F. Nuclear Fundamentals Course at Zion, Illinois

G. BWR simulator training course at Morris, Illinois

H. Westinghouse PWR Information Course

I. MIT Fuel Management Course

J. Training Seminar on Radiographic Testing

K. Berkeley Short Course on Nuclear Power Plant Siting & Surveillance

L. Westinghouse Nuclear Maintenance Seminar

M. GE Nuclear Maintenance Seminar

ATTACHMENT B

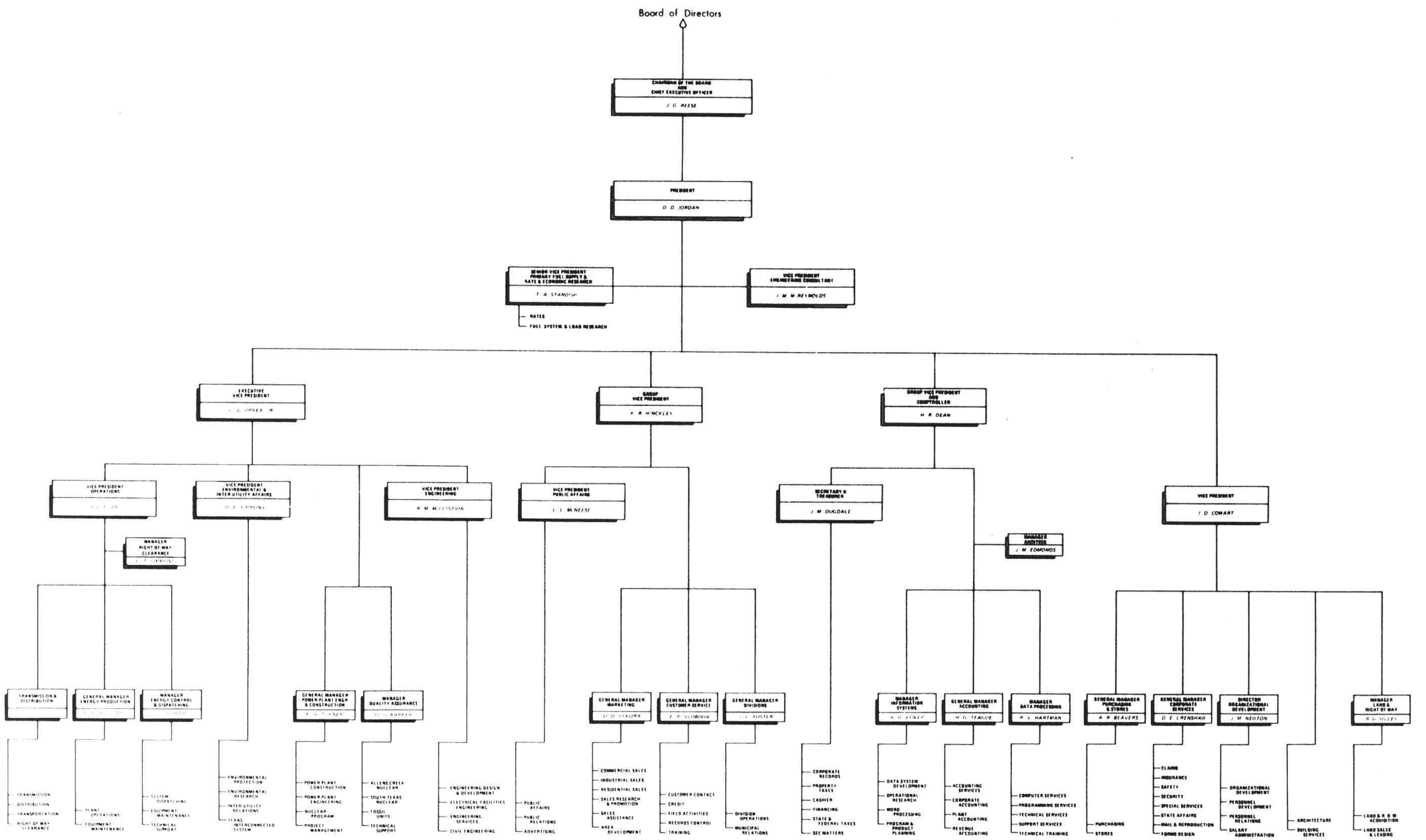
HOUSTON LIGHTING & POWER COMPANY

ORGANIZATION CHARTS

1. Company
2. Power Plant Engineering & Construction Department
3. Energy Production Department
4. Engineering Department
5. Environmental and Inter-Utility Affairs Department
6. Quality Assurance Department

HOUSTON LIGHTING & POWER CO.

Company Organization Chart

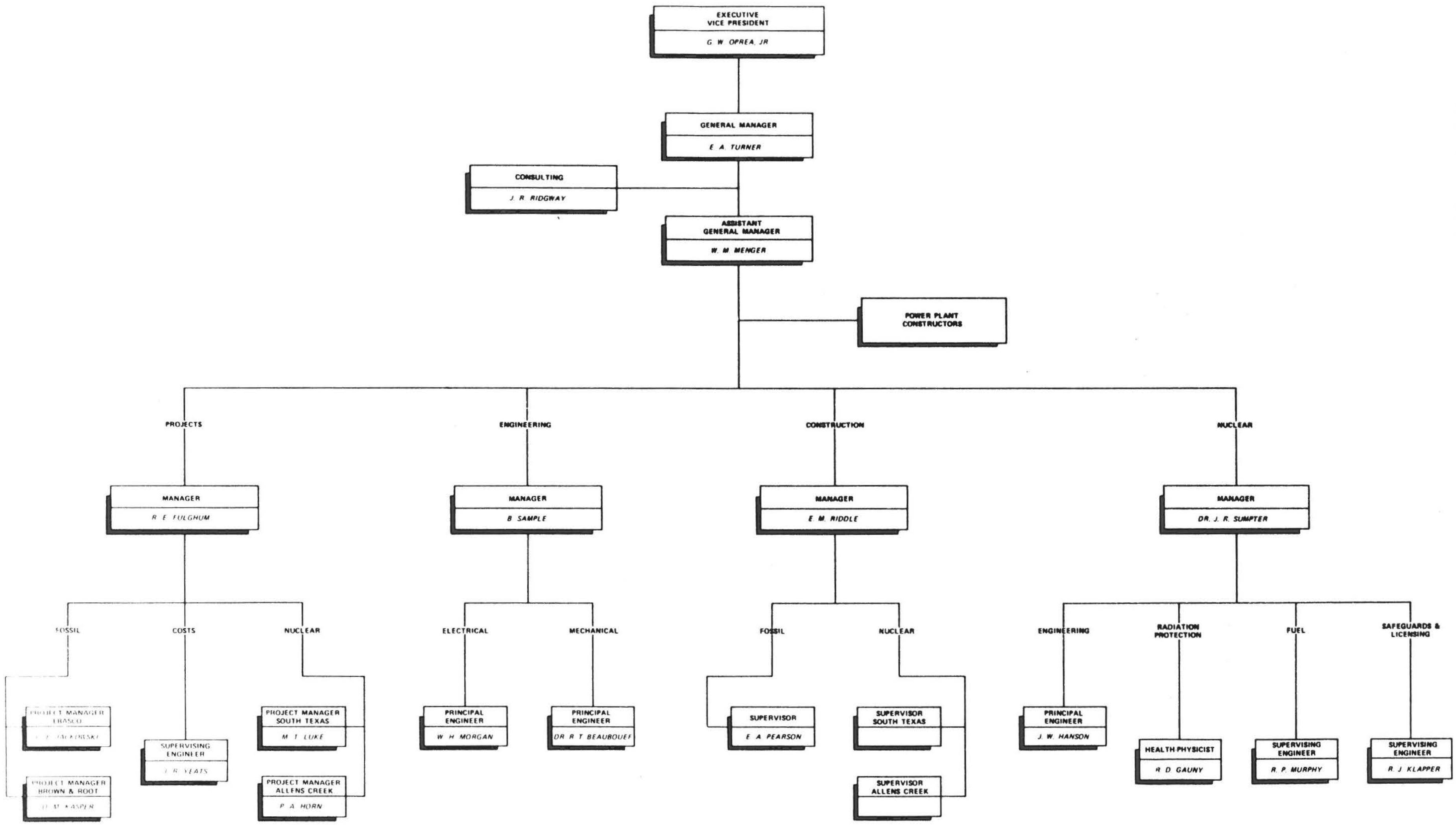


March 1975

Company Organization Chart

HOUSTON LIGHTING & POWER CO.

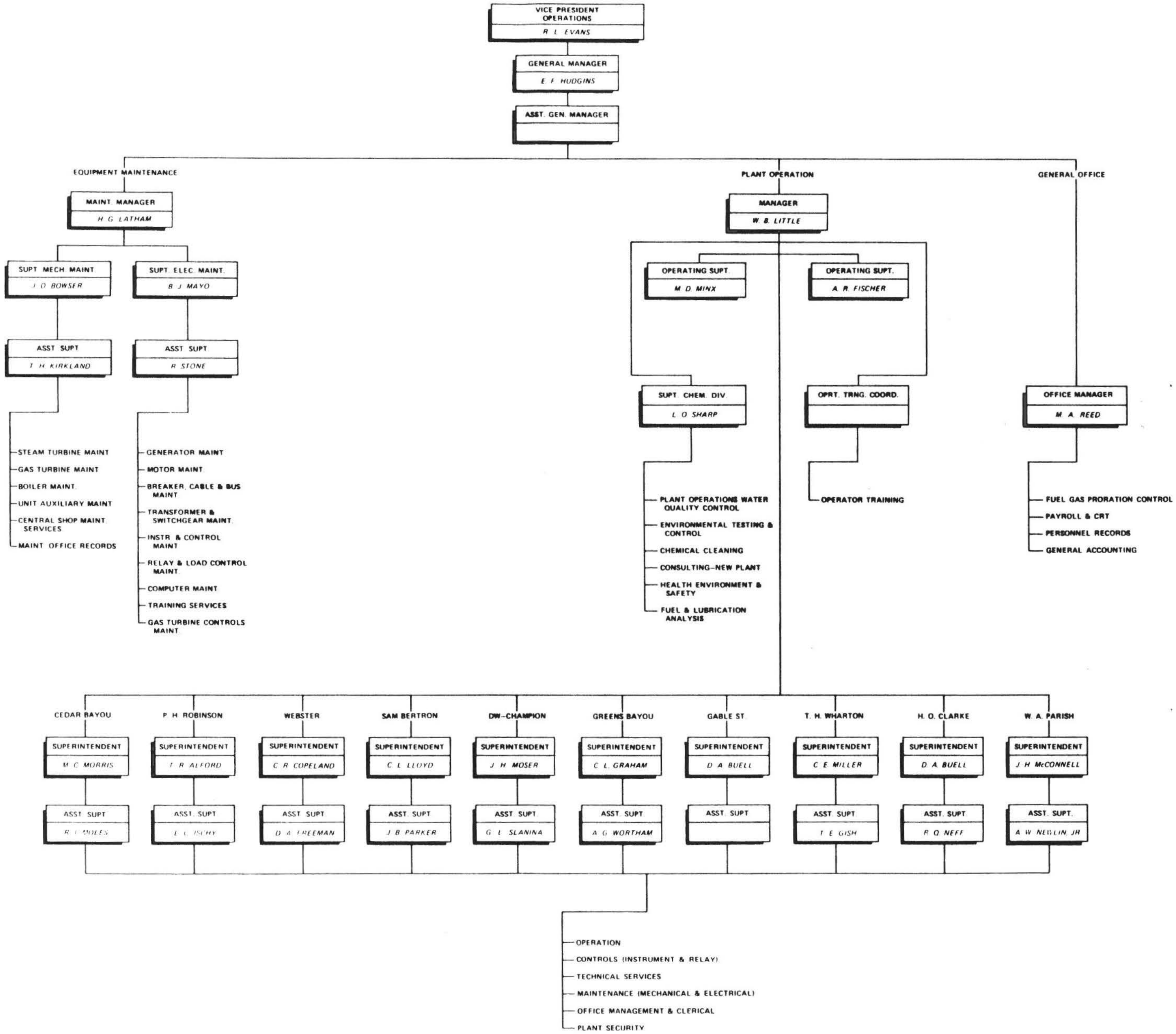
Power Plant Engineering & Construction Department



March 1975

HOUSTON LIGHTING & POWER CO.

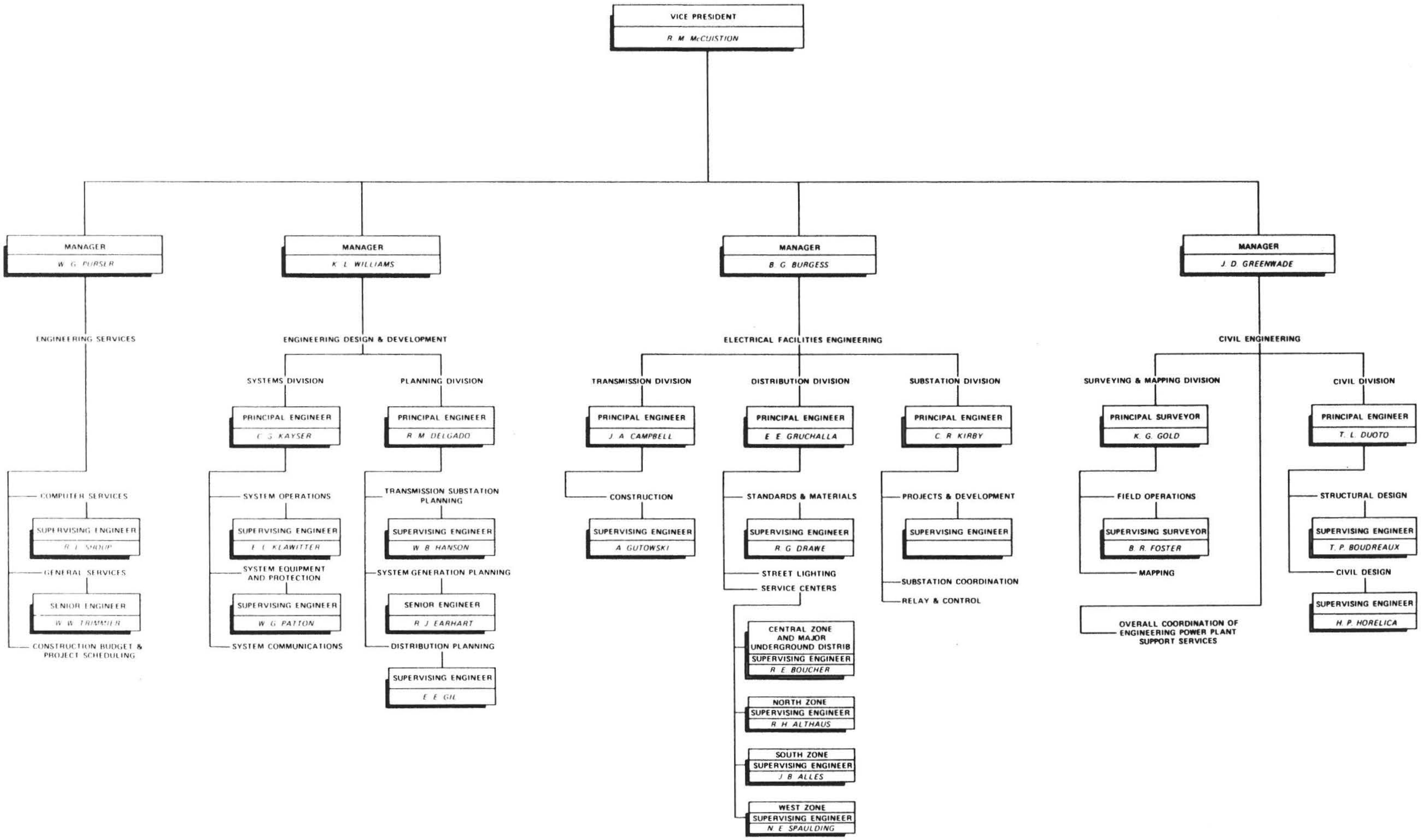
Energy Production Department



March 1975

HOUSTON LIGHTING & POWER CO.

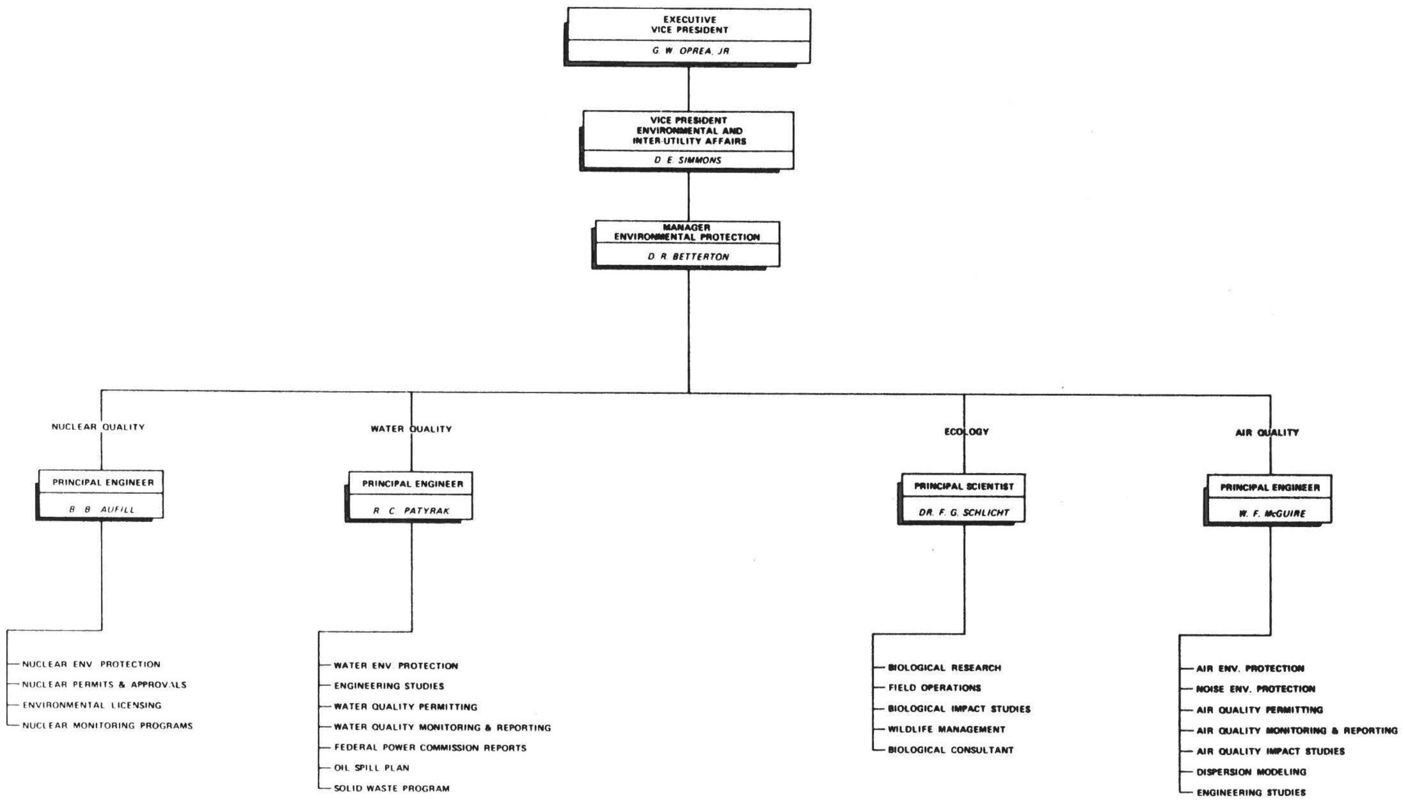
Engineering Department



March 1975

HOUSTON LIGHTING & POWER CO.

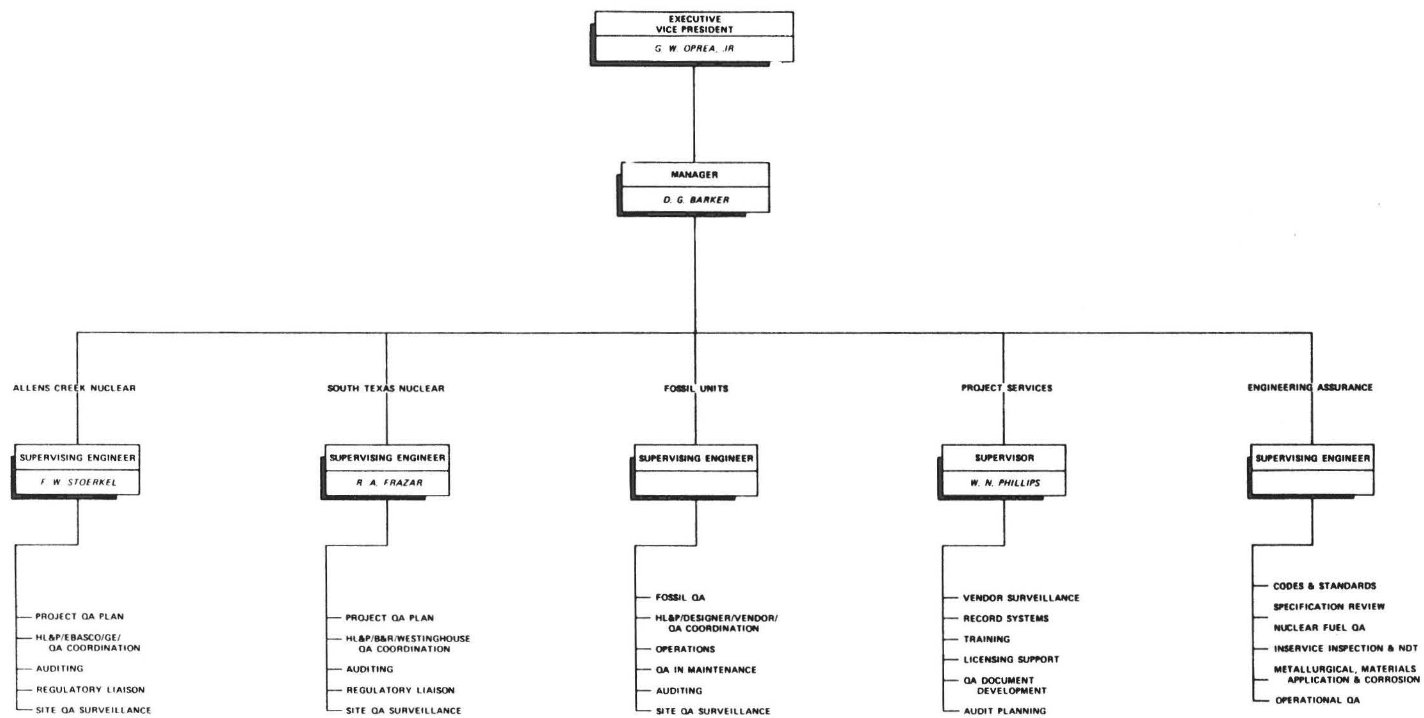
Environmental And Inter-Utility Affairs



March 1975

HOUSTON LIGHTING & POWER CO.

Quality Assurance Department



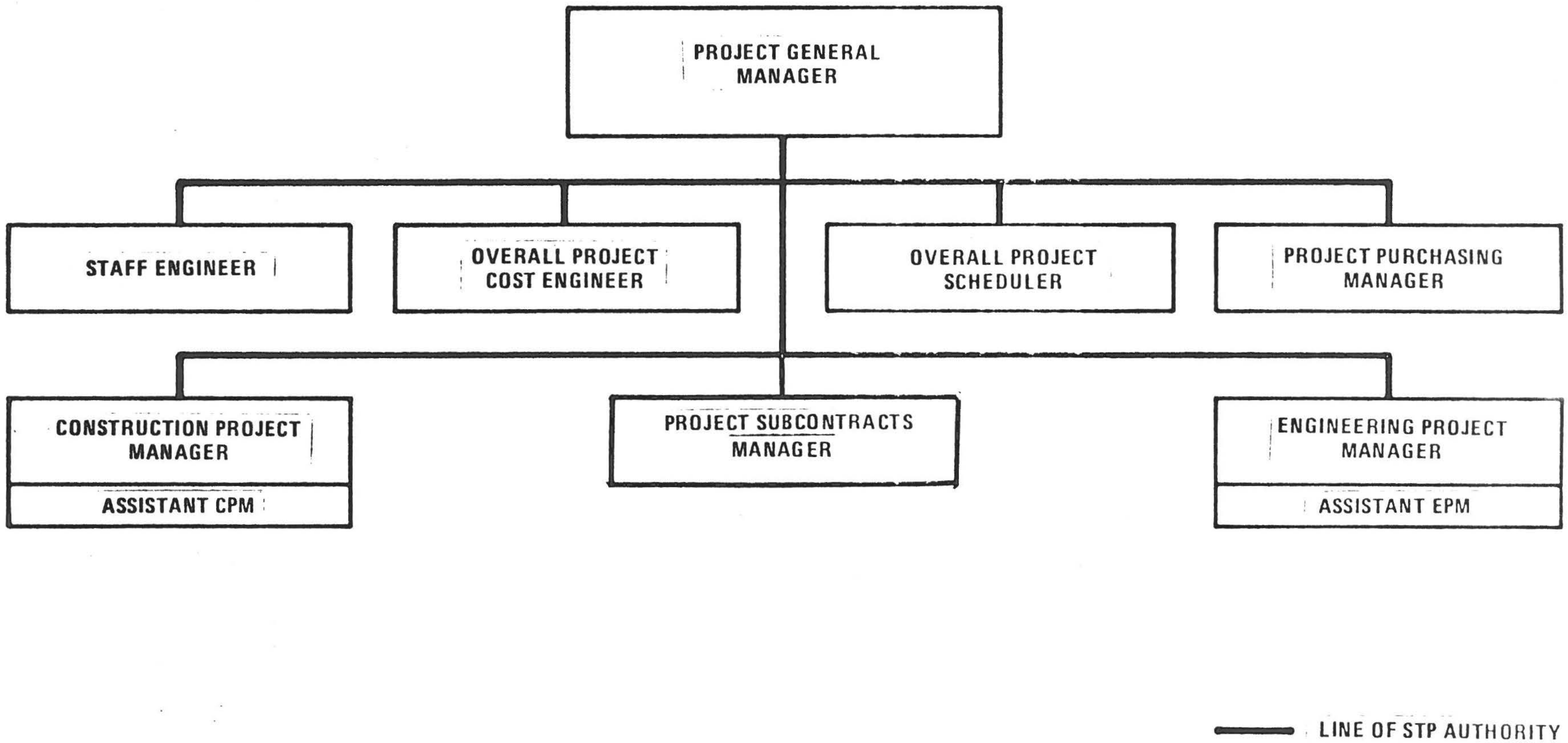
March 1975

ATTACHMENT C

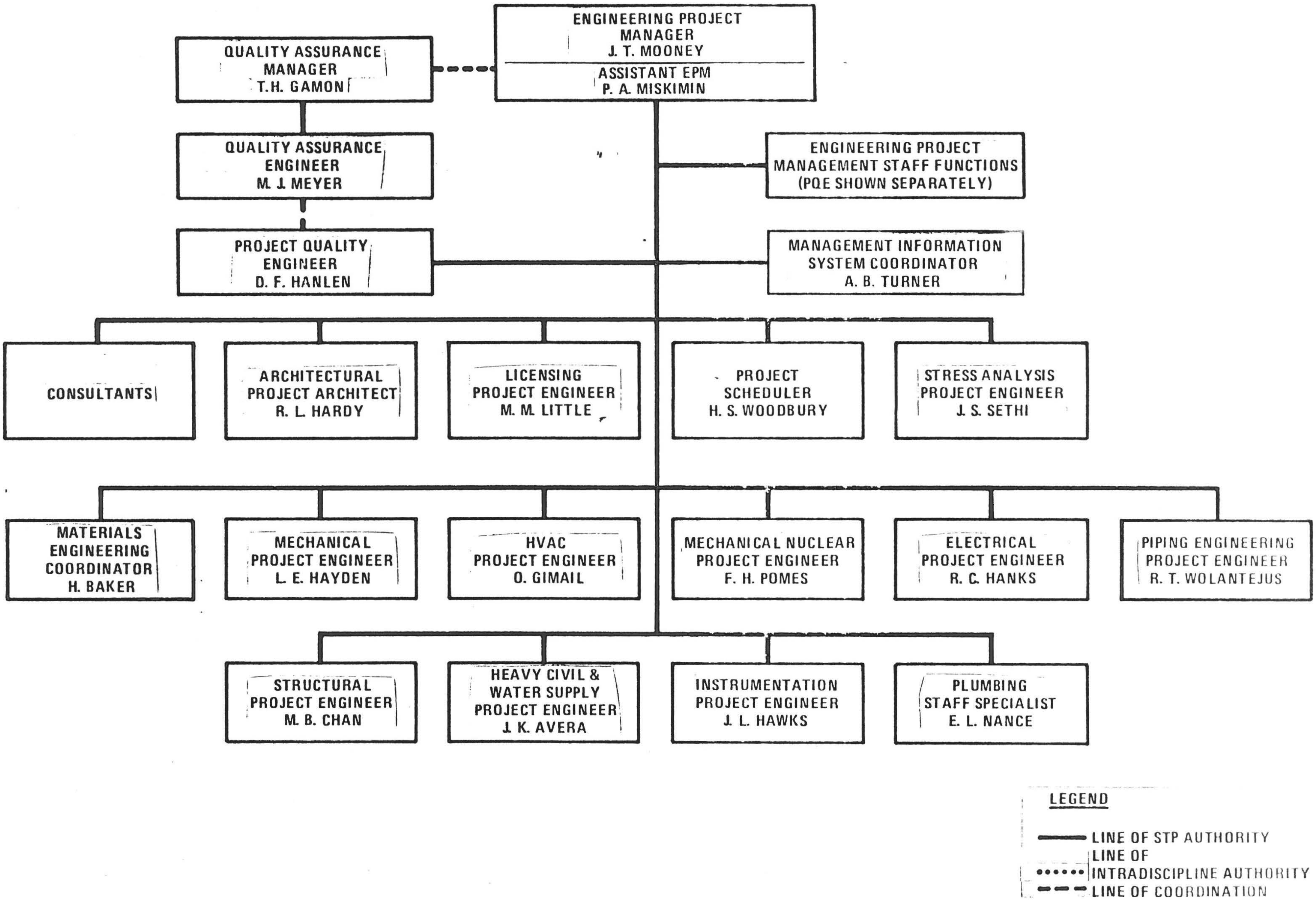
BROWN & ROOT, INC. ORGANIZATION CHARTS

1. South Texas Project Organization
2. Engineering Organization
3. Construction Organization

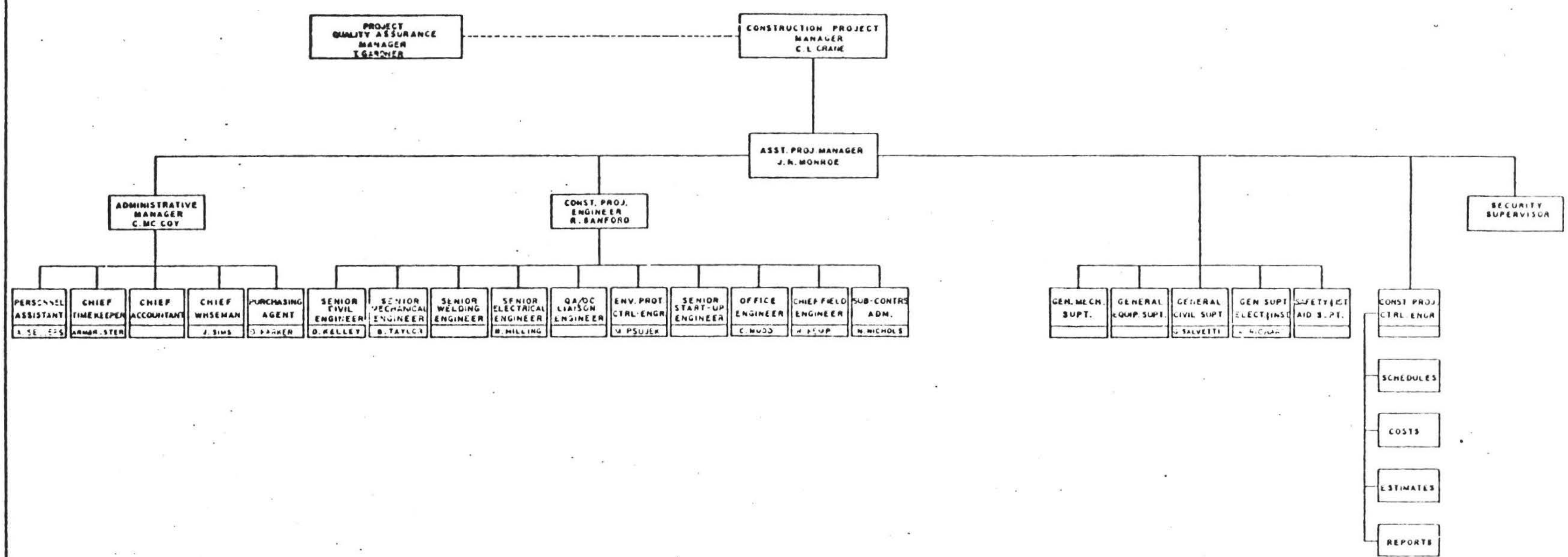
OVERALL STP ORGANIZATION



STP ENGINEERING ORGANIZATION



CONSTRUCTION
ORGANIZATION CHART
TYPICAL



ATTACHMENT D

BROWN & ROOT, INC. ORGANIZATION CHARTS

Personnel Table

ATTACHMENT D

STP KEY PROJECT PERSONNEL
BROWN & ROOT, INC.

NAME	TITLE	EDUCATION	TOTAL EXPERIENCE	NUCLEAR EXPERIENCE
AVERA, J. K.	Project Engineer-Heavy Civil & Water Supply	B.S. Civil Engineering P.E. Texas	10 Yrs.	2 Yrs.
BAKER, H. H.	Project Materials Engineering Coordinator	B.S. Chemistry	13 Yrs.	1 Yr.
BIERMAN, G. F.	Project General Manager	B.S. Mechanical Engineering	26 Yrs.	10 Yrs.
CHAN, M. B.	Project Engineer-Structural	B.S. Civil Engineering M.S. Structural Engineering P.E. California,Oregon,Pennsylvania	15 Yrs.	4 Yrs.
CRANE, C. L.	Construction Project Manager	B.S. Mechanical Engineering P.E. Texas	24 Yrs.	11 Yrs.
GIMAIL, O.	Project Engineer-HVAC	B.S. Mechanical Engineering P.E. Illinois,Texas	13 Yrs.	8 Yrs.
HANKS, R. C.	Project Engineer-Electrical	B.S. Electrical Engineering P.E. Texas	16 Yrs.	3 Yrs.
HANLEN, D. F.	Project Quality Engineer	B.S. Psychology M.S. Chemistry	25 Yrs.	25 Yrs.
HAWKS, J. L.	Project Engineer-Instrumentation	B.S. Marine Engineering	9 Yrs.	8 Yrs.
HAYDEN, L. E.	Project Engineer-Mechanical	B.S. Mechanical Engineering	5 Yrs.	2 Yrs.
LITTLE, M. M., JR.	Project Engineer-Nuclear Licensing	A.A. Mechanical Engineering B.S. Metallurgical Engineering	13 Yrs.	13 Yrs.
MILLAS, G.	Project Design Coordinator	B.S. Mechanical Engineering	7 Yrs.	7 Yrs.

NAME	TITLE	EDUCATION	TOTAL EXPERIENCE	NUCLEAR EXPERIENCE
MISKIMIN, P. A.	Assistant Engineering Project Manager	B.S. Marine Engineering M.S. Nuclear Engineering	13 Yrs.	13 Yrs.
MONROE, J. R.	Assistant Construction Project Manager	B.S. Civil Engineering	9 Yrs.	6 Yrs.
MOONEY, J. T.	Engineering Project Manager	B.S. Chemical Engineering P.E. Pennsylvania, N. Carolina, Tennessee	22 Yrs.	20 Yrs.
MYERS, M. J.	Project Engineer-Quality Assurance	B.S. Civil Engineering P.E. Texas	7 Yrs.	7 Yrs.
POMES, F. H.	Project Engineer-Mechanical Nuclear	B.S. Mechanical Engineering M.B.A. Business Administration P.E. Louisiana	18 Yrs.	8 Yrs.
SETHI, J. S.	Project Engineer-Stress Analysis	B.S. Civil Engineering Bachelor of Laws M.S. Operations Research P.E. New Jersey, Texas	17 Yrs.	7 Yrs.
WOLANTEJUS, R. T.	Project Engineer-Piping & Valves	B.S. Nuclear Science	13 Yrs.	8 Yrs.

BY MR. SCHWARZ:

Q Dr. Sumpter, will you please summarize your prepared testimony?

A (Witness Sumpter) My name is James R. Sumpter, Manager of the Nuclear Division of the Houston Lighting and Power Company. A resume of my educational and professional qualifications has been previously received in evidence.

The purpose of this testimony is to summarize the information regarding the technical qualifications of Houston Lighting and Power Company as Project Manager for the South Texas project, as well as the information regarding technical qualifications of our principal contractors.

Houston Lighting and Power Company is aware of its special responsibilities assumed in undertaking the design, construction and operation of this nuclear station. We have in place a staff fully competent to execute our design and construction responsibilities.

Our plans include the addition of further engineering and operating personnel as required to assure the effective design and construction and operation ofthe South Texas project.

Our architect-engineer and constructor is Brown and Root Incorporated, one of the largest construction engineering companies in the world. Brown and Root's experience in the design and construction of power plant extends back to 1954,

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and includes 79 fossil generating stations and 2 nuclear generating units. Brown and Root has developed a staff of engineering personnel who work under the direction of experienced project management, and key project personnel, which is capable of fulfilling the responsibilities of the architect-engineer for the South Texas project.

In addition, several nationally known consulting organizations are making major contributions to the South Texas project in their areas of special expertise, including NUS Corporation, Woodward-Clyde Consultants, and NEDS Nuclear. Westinghouse, the Nuclear Steam Supply System Inventory certainly has been recognized as an experienced, capable engineering organization in the design of nuclear steam supply systems.

In summary, I believe we have assembled an unusual strong team within Houston Lighting and Power Company and our principal contractors to insure the South Texas project is well built and safely operated.

Thank you.

MR. SCHWARZ: Applicant now calls Mr. David G. Barker, Manager, Quality Assurance Department for Houston Lighting and Power Company. Mr. Barker has been previously sworn.

BY MR. SCHWARZ:

Q Mr. Barker, do you have before you a 5-page

document entitled "Testimony of D. G. Barker, Re: Quality Assurance?"

A (Witness Barker) Yes.

MR. SCHWARZ: This document may be found under Tab 18.

BY MR. SCHWARZ:

Q Was this material prepared by you or under your supervision?

A (Witness Barker) Yes.

Q Is the document true and correct to the best of your knowledge and belief?

A Yes.

Q Mr. Barker, do you adopt the document entitled "Testimony of D. G. Barker, Re: Quality Assurance" as your testimony in this proceeding?

A Yes, I do.

MR. SCHWARZ: Mrs. Bowers, I ask the 5-page document identified by Mr. Barker be incorporated in the record as though read. Copies have been furnished to the reporter.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: The document you have just identified will be physically inserted in the transcript as if read.

(The complete testimony follows.)

TESTIMONY OF D. G. BARKER

Re: Quality Assurance

My name is David G. Barker. My position is Manager, Quality Assurance Department with the Houston Lighting & Power Company (HL&P).

A resume of my educational and professional qualifications has previously been received in evidence.

My functions in connection with the South Texas Project are the development, implementation and management of the HL&P Corporate Quality Assurance Program. This responsibility extends into all project activities including design, procurement, construction, and operation.

The purpose of this testimony is to present information on the matter of quality assurance for the South Texas Project, Units 1 & 2 including the portions of the program implemented by Brown & Root and Westinghouse.

Detailed information on this subject can be found in Chapter 17 of the Preliminary Safety Analysis Report for South Texas Project Units 1 & 2 and Chapter 17 of the RESAR-41 (Reference Safety Analysis Report). This information may be summarized as follows:

HL&P, as Project Manager for the Project Participants, has the responsibility for quality assurance during the design, procurement, fabrication,

construction and operation phases of the South Texas Project.

HL&P is fully aware of the attention that should be applied to quality assurance during all of these phases of the South Texas Project. In order to establish and maintain the high quality level required for project activities, HL&P has developed and has fully implemented a comprehensive Quality Assurance Program. This program is documented in the Quality Assurance Program Manual and the South Texas Project Quality Assurance Plan. This Program was implemented prior to the selection of the NSSS vendor and is presently being utilized in all facets of the project. This program requires, at a minimum, that the quality assurance activities performed by HL&P and its prime contractors, subcontractors, and vendors comply with the NRC criteria established in 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants", appropriate Regulatory Guides and industry standards.

The HL&P Quality Assurance Department was established to provide for the effective control of all quality activities related to the nuclear power plants, including those performed by all contractors and suppliers. We have developed and implemented a detailed

indoctrination, training and continuing education program to assure that all quality assurance personnel are fully qualified to discharge the responsibilities assigned to them.

As the Manager, Quality Assurance, I report on all technical and administrative matters to the Executive Vice President of HL&P. This reporting arrangement provides independence for the quality assurance function.

Our HL&P Quality Assurance personnel have the duty and authority to identify quality problems; to initiate, recommend or provide solutions; and to verify the implementation and effectiveness of solutions. To enforce this, they have authority to "Stop Work" in all design, procurement, construction and operation phases of HL&P nuclear power plant projects.

A Project Quality Assurance Manager is assigned to the South Texas Project. He has the responsibility of implementing the South Texas Project Quality Assurance Plan and deals directly with the HL&P Project Manager, other line organizations, contractors and subcontractors. In addition, HL&P will have on the site qualified resident quality assurance personnel who will perform continuous surveillance on all site activities;

these individuals report to the Project Quality Assurance Manager.

While HL&P retains overall responsibility for the Quality Assurance Program, portions of the Program are implemented by Brown & Root and Westinghouse.

Brown & Root and Westinghouse have developed and implemented quality assurance programs that satisfy the NRC regulatory requirements and those required by HL&P.

Within the Brown & Root organization, a Project QA Manager has been appointed to supervise the site QA activities. He reports to the Brown & Root Manager of Quality Assurance at Brown & Root headquarters in Houston, who in turn, reports to the Senior Group Vice President of the Power Division. At the Houston office, a Project QA Engineer is responsible for quality assurance during design and procurement and reports to the Manager of Quality Assurance. Also, a Vendor Surveillance Coordinator reporting to the Manager of Quality Assurance is responsible for the vendor surveillance activities.

At Westinghouse, the Nuclear Energy System (NES) Divisions are responsible for supplying the Pressurized Water Reactor (PWR) nuclear steam supply

systems and components for the South Texas Project. Within NES, the PWR Systems Division, headed by a General Manager, is responsible for design, procurement, and quality assurance for all of the nuclear systems and components.

The PWR Systems Division Product Assurance Department is responsible for integrating and auditing the quality-related work and the quality assurance programs of the NES Divisions and the external suppliers to Westinghouse. This Department is headed by the Manager, Product Assurance, who reports directly to the General Manager of the PWR Systems Division.

HL&P has conducted a comprehensive audit program to verify that this overall QA Program as described is indeed being implemented in a satisfactory manner.

In summary, a comprehensive quality assurance program has been established and implemented for all quality-related activities as described in Chapter 17 of the South Texas Project PSAR. Implementation will continue for the life of the Project, with reviews and modifications to the program being made, as necessary, to conform to new requirements as they may arise.

BY MR. SCHWARZ:

Q Mr. Barker, could you summarize your testimony?

A (Witness Barker) My name is David G. Barker. My position is Manager, Quality Assurance Department, with Houston Lighting and Power Company. A resume of my educational and professional qualifications has previously been received in evidence.

My testimony presents a brief description of the Houston Lighting and Power Quality Assurance Program and how it is placed into effect through the South Texas project quality assurance plan. It provides information on the organization structure of the Houston Lighting and Power Quality Assurance Department, including its reporting position and the staff that will be responsible for the implementation of the quality assurance plan for the South Texas project.

My testimony further provides information about our architect-engineer, and constructor, Brown and Root. And the responsibilities they have in implementing an effective quality assurance program for the South Texas project. The organization structure in a brief description of the Westinghouse quality assurance program is also presented in my testimony.

This completes my summary.

MR. SCHWARZ: Applicant now calls

Dr. Walton A. Rodger of Nuclear Safety Associates. Dr. Rodger has been sworn previously.

BY MR. SCHWARZ:

Q Dr. Rodger, do you have before you a 16-page document together with a list of references and 6 tables attached entitled "Testimony of Walton A. Rodger, Re: Compliance With Appendix I?"

A (Witness Rodger) Yes, I do.

MR. SCHWARZ: Mrs. Bowers, this document is under Table L-8.

I am sorry. Tab 19. I beg your pardon.

MRS. BOWERS: We have it. Thank you.

BY MR. SCHWARZ:

Q Dr. Rodger, was this document prepared by you or under your supervision?

A (Witness Rodger) It was.

Q Do you have any corrections, additions or modifications to the document?

A Yes, sir. There is one typographical error on page 13 at line 6. There are 2 figures. Under gamma, for a single unit.

It reads 0.013 millirad per year and it should read 0.13 millirad per year.

In addition, I would like to make one addition to Table 6. The first entries on Table 6 are for liquid

effluents, and the second of those 2 entries, organ dose per unit, the word "thyroid" should be added, and then below that I would like to add the word "liver," and in the final column, add 0.027 millirems per year.

MRS. BOWERS: Would you mind repeating that? That last correction.

WITNESS RODGER: Yes. On table 6, in the second column, reads "liquid effluent, total body dose per unit" and then "organ dose per unit." That is the thyroid dose. Below that I would like to add "liver."

In the final column, immediately below the number 00.033 -- I would like to add 0.027, millirem per year.

MRS. BOWERS: Fine, thank you.

BY MR. SCHWARZ:

Q Is the document as so modified true and correct to the best of your knowledge and belief?

A (Witness Rodger) Yes.

Q Do you adopt the document entitled "Testimony of Walton A. Rodger, Re: Compliance With Appendix I" as modified by your testimony, as your testimony including the attachment thereto?

A Yes.

MR. SCHWARZ: Mrs. Bowers, I ask that the 16-page document and attachments identified by Dr. Rodger, as modified by Dr. Rodger at this hearing, be incorporated into the record

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as though read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: The document will be physically inserted in the transcript as if read.

(The complete testimony follows.)

My name is Walton A. Rodger. I am a partner in the consulting firm of Nuclear Safety Associates. My technical and professional qualifications have been previously received in evidence. I have been continuously involved in the nuclear energy field since 1942. Much of my professional career has been devoted to study and consulting in the area of control of effluents from nuclear facilities.

This statement addresses itself to the question whether the proposed nuclear facility, South Texas Project Units 1 & 2, will discharge radioactive effluents to air and water which will be "as low as practicable," and whether the proposed facility meets the requirements of Appendix I to 10 CFR 50, as adopted by the Nuclear Regulatory Commission ("Commission") effective June 4, 1975[(1)] and amended.effective September 4, 1975.[(2)]

Under Section I of Appendix I, design objectives conforming to the guidelines of Appendix I are deemed to be a conclusive showing of compliance with the "as low as practicable" requirements of 10 CFR 50.34a. These guidelines are set forth in paragraphs A, B, C, and D of Section II of Appendix I. This testimony will show that each unit of STP meets the design objectives of paragraphs IIA, IIB, and IIC.

Paragraph IID of Appendix I sets forth a cost-benefit analysis that must be performed to ascertain whether additional items should be added to the radwaste system. As amended by the Commission effective September 4, 1975, however, paragraph IID provides that such analysis need not be performed in the case of an application docketed prior to June 4, 1976--such as that for the South Texas Project--if the radwaste systems satisfy the Guides on Design Objectives for Light-Water-Cooled Nuclear Power Reactors proposed in the Concluding Statement of Position of the Regulatory Staff in Docket-RM-50-2 (hereinafter called the "Staff's Concluding Statement") reproduced in the Annex to Appendix I.[3] Applicant has presently chosen to comply with paragraph IID by demonstrating that it satisfies the Staff's Concluding Statement. Thus, this testimony will also show that the radwaste systems satisfy paragraphs A, B, and C of the Annex to Appendix I.

I have made a completely independent analysis of the South Texas Project radwaste systems using the most recent versions of the Draft Regulatory Guides pertaining to Appendix I as follows:

I.AA Calculation of Annual Average Doses to Man from Routine Releases of Reactor Effluents

for the Purposes of Implementing Appendix I, September 23, 1975.

I.BB Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from PWR, September 9, 1975.

I.DD Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water Reactors, September 22, 1975.

The results of my analyses are summarized in this statement.

I. Description of Waste Systems

The waste systems to be used at the South Texas Project have been described in some detail in Chapter 11 of the Preliminary Safety Analysis Report (PSAR). For an orderly presentation of this testimony, a brief and simplified description of the waste treatment systems proposed for handling the gaseous and liquid wastes from STP follows.

A. Gaseous Systems

The South Texas Project reactors, in company with any Pressurized Water Reactor ("PWR"), can be expected to have small but discernible releases of gaseous wastes from the following sources:

(1) Primary Gas System

(2) Secondary Off-gas

(3) Steam Generator Blowdown Vent

(4) Containment Purging

(5) Ventilation of the Auxiliary Building

(6) Ventilation of the Turbine Building.

A brief discussion of each of the six sources follows.

The primary coolent in a PWR, if the core contains any significant fraction of failed fuel, will contain some radioactive fission products some of which are gases. At one or more points in the system (in the case of South Texas Project at the Volume Control Tank) some of these gaseous fission products are drawn off and sent to the Primary Gas System. This system in the South Texas Project consists of a compressor, cooler, moisture separator, dryer (2 in parallel) and four charcoal-filled delay tanks. The effective holdup time in the delay tanks before discharge is about four days for kryptons and more than 60 days for xenons. The purpose of the holdup is to allow time for the shorter-lived components of the waste gas to decay prior to release. This significantly reduces the dose impact of the

discharge.

In PWR the primary coolant is used in a steam generator to transfer heat to a secondary water circuit in which steam is produced for use in the turbine generator to produce electricity. So long as there are no leaks in the tubes in the steam generator, there will be no radioactivity associated with the secondary system even if there is radioactivity in the primary system. Thus the loss of radioactivity from the secondary system of a PWR is a "second order" probability, that is, there must be simultaneously present significant failed fuel and significant steam generator tube leakage to produce any significant loss of radioactivity from the secondary system. In this analysis allowance has been made for an assumed release from the secondary system.

In most PWR the blowdown taken from the steam generator to maintain proper water chemistry in the system is discharged into a blowdown tank where it is cooled by allowing a portion of the liquid to flash (boil). The off-gas from this tank has been shown to be a possibly significant source of radioactivity, particularly iodine, if discharged directly. At the South Texas Project, however, the vapor from the blowdown tank is

condensed in feed water heaters and all of the liquid is returned to the condenser hotwell. This approach eliminates this source of gaseous waste completely.

PWR are provided with containment shells. There is a great deal of equipment inside these containment shells and it contains the primary coolant at elevated temperature and pressure. It is not possible to maintain all of this equipment in a completely leak-free condition. Therefore, it is to be expected that some of the primary coolent will escape into the containment shell, and that some of the escaped material will become and remain airborne. When it is necessary to enter the containment shell for any length of time, it is generally desirable to purge the containment atmosphere in order to reduce the radioactivity in the air which will be breathed by the personnel entering. When this is done the remaining air-borne activity in the containment atmosphere will be released to the environment. To reduce the amount so released, the South Texas Project containment includes two 10,000-cfm "kidneys", internal devices which circulate the containment atmosphere through charcoal and HEPA filters to reduce the iodine content. In the calculation of emissions from containment, it has been

assumed that there will be a continuous purge of containment at a rate of 1000-cfm, even though the plans for operation do not include the use of continuous purge.

The Auxiliary Building of a PWR houses a good deal of anciliary equipment used for the control of radioactivity of the system and for many other subsystems needed for the operation of the reactor. Many of these can be expected to leak small quantities of radioactive liquids into the building and some of these will become airborne. Thus there is the possibility that some radioactivity will escape with the ventilation air from this building. At the South Texas Project the Auxiliary Building ventilation air is released without treatment prior to discharge.

Similarly, there is a possibility, albeit less than in the case of the Auxiliary Building, that there can be radioactive material in the air in the Turbine Building. At the South Texas Project this ventilation air is released without treatment.

B. <u>Liquid Systems</u>

Liquid wastes from PWR come from a variety of sources which have a considerable disparity in chemical and radiochemical composition and concentration. Normally these wastes are collected and treated

separately. The liquid wastes from South Texas Project fall into the following five categories:

(1) CVCS Waste - (Waste Portion of LWPS)

(2) Clean Waste - (Recycle Portion of LWPS)

(3) Floor Drains - (Waste Portion of LWPS)

(4) Chemical Waste - (Waste Portion of LWPS)

(5) Detergent Waste - (Waste Portion of LWPS)

A brief discussion of each of the five categories follows: The CVCS System is set up to control the concentration of boric acid in the primary coolant. In a real sense it is not a waste system at all but rather an integral part of the control system for the reactor. However, a portion of the product needs to be discarded to control the concentration of tritium in the primary system; thus the system contributes to the discharges of radioactivity in liquids and needs to be considered as a waste system.

The CVCS System for the South Texas Project consists of two ion exchangers (in parallel), two holdup tanks, an evaporator, and a distillate ion exchanger. A portion of the overhead distillate is sent to the waste portion of the Liquid Waste Processing System ("LWPS"), where it could, if necessary, be given, further processing. Since further processing will

normally not be needed, in this analysis I have assumed that this distillate is released after analysis without further processing.

The Clean Waste (Recycle) System is set up to handle reactor-grade water from equipment and sample drains. These wastes are collected separately in a Waste Holdup Tank and may be evaporated, deionized, or both, or released without treatment as circumstances dictate.

The Floor Drain System is set up to handle the wastes which have been collected from the floor sumps of all of the buildings save the Turbine Building. These wastes tend to be more variable in composition and lower in radioactivity than the clean waste. Their treatment at the South Texas Project consists of collection, evaporation, and/or ion exchange, or they may be released without treatment if circumstances warrant.

The Chemical Waste System collects the regenerant from the condensate cleanup system. This waste, if contaminated due to steam generator tube leakage in conjunction with significant failed fuel, will require evaporation.

The overhead from evaporation can be further treated with ion exchange if desired. The evaporator overhead, with or without further treatment, is released. The evaporator bottoms are solidified and sent to a commercial burial ground.

Steam generator blowdown from a PWR will not contain any radioactivity unless there is simltaneous steam generator tube leakage and a significant fraction of failed fuel. At the South Texas Project steam generator blowdown is returned to the condenser hotwell and thence to the condensate demineralizers. Thus in a sense this waste stream does not exist at the South Texas Project.

Detergent wastes come from the laundry, showers, and decontamination operations. The activity level is very low. The detergent content, on the other hand, very much complicates the treatment of other wastes, were these to be combined with them. Consequently it is desirable to segregate this waste category and this is done at the South Texas Project. The treatment provided for this stream at the South Texas Project is normally filtration, although additional treatment is available if needed. In this analysis only filtration is assumed.

Turbine Building drains usually contain only

very low levels of radioactivity even if there is some steam generator tube leakage. It is not generally the practice to provide any treatment for this stream. In our analysis, allowance has been made for the contribution of this stream to total liquid discharges.

II. Emissions of Radioactivity from the South Texas Project

The emissions of radioisotopes from the operation of the South Texas Project have been estimated using techniques similar to those used by the Commission Staff in making their analyses. My source terms were developed using the same PWR-GALE code used by the Staff. All such calculations are dependent, however, on a series of assumptions and judgments. I believe that my assumptions are essentially identical to those of the Staff for the gaseous systems--so the resulting source terms (shown in attached Table 1) should be almost identical. The Project's liquid system is so flexible, however, that no two analysts are likely to make precisely the same assumptions. Thus there may be some small differences between the liquid source terms I have calculated (shown in attached Table 2) and those used by the Staff.

III. Calculation of Individual and Site Boundary Doses

The source terms from Tables 1 and 2 were converted into site boundary and "maximum individual" doses

using the equations given in Draft Regulatory Guide 1.AA (September 23, 1975). Some of the calculations were done by hand calculator, others by the use of computer codes developed by Nuclear Safety Associates.

Site boundary calculations were done for the north sector at a distance of 1430 meters. A number of critical residences were checked--the controlling point was taken as a residence located 4300 meters NNW of the reactors.

In making these calculations it is necessary to use values of atmospheric dispersion, X/Q, and deposition, D/Q, at the points of interest. The applicant's meteorological consultants, NUS Corporation, reviewed the site meteorology as reported in the PSAR and the Environmental Report in light of the new Draft Reg. Guide 1.DD (September 22, 1975). They provided the meteorological parameters listed in attached Table 3 which I used in this analysis.

The calculated maximum doses to an individual from liquid effluents are shown in attached Table 4. It is obvious from Table 4 that the South Texas Project meets with ease either the design objectives of paragraph IIA of Appendix I or those of paragraph A.1 of the Staff's Concluding Statement. Further, Table 2 shows that South

Texas Project meets paragraph A.2 of the Staff's Concluding Statement.

The resulting site boundary air doses were determined to be:

	Single Unit	Two Units
Gamma	0.013 mrad/yr	0.26 mrad/yr
Beta	0.26 mrad/yr	0.52 mrad/yr

Thus it is apparent that the Project also meets with ease the design objectives for noble gas emissions contained in paragraph II.B.1 of Appendix I as well as paragraphs B.1 and B.2 of the Staff's Concluding Statement.

The calculated external doses from gaseous effluents to real individuals, located at the above defined residence, were determined to be:

	One Unit	Two Units
Total Body Dose	7.7E-03 mrem/yr	1.5E-02 mrem/yr
Skin Dose	2.0E-02 mrem/yr	4.0E-02 mrem/yr

Here again these doses are much below the design objectives of paragraph II.B.2 of Appendix I or of paragraph B.3 of the Staff's Concluding Statement.

The calculated doses from the emission of iodines and particulates in effluents to the atmosphere are shown in Table 5. The values shown in Table 5 are for dose pathways which could reasonably exist, as required by

Appendix I. These values are for a single unit. Even doubled to allow for two-unit operation at the site, the maximum individual total body dose is less than 1 mrem/yr and the maximum individual organ dose is less than 2 mrem/yr. Thus STP satisfies paragraph II.C of Appendix 1 and paragraph C.1 of the Staff's Concluding Statement. Table 1 shows that STP also satisfies paragraph C.2 of the Staff's Concluding Statement.

The above calculated doses are summarized in Table 6 and compared to the requirements of Appendix I and the Staff's Concluding Statement. Again it is clear that STP meets all pertinent requirements with ease.

IV. Conservativeness of the Nuclear Regulatory Commission Staff's "Upper Bound" Calculations

In an affidavit filed by Dr. Jacob Kastner for the Commission Staff earlier in this proceeding,[(4)] an "upper bound" calculation of the total annual population dose resulting from the South Texas Project was presented for purposes of demonstrating the unlikelihood that a cost-benefit analysis pursuant to paragraph II.D of Appendix I would require any addition to the radwaste systems. In view of the Commission's subsequent revision of paragraph II.D, as I have previously indicated, no such cost-benefit analysis is presently required in this case. However, it is clear that Dr. Kastner's analysis

was indeed a conservative "upper bound" calculation.

We are now in a position to make a more nearly precise "upper bound" calculation. Attached Tables 4 and 5 show that the real individual subject to maximum exposure may be expected to receive from the operation of a single unit less than 1 mrem/year thyroid dose and less than 0.5 mrem/year total body dose from liquids and gases.

In general the average dose over fifty miles is found to be about 1% of the maximum individual dose. Therefore we can expect that the average doses over the 50-mile radius will be about:

total body	5E-03 mrem/yr
thyroid	1E-02 mrem/yr

The projected year 2020 population for the 50-mile radius surrounding the Project site is about 800,000 persons. Therefore the total annual population dose in 2020 from one South Texas Project unit can conservatively be expected not to exceed:

total body	4 person-rem
thyroid	8 person-thyroid-rem.

Dr. Kastner's "upper bound" estimate, which was based upon a total U.S. population, was about 24 total body person-rem and 35 thyroid-person-rem. This clearly

conservatively overestimated the annual population dose within 50 miles which would be considered if a cost-benefit analysis were being performed under paragraph II.D of Appendix I.

V. Conclusion

My independent analysis of the South Texas Project shows that the radwaste systems proposed by the Applicant meet the design objectives of paragraphs II.A, II.B, and II.C of Appendix I and that, since they satisfy paragraphs A, B, and C of the Staff's Concluding Statement, they also meet the objectives of paragraph II.D of Appendix I.

References

1. Title 10, CFR Part 50, Appendix I. Federal Register, V. 40, p. 19442, May 5, 1975.

2. Title 10, CFR Part 50, Amendment to Paragraph II.D. of Appendix I. Federal Register, V. 40, p. 40818, September 4, 1975.

3. U. S. Atomic Energy Commission Concluding Statement of Position of the Regulatory Staff (and its Attachment) - Public Rulemaking Hearing on: Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criteria "As Low As Practicable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactors, Docket No. RM-50-2, Washington, D.C., February 20, 1974.

4. Affidavit of Dr. Jacob Kastner (Relative to an upper bound estimate of radiological impact on the general public), Docket Nos. 50-498 and 50-499, July 6, 1975.

TABLE 1

Gaseous Source Terms

Noble Gases	Total C_i/yr
Kr-83m	0.0
Kr-85m	9.0E 00
Kr-85	2.7E+02
Kr-87	2.0E 00
Kr-88	1.4E+01
Kr-89	0.0
Xe-131m	1.7E+01
Xe-133m	1.5E+01
Xe-133	8.7E+02
Xe-135m	0.0
Xe-135	3.3E+01
Xe-137	0.0
Xe-138	0.0
Total Noble Gases	1.2E+03
I-131	1.8E-01
I-133	1.5E-01
Tritium	1.0E+03
Others	
Mn-54	3.9E-02
Fe-59	1.3E-02
Co-58	1.3E-01
Co-60	6.0E-02
Sr-89	2.9E-03
Sr-90	5.3E-04
Cs-134	3.9E-02
Cs-137	6.7E-02
C-14	8.0E 00
A-41	2.5E+01

TABLE 2

Liquid Source Terms

Corrosion & Activation Products	Total C_i/yr
Cr-51	0.00009
Mn-54	0.00100
Fe-55	0.00009
Fe-59	0.00005
Co-58	0.00490
Co-60	0.00880
Np-239	0.00004
Fission Products	
Br-83	0.00003
Sr-89	0.00002
Y-91	0.00010
Mo-99	0.00910
Tc-99m	0.00870
Te-127m	0.00001
Te-127	0.00002
Te-129m	0.00007
Te-129	0.00004
I-130	0.00015
Te-131m	0.00005
I-131	0.07700
Tc-132	0.00077
I-132	0.00200
I-133	0.04100
Cs-134	0.01600
I-135	0.00720
Cs-136	0.00110
Cs-137	0.02600
Ba-137m	0.00210
All others	0.00007
Total except Tritium	0.22000
Tritium	480

TABLE 3

Meteorological Parameters Used In Calculations

		Direction from Site	Distance meters	X/Q, Sec/m^3
1.	Noble Gas Values			
	Maximum Site Boundary	N	1430	4.7E-06
	Residences:	ESE	2000	4.3E-07
		WSW	3900	3.8E-07
		W	3900	4.9E-07
		NNW	4300	4.8E-07
2.	Radioiodines and Particulates*			
	Gardens	ESE	2000	3.4E-07
		WSW	3900	2.7E-07
		W	3900	2.5E-07
		NNW	4300	2.9E-07
	Cow	E	11,300	1.8E-08
3.	Deposition Values*			D/Q, m^{-2}
	Gardens	ESE	2000	2.3E-09
		WSW	3900	1.3E-09
		W	3900	1.4E-09
		NNW	4300	3.3E-09
	Cow	E	11,300	4.5E-11

* Includes cloud depletion.

TABLE 4

Liquid Doses to "Maximum Individual"*

Pathway	Child	Teen	Adult
Total Body Doses:			
1. Ingestion of Fish (Salt Water)	3.5E-03	9.5E-03	1.3E-02
2. Ingestion of Seafood	1.3E-03	2.1E-03	2.9E-03
3. Deposition on Shoreline	6.1E-04	4.3E-03	6.1E-04
Total Liquid Total Body Dose	5.4E-03	1.6E-02	1.7E-02
Thyroid Doses:			
1. Ingestion of Fish (Salt Water)	1.4E-03	1.9E-03	2.0E-03
2. Ingestion of Seafood	1.4E-03	1.2E-03	1.3E-03
3. Deposition on Shoreline	--	--	--
Total Liquid Thyroid Dose	2.8E-03	3.1E-03	3.3E-03

* Assumed to live at "Nearest" Residence shown in Table 5.

TABLE 5

Summary of Particulate & Iodine Doses at Nearest Residence*
(from a single unit)

Pathway	Infant	Child	Teen	Adult
Total Body Doses:				
1. Noble Gas Immersion	7.7E-03	7.7E-03	7.7E-03	7.7E-03
2. Deposition on Ground	2.5E-01	2.5E-01	2.5E-01	2.5E-01
3. Inhalation	8.4E-03	8.8E-03	7.6E-03	1.6E-02
4. Leafy Vegetables	--	6.7E-03	7.1E-03	1.3E-02
5. Stored Vegetables	--	9.8E-02	9.5E-02	9.7E-02
6. Water	0	0	0	0
Total	2.7E-01	3.7E-01	3.7E-01	3.8E-01
Thyroid Doses:				
1. Noble Gas Immersion	7.7E-03	7.7E-03	7.7E-03	7.7E-03
2. Deposition on Ground	2.5E-01	2.5E-01	2.5E-01	2.5E-01
3. Inhalation	5.1E-02	3.4E-02	2.5E-02	3.6E-02
4. Leafy Vegetables	--	4.4E-01	2.6E-01	3.3E-01
5. Stored Vegetables	--	4.4E-02	2.3E-02	5.0E-02
6. Water	0	0	0	0
Total	3.1E-01	7.8E-01	5.7E-01	6.7E-01

* Located 4300 meters NNW of the site. This is not the "nearest" residence, but it has the poorest value of X/Q.

TABLE

Comparison of Calculated Doses with Design Objectives

Design Objective Stated In	Applied to	Design Objective	Calculated Value
Appendix I:			
¶IIA	Liquid Effluents		
	Total Body Dose per Unit	3 mrem/year	0.017 mrem/year
	Organ Dose per Unit	10 mrem/year	0.0033 mrem/year
¶IIB	Gaseous Effluents		
	Gamma Air Dose per Unit	10 mrad/year	0.13 mrad/year
	Beta Air Dose per Unit	20 mrad/year	0.26 mrad/year
	Total Body Dose to Real Individual per Unit	5 mrem/year	0.0077 mrem/year
	Skin Dose to Real Individual per Unit	15 mrem/year	0.02 mrem/year
¶IIC	Particulates & Iodine per Unit	15 mrem/year any organ	0.77 mrem/year (thyroid)
Staff's Concluding Statement:			
¶A	Liquid Effluents Total Body or Any Organ per Site	5 mrem/year	0.034 mrem/year
	Liquid Effluents curies/unit	5 curies/year	0.22 curie/year
¶B	Gaseous Effluents Gamma Air Dose/site	10 mrad/year	0.26 mrad/year
	Gaseous Effluents Beta Air Dose/site	20 mrad/year	0.52 mrad/year
	Total Body Dose to Real Individual per Site	5 mrem/year	0.015 mrem/year
	Skin Dose to Real Individual per Site	15 mrem/year	0.04 mrem/year
¶C	Gaseous Effluents Particulate & Iodine/site	15 mrem/year	1.5 mrem/year
	Gaseous Effluents I-131 per unit	1 curie/year	0.18 curie/year

MRS. BOWERS: Dr. Rodger will be here later for questions?

MR. SCHWARZ: Yes, he will.

BY MR. SCHWARZ:

Q Dr. Rodger, would you please summarize your prepared testimony?

A (Witness Rodger) Yes, sir.

My name is Walton A. Rodger. I am a partner in the nuclear consulting firm of Nuclear Safety Associates, Bethesda, Maryland. My technical and professional qualifications have been previously received into evidence.

My testimony addresses itself to the question of whether the proposed nuclear facility South Texas project Units 1 and 2, will discharge radioactive effluents to air and water which will be as low as practicable.

I have made a completely independent analysis of the South Texas project radwaste systems, using methods similar to those used by the staff in preparation of their testimony and using the most recent versions of the draft Regulatory Guides pertaining to Appendix I, specifically Regulatory Guide 1.AA, which has to do with the calculation of doses, Regulatory Guide 1.BB which has to do with the calculation of the source term and Regulatory Guide 1.DD, which has to do with the estimating of atmospheric diffusion.

The results of my analysis are described in my

prepared testimony and summarized in a series of tables attached thereto, but specifically summarized in table 6, which we just added.

Table 6, which we just added. Table 6 shows that the South Texas project meets with ease in all respects the requirements of paragraphs 2A, 2B and 2C of Appendix I, and that it also meets with ease in all respects paragraphs A, B and C of the Staff's concluding statement, and thus under the operation afforded, meets paragraph 2D of Appendix I.

Therefore, it does indeed meet all of the requirements of Appendix I and its releases are indeed as low as practicable.

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BY MR. SCHWARZ:

Q Dr. Rodger, are you familiar with the list of the questions furnished by the Board on November 4, 1975?

A Yes, I am.

Q Dr. Rodgers, the last of these questions reads: It is not clear to the Board whether the statement at page 11-2 or Supplement 1 to the effect that air doses will not exceed 10 M rad per year gamma and 20 M rad per year beta include contributions from gas stream releases of Carbon 14, tritium and paticulates.

Are we to rely on the implication in the July 18, 1975 affidavit of Dr. Boegli that such doses due to Carbon 14 in particular are negligible?

I beg your pardon. I believe it continues.

If so, is the dose from tritium also negligible?

And then, B: are the releases on which the Staff's present air dose assessment is based, those of Boegli or those of the FES Table 3.7, as implied in the SER at page 11-7?

I recognize that this question appears to be addressed principally to the Staff. However, do you have any comments on either of these questions?

A Well, yes, in regard to Question AA, based on my knowledge of the development of Appendix I, and a review of Reg Guide 1AA, particularly Appendix B thereof,

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it is my understanding that the intent of th air dose limits of 10 millirad per year gamma and 20 millirad per year beta was and is that the calculated dose specifically refers only to the noble gases, that is krypton, xenon and argon 41 and the effects of carbon 14, tritium and particulate are taken into account by other means and specifically those described in Appendix C to Regulatory Guide 1AA.

It may be noted that Table B1 of Regulatory Guide 1AA includes immersion dose factors only for the noble gases.

Since there are no immersion dose factors -- and I didn't have any availble to me -- for carbon 14, tritium or particulates, I roughly estimated what the dose from these immersions might be by the use of a technique that we formerly used.

That is, concentrate the concentration of the release in question at the point of interest, compare that to the maximum permissible concentration as given in 10 CFR Part 20, and assume that the 10 CFR Part 20 MPC is equivalent to 500 millirem per year, thus the concentration of the MPC to 500 gives a rough estimate and I repeat, rough estimate of the dose.

On this basis the estimated releases of carbon 14, tritium and the total of all prticulate releases would increase the calculated noble gas immersion

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dose to individuals by less than .15 percent, .5 percent, and 3 percent respectively.

As to 33, I don't believe it is appropriate for us to answer that question.

MR. SCHWARZ: Fine.

Applicant now calls Mr. R. D. Gauny, health physicist for the Houston Lighting and Power Company.

Mr. Gauny has been previously sworn.

DIRECT EXAMINATION

BY MR. SCHWARZ:

Q Mr. Gauny, do you have before you an eight-pae document entitled Testimony of R. D. Gauny Re Occupatinal Exposures?

A Yes, I do.

MR. SCHWARZ: The document will be found under Tab 20.

BY MR. SCHWARZ:

Q Mr. Gauny, was this document prepared by you or under your supervision?

A Yes, it was.

Q Do you have any corrections, additions, or modifications?

A No.

Q Is the document true and correct to the best of your knowledge and belief?

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A Yes, it is.

Q Do you adopt the document entitled Testimony of R. D. Gauny Re Occupational Exposures as your testimony in this proceeding?

A Yes, I do.

MR. SCHWARZ: Mrs. Bowers, I ask that the 8-page document just identified by Mr. Gauny be incorporated into the record as though read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: No objection.

MRS. BOWERS: The document just identified will be physically incorporated in the transcript as if read.

(Testimony follows.)

TESTIMONY OF R. D. GAUNY

Re: Occupational Exposures

My name is R. D. Gauny. I am a Health Physicist in the Nuclear Division of the Power Plant Engineering and Construction Department of Houston Lighting & Power Company.

A resume of my educational and professional qualifications has previously been received in evidence. It is my function in the South Texas Project to assure that the facility is designed and operated in a manner that assures that exposures are within regulatory requirements.

At the earlier hearings in this proceeding, the Board expressed interest in the occupational dose estimate included by the NRC staff in the Final Environmental Statement for the South Texas Project. The FES assumed that the occupational dose associated with the South Texas Project plant would be 450 man-rem per year per unit. This, of course, is only an estimate based upon experience at other nuclear power plants. Specifically, it is derived from WASH-1311, "A Compilation of Occupational Radiation Exposure from Light Water Cooled Nuclear Power Plants, 1969-1973."

The matter of occupational exposures is dealt with in detail in the Preliminary Safety Analysis Report for the South Texas Project, specifically in

Section 12.1.6 and Tables 12.1-24 through 12.1-30.

At the outset, I would like to state that the 450 man-rem per unit figure (which includes exposures to both permanent operating personnel and support maintenance people) is neither a goal nor a design objective for the Project. It will be our objective to reduce occupational exposures to a level as low as reasonably achievable and, in fact, we would expect to maintain in-plant exposures significantly lower than those estimated by the Staff. Our management is committed to this goal in the manner required by paragraph C.1. of Regulatory Guide 8.8 on "Occupational Radiation Exposures at Nuclear Reactors."

In implementation of our management commitment, we are taking steps in the design of the facility and will adopt work practices to help us achieve our goal of minimizing radiation exposures to onsite personnel, whether permanent or transient.

Turning first to the matter of design, the South Texas Project facility will incorporate features which should be extremely helpful in reducing occupational exposures. Among the specific features designed to reduce exposures are permanently installed scaffolding around the steam generator, and a design that allows

for removal of the steam generator in one piece. The use of volatile chemistry in the treatment of the secondary side of the steam generator has also been selected in an effort to reduce exposures. The use of remote welding techniques and explosive plugs are being considered to further reduce exposures during steam generator maintenance. As the Board is aware, the surveillance and maintenance of steam generator tubes has proven to be a major contributor to occupational exposures. It is our expectation that the South Texas Project design features will reduce substantially the dose associated with such operations.

The overriding design criterion for the facility shielding, equipment, and layout has been to keep radiation exposure to operating personnel as low as reasonably achievable (ALARA) and well within the limits of 10 CFR 20. The facility is being designed in conformance with the recommendations of Regulatory Guide 8.8, which suggest ways in which ALARA exposures can be achieved (such as careful selection and placement of equipment, isolation of that equipment from personnel as much as possible, and reducing frequency and duration of equipment maintenance periods). A few examples of how this has been achieved in the design of the South

Texas Project, Units No. 1 and 2 follow.

The Mechanical and Electrical Auxiliary Building where facility radioactive waste is collected, processed, and prepared for disposal, has been arranged with a large part of the middle level exclusively devoted to the routing of pipes containing radioactive fluids. This radioactive pipe chase is connected with all of the shielded enclosures that are provided for equipment containing radioactivity. In this way the facility has been designed so that personnel will always be shielded from radioactive piping and equipment during routine operations.

Valve manipulation is accomplished in radioactive systems via remote reach rods or with powered valve operators. Furthermore, the valves are isolated from the system components that they serve. By careful design, personnel will not normally be exposed to unshielded radioactive valves or pipes. When maintenance is required on these valves, the worker will be shielded from the pump, tank or other radioactive system component. Each radioactive system component is similarly isolated from neighboring equipment so that maintenance can be accomplished with minimal radiation exposure to personnel and without shutdown of that system.

Each radioactive filter in the facility is individually shielded and these filters are clustered in one part of the Mechanical and Electrical Auxiliary Building. Filter cartridge replacement has been carefully planned so that rapid and safe accomplishment is assured. Shielded cartridge transfer casks will provide efficient delivery to the drumming area with minimum personnel exposure.

Shielding and isolation are provided for systems containing low levels of radioactivity. Some examples of this are the Laundry and Hot Shower Tank and associated components and the Spent Fuel Pool Cooling and Purification System.

The residual heat removal (RHR) system components and piping are all either located behind the Reactor Containment Building (RCB) secondary shield or are individually located in shielded cubicles. This allows safe access for personnel into the RCB shortly after shutdown of the reactor and while the RHR system is cooling the reactor down.

Another important source of occupational exposures is that received during refueling operations. It is our expectation that the Westinghouse rapid refueling features incorporated in the South Texas

Project design will result in decreased radiation exposures. Westinghouse has informed us that this feature may reduce total exposures during such operations by as much as a factor of 4.

These are but a few of the many features that will keep occupational exposures as low as reasonably achievable. The design of the facility has been and is being monitored by competent radiation protection specialists to ensure that this goal will be achieved.

We are taking other important design measures to minimize occupational exposures. We require our architect-engineer radiation protection specialists to review the plant design to assure that it is consistent with our occupational dose objectives. The architect-engineer must demonstrate to us that criteria intended to reduce radiation exposures are incorporated in the design. In general, we are using the design guidance set forth in Regulatory Guide 8.8. In addition, we have established a systematic method to review abnormal occurrences at other reactors so that this experience can be factored into our design thereby minimizing the possibility of unscheduled maintenance.

Turning now to work practices and procedures, the South Texas Project is committed to the development

of practices in plant operation to minimize occupational radiation exposures. These practices will be incorporated in the plant radiation manual and will be revised to reflect operating experience. Among the practices to be followed are such important measures as draining and flushing components before maintenance, pre-job training and planning, proper supervision of maintenance personnel, and the transfer of components under repair to areas with lower radiation fields. In the area of administrative devices to reduce exposures, we expect to make extensive use of personnel training measures, including the use of mock-ups as required to familiarize maintenance employees with the environment in which they will work. We believe that by so doing exposures during maintenance can be significantly reduced. Again our plans and procedures for plant operation will be developed in accordance with the recommendations of Regulatory Guide 8.8.

At our earlier hearings, the Board questioned whether the assumption of 450 man-rems per year per unit, as stated in the FES, was compatible with the individual limits on radiation exposures in 10 CFR 20. As noted above, the 450 man-rem figure employed by the staff includes exposures to regular plant personnel as

well as to support maintenance personnel (i.e. those maintenance personnel not permanently assigned to the plant). Thus, there is no necessary inconsistency between the 450 man-rem figure and the requirements of 10 CFR Part 20 with respect to individual exposures. In any event, as noted above, 450 man-rem is neither a goal nor design objective for the South Texas Project. Present estimates of occupational exposures, excluding support maintenance personnel, are in the range of 104.4 man-rem per unit per year to plant personnel during routine operation and maintenance. We believe that the steps outlined above provide a basis for the expectation that occupational doses for the South Texas Project will be substantially lower than 450 man-rem per year per unit, even including non-routine maintenance. In any event, steps will be taken to assure that occupational exposures of individuals are within the regulatory requirements of 10 CFR 20.

In summary, the Applicant's commitment to minimizing occupational exposures is evidenced throughout the plant design and will also be reflected in our operational practices and procedures.

BY MR. SCHWARZ:

Q Mr. Gauny, would you please summarize your prepared testimony?

A My name is R. D. Gauny. I am a health physicist in the Nuclear Division of Houston Lighting & Power Company.

A resume of my educational and professional qualifications has been previously received in evidence.

At earlier hearings in this proceeding the Board expressed interest in the 450 man-rem per year per unit occupational dose estimate included by the NRC Staff in the Final Environmental Statement for the South Texas Project.

450 man-rem per unit per year is neither a goal nor a design objective for the Project.

It will be our objective to reduce occupational exposures to a level as low as reasonably achievable and, in fact, we would expect to maintain in-plant exposures much lower than those estimated by the Staff.

In the matter of design, we have incorporated numerous features which should reduce occupational exposure. These include improvements in steam generator access, considerations of remote welding techniques and explosive plugs, careful selection and placement of

equipment, shielding, rapid refueling and remote operation.

In general, the design guidance of Regulatory Guide 8.8 Rev. 1 (Sept. 1975) is being utilized.

This regutory guide has been closely followed in the development of work practices and administrative procedures.

Among the practices to be followed are the flushing of lines before maitenance, prejob training and planning, proper supervisionof maintenance personnel, and the transferof components under repair to areas with lower radiation fields. Administrative procedures will make extensive use of personnel training.

In summary, the Applicant's commitment to minimizing occupational exposures is evidenced throughout the plant design andwill also be reflected in the operational practices and procedures.

We believe that the steps outlined above provide a basis for our expectation that occupational doses for the South Texas Project will be substantially lower than 450 man-rem per year per unit.

In any event, steps will be taken to assure that occupational exposures of individuals are within the regulatory requirements of 10 CFR 20.

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MR. SCHWARZ: I now call Mr. Richard J. Klapper, Supervisor, Engineering, with Houston Lighting & Power Company.

He has been sworn.

DIRECT EXAMINATION

BY MR. SCHWARZ:

Q Do you have before you a 4-page document entitled Testimony of Richard J. Klapper Re Interface Between South Texas Project and RESSAR-41?

A Yes, sir.

MR. SCHWARZ: Mrs. Bowers, this document will be found under Tab 21.

BY MR. SCHWARZ:

Q Mr. Klapper, was this document prepared by you or under your supervision?

A Yes.

Q Is the document true and correct to the best of your knowledge and belief?

A Yes, it is.

Q Do you adopt the document entitled Testimony of Richard J. Klapper Re Interface Between South Texas Project and RESSAR-41 as your testimony in this proceeding?

A Yes, I do.

MR. SCHWARZ: Mrs. Bowers, I ask the 4-page document identified by Mr. Klapper be incorporated in the

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record as though read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: State has no objection.

MR. STRIDIRON: No objection.

MRS. BOWERS: The document you have just identified will be physically incorporated in the transcript as if read.

(Testimony follows.)

TESTIMONY OF RICHARD J. KLAPPER

Re: Interface Between South Texas Project and RESAR-41

My name is Richard J. Klapper. My position is Supervising Engineer, Nuclear Safeguards and Licensing with Houston Lighting & Power Company.

A resume of my educational and professional qualifications has previously been received in evidence.

My functions in connection with the South Texas Project are to assure that the design, construction and operation of the Project are in conformity with all applicable NRC regulations and criteria.

The purpose of this testimony is to present information on the matter of the safety-related interfaces between the nuclear steam supply system and the balance of the nuclear power plant.

Detailed information on this subject can be found in Section 1.1.2 of the Preliminary Safety Analysis Report for the South Texas Project Units 1 and 2 and on the blue pages in RESAR-41.

A design interface is a broad term generally used to refer to a requirement established to assure that two related systems will be constructed and operated in an appropriate and compatible fashion. The NSSS supplier provides a great deal of information to the utility, including a large number of specified interfaces, in order to assure that the architect-

engineer, the constructor and the utility will properly design the balance of the plant (BOP) taking into account the characteristics of the NSSS which affect the BOP. In the case of the South Texas Project, this extensive information was provided by Westinghouse as part of a standard design information package.

For regulatory purposes, it is necessary that an Applicant for a standard design identify and designate in its submittals to the NRC those safety-related design interfaces that will assure compatibility between the standard design and the BOP.

In the case of the South Texas Project, the process of identifying and designating such safety-related interfaces commenced in the RESAR-41 submitted by Westinghouse pursuant to the provisions of Appendix O of 10 CFR Part 50. Section 3 of Appendix O requires that a standard design submitted for NRC approval include a description, analysis and evaluation of the interfaces between the submitted design and the balance of the nuclear power plant.

When the South Texas Project application was docketed, the NRC Staff had not completed its detailed review of RESAR-41, including its review of the portion thereof that identifies safety-related interfaces. It

thus became important to assure that completion of NRC Staff review of the interfaces applicable to the South Texas Project units would not be delayed by the more comprehensive review required for issuance of a Preliminary Design Approval (under Appendix O) that would be applicable to all future plants that might wish to incorporate RESAR-41 by reference.

Accordingly a program was undertaken by Westinghouse and HL&P to identify and designate on a timely basis all of the safety-related RESAR-41 interfaces necessary for purposes of the STP units. This specific effort included a systematic evaluation by Westinghouse of all information provided as part of the standard/information package and to define additional interface information to be included in RESAR-41. Such information was incorporated into Amendment 17 of RESAR-41 submitted in June, 1975. The NRC Staff identified those aspects of the South Texas Project units involving RESAR-41 interfaces that had to be resolved for the specific purposes of the South Texas Project docket prior to the issuance of the construction permit. The NRC Staff issued three sets of questions to Houston Lighting & Power Company on RESAR-41 interfaces and these matters were satisfactorily resolved through

amendments to the STP PSAR submitted on August 15, October 1, October 9, and October 27, 1975. Thus, the combination of amendments to RESAR-41 and amendments to the South Texas Project PSAR incorporating information specifically applicable to the Project have provided the necessary identification of the safety-related interfaces.

The NRC Staff is continuing its review of RESAR-41 for the purpose of issuing a PDA that will enable future utility applicants to reference RESAR-41 without further review. This process, which is aimed at a final, generic approval of RESAR-41 as a reference design will continue. In the interim, those aspects of the design requiring resolution prior to the issuance of the construction permit for the South Texas Project have been resolved to the satisfaction of the NRC Staff.

BY MR. SCHWARZ:

Q Mr. Klapper, would you please summarize your testimony?

A My name is Richard J. Klapper. My position is Sueprvising Engineering, Nuclear Safeguards and Licensing, Houston Lighting & Power Company.

A resume of my educational and professional qualifications have previously been received in evidence.

In summary, the purpose of this testimony is to present information on the matterof the safety-related interfaces between the nuclear steam supply ayarwm and the balance of the nuclear plant.

For regulatory purposes it is necessary that an Applicant for a standard design, RESSAR-41, identify and designate in its submittals to the NRC those safety related design interfaces that will ensure compatibility between the standard design and balance of plant.

For the South Texas Project, the RESSAR-41 document identifies the appropriate reglatory interfaces. However, when the South Texas Project application was docketed, the NRC Staff had not completed its detailed review of the RESSAR-41 interfaces.

The program was undertaken by Westinghouse and Houston Lighting & Power Company to identify and designate on a timely basis all of the safety-related RESSAR-41

interfaces.

This information was incorporated into Amendment 17 of RESSAR-41, which was submitted in June of 1975.

Subsequently, the NRC Staff identified those aspects of the South Texas Project units involving RESSAR-41 interfaces that had to be identified for the specific purposes of the South Texas Project docket prior to issuance of the construction permit.

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Combination of amendments to RESSAR-41 and amendment to the South Texas Project PSAR incorporating information specifically applicable to the project has provided the necessary identification of the safety-related interfaces.

In conclusion, those interfaces requiring identification prior to the issuance of construction permit for the South Texas Project have been resolved.

MR. SCHWARZ: We now call Mr. D. R. Betterton, Manager, Environmental Protection Department for Houston Lighting and Power Company. Mr. Betterton has been sworn previously.

Whereupon,

D. R. BETTERTON

was called as a witness and, having been previously duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

XXXX BY MR. SCHWARZ:

Q. Do you have before you an eight-page document entitled, "Testimony of D. R. Betterton, re: Site Monitoring Systems"?

A. I do.

MR. SCHWARZ: This document may be found under tab 22.

BY MR. SCHWARZ:

Q. Mr. Betterton, was this document prepared by you or under your supervision?

A. It was.

Q. Is the document true and correct to the best of your knowledge and belief?

A. It is.

Q. Have you adopted this document as your testimony in this proceeding?

A. I do.

MR. SCHWARZ: Mrs. Bowers, I ask that the eight-page document just identified by Mr. Betterton be incorporated in the record as though read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: Assuming Mr. Betterton is still alive and with us, we have no objection.

MRS. BOWERS: Dr. Hand thought his ID sounded as though he was getting married.

DR. HAND: With regret.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: The Staff has no objection.

MRS. BOWERS: The document that has been identified will be physically incorporated into the transcript as if read.

XXXX (Testimony follows.)

TESTIMONY OF D. R. BETTERTON
Re: Site Monitoring Systems

My name is D. R. Betterton. My position is Manager, Environmental Protection Department with Houston Lighting & Power Company.

A resume of my educational and professional qualifications has previously been received in evidence.

My functions in connection with the South Texas Project include managerial responsibility for the conduct of a wide variety of studies relating to the suitability of the South Texas Project Site including, but not limited to geological and seismological investigations. I participated in the development of the monitoring programs at the site which are discussed in this testimony.

The purpose of this testimony is to present information on the monitoring program established to measure the settlement of facility structures and to measure regional ground surface subsidence.

Detailed information on this subject will be found in the Preliminary Safety Analysis Report for South Texas Project Units 1 and 2, specifically in Section 2.5.4.13 at pages 2.5-157 through 2.5-157f. This information may be summarized as follows:

A comprehensive site performance monitoring program will be established to measure the settlement

of facility structures and to measure regional ground surface subsidence. The monitoring programs are designed to enhance the safety of the project by giving advance warning of any unforeseen occurrences and to provide basic data for verification of predicted plant foundation performance. The settlement portion of the monitoring program will consist of an array of borehole heave points, extensometers, open standpipe piezometers, pore pressure cells, and structural benchmarks. The regional ground surface subsidence monitoring program will consist of an array of shallow and deep aquifer open standpipe piezometers, a network of vertical and horizontal ground control benchmarks, and a deep-reference benchmark with continuous subsidence monitoring instrumentation.

The settlement monitoring program will be capable of monitoring heave and settlement of individual soil layers during construction as well as the actual settlement of facility structures. This will be accomplished by the installation of twenty conventional downhole monuments that are capable of measuring heave of individual soil layers. Fourteen Sonde extensometers will also be installed to depths of 230 feet and 300 feet below the ground surface. The Sonde extenso-

meters consist of corrugated plastic tubing with gauging points fixed at selected increments. The flexible nature of the Sonde tubing allows the gauging points to move vertically as the subsoil heaves and settles during construction activities and allows an accurate determination of the deformation of individual soil layers throughout the extent of the installation. In excess of one hundred structural benchmarks will be installed on plant structures as plant foundation and substructure construction proceeds. These benchmarks will be measured on a periodic basis to determine the vertical movement of individual structures and Category I piping systems.

In addition to the conventional downhole monument, extensometer, and structural benchmark installations, a piezometer field will be installed to monitor shallow aquifer ground water in the construction area. The piezometer field will utilize an initial installation of open standpipe piezometers that are capable of measuring the piezometric head in individual soil layers. Certain piezometers within the excavation will be located adjacent to extensometer and conventional downhole monument installations in areas beneath plant structures. In order to permit continued monitoring of

these piezometers during plant construction, pore pressure cells will be installed in selected piezometers and subsequently monitored remotely at a terminal box at finished site grade. In addition, a number of pore pressure cells will be installed directly in the structural backfill to monitor the ground water in this material. The piezometer and pore pressure cell installations will be used to monitor the effectiveness of the dewatering system and the ground water measurements will be used to evaluate the effects of dewatering on subsoil deformations during construction.

The regional subsidence monitoring program will be capable of monitoring both vertical and horizontal ground surface movements at the South Texas Project site. This will be accomplished in part by the installation of a deep-reference benchmark that is designed to continuously measure total subsidence at the South Texas Project site throughout the life of the plant. The deep-reference benchmark will be positively anchored to the strata, below the potential subsidence zone (approximately 1155 feet below ground surface) and separated from the possible consolidation effects of the overlying compressible zones by a 4-inch casing. To provide continuous ground surface subsidence measure-

ments a modified Stevens Type F Recorder will be installed and operated within an Instrument Shelter. The deep-reference benchmark design is similar to the United States Geological Survey deep benchmarks currently in operation in the Houston area.

The deep-reference benchmark will be installed prior to the commencement of dewatering and will be used to establish baseline vertical datum control for both the settlement and regional monitoring programs. The deep reference benchmark will be referenced to the National Geodetic Survey (NGS) benchmarks in Bay City, Texas, in order to correlate site specific data with other subsidence readings in the area. This will be done whenever the NGS makes its own level loops.

Twelve near-surface monuments capable of measuring vertical ground surface movement will be installed in the plant vicinity at a depth (approximately 15 feet) sufficient to minimize seasonal shrink-swell ground surface movements due to variations in water content in the surface clays. The near-surface monuments will be referenced on a periodic basis to the deep-reference benchmark.

Eight near-surface monuments will be installed in the plant vicinity to measure horizontal movement at

the ground surface. These monuments will also be designed to minimize seasonal shrink-swell ground surface movements. The horizontal positions of these monuments will be referenced to the NGS Texas Plane Coordinate System.

To supplement the vertical and horizontal near-surface monuments an array of open standpipe piezometers will be utilized to monitor the two distinct groundwater aquifer zones. Ten deep-aquifer piezometers have been installed and are currently being monitored on a weekly basis. One additional deep aquifer piezometer will be installed adjacent to the deep reference benchmark so that variations in ground water level can be directly related to the regional subsidence monitoring data. In addition to the field of piezometers and pore pressure cells installed in the plant area to monitor dewatering in the shallow aquifer zone, twenty open standpipe piezometers will monitor the shallow aquifer zone at various locations throughout the South Texas Project site area. Data from deep and shallow piezometers will be used to evaluate the Project's regional subsidence model. As regional subsidence results from piezometric decline and is time dependent, the data from the piezometer monitoring system will serve as an

advance warning of any unforeseen occurrence and will provide a data base to verify the regional subsidence model.

All the subsidence and settlement measurements on deep and near-surface monuments and structural benchmarks will be taken by Houston Lighting & Power Company personnel or their appointed representatives. This program will permit observations within the plant site area to record elevation differences of 0.010 ft. and horizontal movements at an accuracy of 1:10,000.

In summary, a site performance monitoring system will be implemented to detect changes in ground water levels across the Project site and to measure changes in vertical elevation in and around the Category I Structures. The vertical monitoring system will be referenced to both a deep-reference benchmark on the site and by periodic level to the NGS's first-order loop in Bay City, Texas. Horizontal measurements between selected monuments will also be accomplished on a periodic basis and referenced to the NGS Texas Plane Co-ordinate System. The level of accuracy of the measurements will be such that changes significantly smaller than the design limits can be observed and evaluated prior to the time that the limits would be

exceeded.

Results of the monitoring and related studies will give advance warning of any unforeseen occurrences and will provide data in support of predicted plant foundation performance. The Applicant has committed to advise the Nuclear Regulatory Commission should measured performance approach the design criteria limits during the life of the plant.

BY MR. SCHWARZ:

Q. Mr. Betterton, would you please summarize this testimony?

A. My name is Donald R. Betterton. My position is Manager of the Environmental Protection Department with Houston Lighting and Power Company. My functions in connection with the South Texas Project include managerial responsibility for the conduct of a wide variety of studies relating to the suitability of the South Texas Project site, including the geological and seismological investigations.

In addition, I participated in the development of the monitoring program at the site, which are discussed in this testimony.

The purpose of this testimony is to present information on the monitoring program established to measure the settlement of facility structures and to measure regional ground surface subsidence. These monitoring programs will enhance the safety of the project by giving advance warning of any unforeseen occurrences, and will provide basic data for varification of predicted plant foundation performance.

That concludes my summary.

MR. SCHWARZ: Thank you.

I would now call Mr. John T. Mooney of Brown and Root, who has been previously sworn.

Whereupon,

[illegible]

was called as a witness and, having been previously duly sworn, was examined and testified as follows:

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DIRECT EXAMINATION

BY MR. SCHWARZ:

Q. Mr. Mooney, are you familiar with the list of questions furnished by the Board on November 4, 1975? Particularly, questions 5B, 6 and 7.

A. Yes, I am.

Q. Mr. Mooney, question 5B reads: "What precautions, such as secondary water treatment and tube inspection, are now envisaged to assure steam generator tube integrity under all conditions at South Texas Project?"

Would you please respond to that question?

A. Yes, sir.

South Texas Project is well aware of the importance of insuring that adequate steam generator tube integrity is maintained under all conditions of operation. In light of current nuclear operating experience, the steam generators for the South Texas Project, Unites 1 and 2, will be operated with all volatile treatment. That is AVT, secondary water chemistry, and will follow the Westinghouse AVT chemistry control specifications. All volatile treatment uses volatile means for control of water chemistry rather than a combined phosphate and sodium treatment.

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The ACT control of the steam generator secondary site includes a surveillance and maintenance program to minimize the introduction of contaminants to the system and a controlled chemistry program to minimize the corrosion of the material and construction in the condensate and free water systems. The results of proper implementation of all volatile chemistries control are to, (a), minimize metal corrosion, (b), limit accumulation of sludge in the steam generator, (c), to minimize hardness scale formation on heat transfer surfaces, (d), minimize the potential for formation of precaustic or acid, and (e), to maintain low oxygen concentration in secondary fluids.

Plant design efforts, start-up operations and operating procedures will be prepared and executed in line with these objectives.

Fuel licensed PWRs, which have been in operation since August of 1974, including Perry Island Unit 2 and Donald C. Cook Unit 1, have employed AVT water secondary treatment.

Other plants have operated successfully for longer time periods using AVT chemistry control. In service inspection of the steam generator tubes in plants which have converted to AVT without prior long-term phosphate chemistry investigation has showed no corrosion has occurred. Negligible sludge accumulation in these plants further confirms that

that general corrosion has been minimized.

These favorable results can be attributed to close control and monitoring of the steam generator chemistry; the use of premium quality materials in the construction of the condenser to minimize condenser leakage in order to avoid entry of corrosive and scale forming chemicals and continuous blowdown of steam generator, as effective means of maintaining the proper environment to the steam generator; the design of the Westinghouse Model E steam generator, factors in the mechanical modifications previously evaluated in similar steam generators, which minimize low flow velocity areas which tend to accumulate sludge.

South Texas Project will utilize a condensate polishing system consisting of mixed bed demineralizer in the condensate stream, between the condensate pump discharge and the planned steel condenser. The function of the condensate polishing system is to remove impurities from the streat and to produce a high quality effluent capable of meeting feed water and steam generator specifications.

The steam generator blowdown system will provide blowdown of the secondary side of the steam generators to maintain the steam generator secondary side water chemistry within specification, and to prevent buildup of corrosion products and to reduce steam generator activity level.

All volatile treatment; chemical specifications will be insured by plant in-stream instrumentation after a backup laboratory analysis. In-streat monitoring of the steam generator blowdown includes conductivity, sodium and pH analyses. In-streat monitoring of condensate and feed water includes conductivity, sodium, pH and oxygen analyses. In-stream monitoring of main steam includes conductivity and pH analyses. A laboratory program will be established employing approved sampling and analyses procedures schedules and records to insure that all volatile treatment chemistry conditions are porperly maintained.

This program in the condenser evacuation systems radioactivity monitoring will also insure early detection of the reactor coolant leakage into the secondary system. To reduce the probability and consequences of steam generator tube failures, the South Texas Project will include a program of periodic in-service inspection to monitor the integrity of the tubing.

Accordingly, a baseline eddy current examination of the South Texas Project Units 1 and 2 steam generator tubes will be performed. Eddy current inspections have been conducted on thousands of steam generator tubes in operating plants. The same techniques, with improvements which have been developed over the years of use, will be employed during the South Texas Project baseline examination.

Eddy current accuracy have been confirmed in laboratory test programs and through comparison of defective tubes removed from operating plants with baseline data. The South Texas Project is convinced that these actions will assure safe operation of the steam generators throughout the full range of operating conditions. This assurance is based on implementing the AVT chemistry control, utilizing a condensate polishing system and steam generator blowdown system, monitoring the secondary side water chemistry and performing periodic in-service inspection of steam generator tubing.

Q. The sixth question reads: "The SER at page 10-4 states that information will be forthcoming regarding the means by which the Applicant proposes to preclude water hammer in the steam generator feed water system. Is such information available? What steps are presently proposed to deal with the problems?"

Mr. Mooney, would you provide the Applicant's response to question 6 furnished by the Board?

A. Yes, sir.

The design of the South Texas Project steam generator is different from that of any employed in Unit 2. The difference in design will prevent an incident similar to taht experienced in June of '73 in which a prober wave propagation, water ampere, induced cracking of the feed water containment penetration pipe well. Evaluation of the Indian Point 2 incident showed due to

the peculiar arrangement of the steam generator an inlet line steam could fill portions of the inlet line in the event of loss of feed water or low feed water level in the steam generator. Collapse of the volume upon concentration of feed water flow resulted in water ampere which eventually caused the Indian Point 2 incident.

The South Texas Project design incorporates the Westinghouse Model E steam generator. Refer to RESAR figure 5.5-3. For the steam generator the inlet water flows into a preheat section where the feed water is heated to near saturation temperature before entering the boiling section. During normal operation the water level in the steam generator is as indicated in figure 5.5-3 in RESAR-41. With the steam generator configuration to expose the feed water line to filling with steam, the water level would have to be lowered far below the low steam generator water level set points which initiates the auxiliary feed water system. Redundant capacity implementation is provided to monitor the water level.

We understand the Staff has this mater under continuing review on a generic basis. If further requirements applicable to STP are established as a result of the review they will be considered in the final design at STP.

Q. Mr. Mooney, the seventh question reads: "What is the status and general plan of the program mentioned in Supplement 1, page 18-2, to review design features intended

to prevent fires or limit the safety consequences of fires?"

I recognize that this question appears to be addressed primarily to the Staff. However, would you please furnish the Board a review of the steps which have been taken in connection with the matter?

A. Yes, sir.

After reports of the Brown's Ferry incident on page 22D, 1975, Federal evaluation of the South Texas Project design was initiated to establish the likelihood and possible consequences of a similar incident at South Texas. From the evaluation two conclusions are reached.

First, there is little likelihood of a similar incident at South Texas because of the adherence to updated regulatory guides, and IEEE standards adopted since Brown's Ferry 1 and 2 received their construction permit in 1966. As an example of that, the South Texas Project cable qualified to IEEE 383 of 1974, but passed stringent flame tests and non-combustible or self-extinguishing flame retardant sealing material will be used.

Secondly, if a cable fire were to occur in a cable spreading room at the South Texas Project, the consequences would not be as serious as at Brown's Ferry because of the following: (a), the physical separation between Units 1 and 2; (b), the independence of safety-related systems; (c), the adherhence to regularory guides on cable materials

and separation; (d), automatic initiation of carbon dioxide fire protection systems; and (e), detailed administrative procedures that will provide for prompt action by trained on-site personnel with portable firefighting equipment.

The design features mentioned above were being implemented in the South Texas Project prior to the Brown's Ferry incident. Detailed information on the fire protection design for South Texas Project can be found in the PSAR, particularly in Section 9.5.1 on pages 9.5-1 through 9.5-1A, 9.5-33, 9.5-34 and 9.5-36 through 9.5-39. Also Appendix 9.5A and figures 9.5-1 through 9.5-28.

No defects have been identified by the evaluation we have conducted, and no need for any design requirements have been identified. Any additional information developed by the FRC Staff and applicable to the South Texas Project will be taken into account in the development of a final South Texas Project design.

MR. SCHWARZ: Mrs. Bowers, this completes our direct case. In accordance with the proposed agenda submitted to the Board, we suggest that the Staff now be permitted to place the direct case into evidence. Each of our witnesses, along with Mr. Schwantes, who are sworn and identified, will be available to serve on a panel to respond to questions.

MRS. BOWERS: Mr. Schwarz, I just wanted to thank you and your associates on behalf of the Board. Normally,

in test cases the Applicant simply submits to the Board a stack of papers and there is no way for us to know what order the witnesses are going to come up, and so a good part of the time at the proceeding the Board is shuffling through all of these papers to get the direct testimony of that particular witness. So we are very grateful for your organization here and the form in which you have submitted your direct case. It saved everybody a lot of time and frustration. Thank you.

MR. SCHWARZ: We are very pleased that it has been helpful.

MRS BOWERS: Mr. Stridiron?

MR. STRIDIRON: Yes, Mrs. Bowers.

As I stated earlier --

MRS. BOWERS: Just a minute. We will have a five-minute break.

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(Recess.)

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MRS. BOWERS: We would like to resume.

Mr. Stridiron, are you ready to proceed?

Pardon me. Mr. Pendergraft, is the State of Texas putting on a direct case?

MR. PENDERGRAFT: We have no direct case.

MRS. BOWERS: Mr. Stridiron, do you want to proceed?

MR. STRIDIRON: Yes. As I stated in my opening statement, there are a number of gentlemen on the panel who have not been previously sworn. At this time I would ask that the following gentemen stand and be sworn: Gordon Chipman, Marvin Denenfeld, Ronald Gamble, and Jai Raj Rajan.

Whereupon

GORDON CHIPMAN, MARVIN DUNENFELD, RONALD
GAMBLE AND JAI RAJ RAJAN

were called as witnesses and, having been first duly sworn, were examined and testified as follows:

MR. STRIDIRON: Mrs. Bowers, I have two documents. One is the safety evaluation report related to the South Texas Project.

MRS. BOWERS: Is the page phone on?

MR. STRIDIRON: I have two documents which I would ask be marked for identification Staff Exhibit 5, which will be the safety evaluation report related to construction

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of the South Texas Project, Units 1 and 2, Houston Lighting and Power Company, et al. The Second document, Staff Exhibit Number 6, that is the safety evaluation report related to construction of South Texas Project Units 1 and 2, Houston Lighting and Power Company, et al., Supplement Number 1.

MRS. BOWERS: Would you mind repeating those numbers?

MR. STRIDIRON: Number 5 will be the safety evaluation report and Number 6 would be the supplement to the safety evaluation report.

MRS. BOWERS: Any objection, Mr. Pendergraft to marking them for identification?

MR.PENDERGRAFT: We have no objection.

MRS. BOWERS: Mr. Schwartz?

MR. SCHWARTZ: Applicant has no objection.

MRS. BOWERS. They will be so identified.

(The documents referred to were marke Staff Exhibit Numbers 5 and 6 for identification.)

xxxx

MR. STRIDIRON: I would like to qualify the following witnesses. Mr. Chipman, do you have before you a document entitled "Gordon L. Chipman, Jr., Professional Qualifications, Light Water Reactors, Project Branch 1-1, Division of Reactor Licensing"?

WITNESS CHIPMAN: Yes, I do.

DIRECT EXAMINATION

BY MR. STRIDIRON:

Q Was the document prepared by you or under your direction?

A (Witness Chipman) Yes. It was.

Q Are the statements contained in that document true and correct to the best of your information and belief?

A Yes. They are.

Q Thank you.

Mr. Dunenfeld, do you have before you a document entitled "Marvin S. Dunenfeld, Professional qualifications"?

A (Witness Dunenfeld) Yes, I do.

Q Was that document prepared by you or under your direction?

A Yes.

Q Are the statements contained therein true and correct to the best of your information and belief?

A Yes.

Q Mr. Gamble, do you have before you a document entitled "Professional qualifications of Ronald M. Gamble, M. S., B.S."?

A (Witness Gamble.) Yes, I do.

Q Was that document prepared by you or under your direction?

A. Yes, it was.

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Q Are the statements in the document true and correct t the best of your information and belief?

A Yes. They are.

Q Mr. Rajan, do you have before you a document entitled "Professional Qualifications of Jai Raj Rajan, U.S. Nuclear Regulator Commission, Mechanical Engineering Branch, Division of Technical Review"?

A (Witness Rajan) Yes.

Q Was this document prepared by you or under your direction?

A Yes.

Q Are the statements contained therein true and correct to the best of your information and belief?

A Yes.

Q Mr. Dromerick, do you have before you a one-page document entitled "James E. Fairobent, Professional Qualifications, Site Analysis Branch, Nuclear Regulatory Commission"?

A (Witness Dromerick) Yes.

Q Was the document prepared by you or under your direction?

A. Under my direction.

Q To the best of your information and belief are the statements contained in the document true and correct?

A Yes. They are.

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MR. STRIDIRON: Mrs. Bowers, at this time I would move the statements of professional qualifications of these gentlemen be incorporated in the record as read.

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Schwartz?

MR. SCHWARTZ: Applicant has no objection.

MRS. BOWERS: The documents you just identified will be physically inserted in the transcript as if read.

(The documents stating the professional qualifications of Gordon Chipman, Jr., Marvin S. Dunenfeld, Ronald M. Gamble, Dr. Jai Raj N. Rajan, and James E. Fairobent follow.)

GORDON L. CHIPMAN, JR.

PROFESSIONAL QUALIFICATIONS

LIGHT WATER REACTORS PROJECT BRANCH 1-1

DIVISION OF REACTOR LICENSING

I am a Project Manager in Light Water Reactors Branch 1-1 of the Division of Reactor Licensing, U. S. Nuclear Regulatory Commission. I am responsible for the evaluation of nuclear safety aspects of nuclear reactor facilities and serve as the project manager for technical evaluation of nuclear power reactor license applications.

I attended the University of Nebraska where I majored in Electrical Engineering and participated in the Navy Regular ROTC program. I graduated with a Bachelor of Science degree and was commissioned as a regular officer in the United States Navy in June, 1965. Additional graduate level studies in nuclear reactor theory, health physics and related engineering fields were completed in 1966 at the Officer Naval Nuclear Power School, Mare Island, California. I subsequently studied and qualified as an operator and supervisor at the Naval Reactors nuclear power facility in West Milton, New York.

My association with the Naval Nuclear Propulsion program provided me with five years of professional experience in the nuclear field, primarily with pressurized water reactors. I have been qualified as a Senior Reactor Operator on three Navy nuclear propulsion plants. For two years I was assigned to an operating nuclear submarine, during which time my duties included directing, training and supervising technicians in the operation, maintenance and repair of various equipment and systems, including the

nuclear propulsion plant. Starting in 1969, I was assigned to the crew of a nuclear submarine under construction. My duties included supervising the Electrical Division and the Reactor Control Division, testing of the nuclear propulsion plant, directing and supervising technicians in the inspection, testing and operation of various equipment and systems, and training of technicians for examination and qualification as reactor operators and various other operating positions. In 1970 I was assigned as an instructor in advanced tactics at the Officers Submarine School where I instructed and trained crews of nuclear submarines.

I joined the Regulatory staff of the Atomic Energy Commission September, 1972 as a reactor engineer. Since then I have participated as an Environmental Project Manager in the analysis and evaluation of the environmental features of design of the Dresden Units 2 and 3 facilities. As a Project Manager in operating reactors, I participated in the review and evaluation of safety considerations associated with the design and operation of several licensed power reactors. Subsequently, I have participated in the analysis and evaluation of engineering safety features of design of power reactors under license application review. I have been particularly closely associated with the reviews of the Westinghouse Electric Corporation's Reference Safety Analysis Report, RESAR-41, and Boston Edison Company's Pilgrim Nuclear Generating Station, Unit 2, and the preapplication review of South Carolina Electric and Gas Company's Virgil C. Summer Nuclear Station Unit 2.

MARVIN S. DUNENFELD

PROFESSIONAL QUALIFICATIONS

My name is Marvin S. Dunenfeld. I am a Reactor Physicist in the Core Performance Branch within the Directorate of Licensing. As a Reactor Physicist, I share with other members of the Branch the responsibility for technical review of reactor physics safety aspects of light water cooled power reactors for Construction Permits and Operating Licenses.

I was born in Newark, New Jersey, on December 31, 1926. I attended public schools in Flushing, New York, and entered Queens College in Flushing, New York, in 1944. I transferred to the University of Michigan in 1945, graduating with a Bachelor of Science degree (physics major) in 1951 and a Master of Arts in mathematics in 1953.

I was employed by the Ford Motor Company in Ypsilanti, Michigan, from 1953 to 1957 as an Electrical Product Project Engineer. I joined the nuclear industry in 1957 in a position at the Atomics International division of North American Rockwell Corp. in Los Angeles, California. I was employed there for about two years in reactor shielding and then four years as a physicist in reactor kinetics. In the latter capacity, I participated in research and analysis of reactor transients on the kinetics experiment on water boilers.

In 1963 I accepted employment as a nuclear physicist with the Allison Division of General Motors in Indianapolis, Indiana. I was responsible for safety analysis on the Military Compact Reactor Project, and later performed reactor physics and safety analyses on other reactor concepts.

In 1967 I joined the Division of Reactor Licensing, U. S. Atomic Energy Commission. My responsibilities with the Commission have been in the technical evaluation of physics related safety aspects of light water reactors. I have participated in the evaluation of all the PWR Operating Licenses Regulatory has reviewed since 1967, about half of the PWR Construction Permits, and a few of the BWR applications. I have also directed the efforts of the four physics consultants to Regulatory at Brookhaven National Laboratory since the inception of this activity in 1967.

PROFESSIONAL QUALIFICATIONS

OF

RONALD M. GAMBLE, M.S., B.S.

I am a materials Engineer in the Materials Application Section, Materials Engineering Branch, Division of Technical Review, Office of Nuclear Reactor Regulation. My duties and responsibilities involve the review and evaluation of technical reports, metallurgical investigative studies, failure analyses and fracture mechanics analyses as related to the construction of nuclear power plant components including the formulation of regulations and safety criteria and guides related to materials performance.

I have a M.S. in engineering mechanics from the University of Florida (1972) and a B.S. in engineering mechanics from Pennsylvania State University (1965).

Prior to my present appointment, I was associated with Turbodyne Corporation as Group Leader, Materials. My duties and responsibilities included conducting and supervising analytical, experimental and field investigations in areas related to fatigue and corrosion cracking and fracture mechanics for gas and steam turbines and related components. I was also responsible for formulating manufacturing and quality assurance criteria related to materials and structural application.

From 1965 to 1968 I was an analytical engineer with Hamilton Standard Division of United Aircraft Corporation. My duties and responsibilities included analytical and experimental work in fatigue and fracture and the development of material design limits for aerospace components.

PROFESSIONAL QUALIFICATIONS

JAI RAJ N. RAJAN

U. S. NUCLEAR REGULATORY COMMISSION

MECHANICAL ENGINEERING BRANCH

DIVISION OF TECHNICAL REVIEW

I am a mechanical engineer responsible for reviewing and evaluating safety analysis reports with regard to mechanical engineering aspects of components, the dynamic analyses and testing of safety related systems and components and the criteria for protection against the dynamic effects associated with postulated failures of fluid systems for nuclear facilities. I am the Mechanical Engineering Branch's principal reviewer on the issue of the structural integrity and plugging criteria of degraded steam generator tubes. I am also responsible for the review and evaluation of water hammer problems of a generic nature in the piping systems and components of nuclear facilities.

I received a B.S. degree in 1953 from Lucknow University India majoring in Physics, Mathematics and Chemistry. In 1956 I received a B.S. in Civil Engineering from Roorkee University, India majoring in Structural and Hydraulic Engineering. In 1962 I received a M.S. degree from Duke University majoring in Applied Mechanics and Ph.D. degree in 1966 from the same university with majors in Fluid Mechanics. From 1960 to 1962 I was an instructor in structural engineering at Duke University. From 1962 to 1966 I was employed by the U.S. Army Research Office in Durham, N.C. as a research engineer conducting theoretical and experimental research in

high pressure pneumatic and hydraulic shock tubes and investigating wave propagation phenomenon in pipes. From 1966 to 1973 I worked as a project mechanical engineer and subsequently as a senior project mechanical engineer at the Naval Research and Development Center at Annapolis, Md. Major projects involved design analysis, test and evaluations of fluid piping systems and power fluid systems of advanced nuclear submarines. Investigations were multidisciplinary in scope utilizing advanced techniques. Mathematical models of power plant machinery and piping systems of nuclear submarines were developed and analyzed to determine system response to flow induced vibrations and hydraulic shock. Thermodynamic and hydrodynamic analyses of naval boilers and steam plants were conducted.including full scale tests.

In April of 1974 I joined the U. S. Atomic Energy Commission prior to the formation of the U. S. Nuclear Regulatory Commission and have remained with the Mechanical Engineering Branch of the Division of Technical Review as a mechanical engineer performing the type of work as previously described.

I have taught at the University of Maryland on a part-time basis since 1967 both at the graduate and undergraduate levels in courses of mechanics of materials, fluid mechanics and applied mechanics.

Publications include Journals of AIAA and ASME and I am an associate member of Sigma Xi honor society.

JAMES E. FAIROBENT
PROFESSIONAL QUALIFICATIONS
SITE ANALYSIS BRANCH
NUCLEAR REGULATORY COMMISSION

I have been a Meteorologist with the Site Analysis Branch, Division of Technical Review, since February 1973.

I recevied a B.S. degree with a major in meteorology from the University of Michigan in 1970. While an undergraduate, I participated in a study of precipitation scavenging by convective storms which included field research programs in Oklahoma and Illinois. My responsibilities included maintenance of a precipitation collection network, analyses of mesoscale weather systems conducive of the formation of convective storms, and neutron activation and radiochemistry analyses of rain-water samples.

I entered the graduate program at the University of Michigan in 1971, and was awarded an M.S. degree with a major in meteorology in 1972. In continued my association with the precipitation scavenging project as a graduate student as well as becoming weather observer at the University of Michigan climatological station and a teaching fellow.

I accepted my present position in February 1973. I am responsible with the supervision of the Meteorology Section Leader, for the evaluation of the meteorological characteristics of reactor sites and their implications with respect to safety requirements of nuclear facility design and the impact of these facilities on the environment.

I am a member of the American Meteorological Society.

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Q Mr. Dromerick, do you have before you a document marked Staff Exhibit Number 5?

A (Witness Dromerick) Yes.

Q This is entitled "Safety Evaluation Report, Relate to Constructing of South Texas Projects, Unites 1 and 2, Houston Lighting and Power Company, et al."?

A. Yes, I do.

Q Was this document prepared by you or under your direction and control?

A Yes. It was.

Q Are there any corrections or additions you wish to make to the document?

A There is one addition I would like to make. That is Supplement Number 1 to the Safety Evaluation Report.

Q With the addition of this supplement, is the document true and correct to the best of your information and belief?

A. Yes. It is.

Q You -- do you have before you a document marked for identification as Staff Exhibit Number 6?

A Yes.

Q Entitled "Safety Evaluation Report, Related to Construction of South Texas Project Units 1 and 2, Houston Lighting and Power Company, et al., Supplement 1"?

A Yes. I do

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Q Was this documetn also prepared by you and under your control?

A Yes.

Q Are the statements contained in this document true and correct?

A Yes. They are.

Q Mr. Dromerick, would you briefly describe the scope of the staff's review and the conclusions reached with respect to the application to construct the South Texas Project?

A Yes. I would. A preliminary safety analysis report was submitted with the South Texas Project application. This report describes the design of the balance of plant structures, systems and components, and incorporates by reference the Westinghouse Electric Corporation report reference safety analysis report, RESAR-41, RESAR-41 describes the design of the standard nuclear standard steam supply system. RESAR-41 was submitted by the Westinghouse Electric Corporation in the form of an application for preliminary design approval from the Commission and was in response to option 1 of the Nuclear Regulatory Commission's standard decison policy. Option 1 allows for the review of a reference system that involves an entire facility design or major fraction of a design outside the context of a license application. On March 11, 1974, the Application for RESAR-41

were docketed. Our evaluation for RESAR-41 is presented in our report to the Advisory Committee on Reactor Safeguards, a copy of which is attached as Appendix A, to the South Texas Project Safety Evaluation Report.

In our evaluation of the the South Texas Project, PSAR, we reviewed the population density and use characteristics of the site, including seismology, meteorology, geology and hydrology, to determine that the site met the Commission's siting criteria, defined in 10-CFR, Part 100. We reviewed the design fabrication, construction, and testing criteria, and expected performance characteristics of the structure, systems and components important to safety, to determine that they are in accord with the Commission's general design criteria, quality assurance criteria, Regulatory Guides, and other appropriate goals and standards and that any departure from these criteria, goals and standards, be identified and justified.

We considered the response of the facility to certain anticipated transients and postulated accidents. We considered the potential consequences of a few highly unlikely postulated accidents and performed conservative analyses of these accidents and determined that the calculated potential off-site doses, that might result in a very unlikely event of their occurrence, would not exceed the Commission's guidelines.

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We evaluated the Applicant's plans for conduct of plant operation, including the organizational structure and general qualifications of operating and technical support personnel, and measures taken for industrial security and the planning for emergency actions to be taken in the unlikely event of an accident that might affect the general public,to determine that the Applicants will be technically qualified to operate the plant and will have established effective organization and plants for continuing safe operations of the facility.

We evaluated the design of the systems provided for control of radioactive effluents from the facility to determine that these systems can control the release of radioactive effluents within the limits of the Commission's regulations.

We also evaluated the financial data and information provided by the Applicants, as required by the Commission's regulations, Section 50.33 F, of 10-CFR, Part 50 and 10-CFR, Part 50 And Appendix C to 10CFR, Part 50, to determine that the Applicants are financially qualified to design and construct the proposed facility.

Our evaluation of the South Texas PSAR is now complete and this evaluation, along with our evaluation of RESAR-41, are presented in the South Texas Project Safety Evaluation Report as updated in our supplement Number 1 to

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the SER. On the basis of our evaluation of the South Texas Project PSAR, and RESAR-41, we are able to conclude that the South Texas Project Units 1 and 2, can be constructed and operated as proposed, without endangering the health and safety of the public.

Q Thank you, Mr. Dromerick.

Mrs. Bowers, at this time I would move the documents marked for identification Staff Exhibit Number 5 and Exhibit Number 6 be accepted into evidence as Staff Exhibits 5 and 6.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Schwartz?

MR. SCHWARTZ: Applicant has no objection.

MRS. BOWERS: Staff's Exhibit Number 5 and 6 are accepted in evidence.

(The documents, heretofore marked Staff Exhibits Numbers 5 and 6 for identification, are received in evidence.)

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BY MR. STRIDIRON:

Q. Mr.Boegli, do you have before you a document entitled Supplementary Testimony of NRC Staff on evaluation of liquid and gaseous effluents with respect to Appendix I of 10 CFR Part 50, South Texas Project, Units 1 and 2, Docket Numbers 50-498 and 50-499, by J. S. Boegli, effluent systems branch, Division of Technical Review, Office of Nuclear Reactor Regulations?

A. Yes, I do.

Q. Was the document prepared by you or under your supervision?

A. Yes, it was.

Q. Are the statements contained in this document true and correct to the best of your information and belief?

A. Yes.

Q. Would you briefly summarize the document?

A. Supplemental testimony presented November 5th, 1975, by the NRC Staff, on evaluation of liquid and gaseous effluents with respect to Appendix I of 10 CFR Part 50, for the South Texas Project provides a detailed assessment, using the parameters and practical model given in draft Regulatory Guide 1BD, entitled Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Pressurized Water Reactors. PWRs. Dated September 9th, 1975.

This guide was used to calculate few source terms in

order to calculate the doses as described in testimony to be presented by Mr. Waterfield.

Based on the Staff evaluation and testimony presented, we conclude that the South Texas Project Unit 1 and 2 meet the design objectives of Section roman numeral II-A, II-B, and II-C, to Appendix I of 10 CFR Part 50. And meet the requirements of Section II-D by satisfying the September 4th, 1975, option to Appendix I, to meet the design objectives set forth in 50-2.

Thank you.

Q. Thank you, Mr. Boegli

MR. STRIDIRON: Mrs. Bowers, at this time I would move the supplemental testimony of Mr. Boegli relating to the evaluation of liquid and gaseous effluents with respect to 10 CFR Appendix I, Part 50, be incorporated as if read.

MR. PENDERGRAFT: We have no objection. Mrs. Bowers, for the record I would like to point out we have no objection to testimony items coming in the record. We are not stipulating as to their authenticity or correctness but only as to their admissibility. I assumed that was understood all along.

MRS. BOWERS: That's right. The Board accepts that. Mr. Schwarz?

MR. SCHWARZ: The Applicant has no objection.

MRS. BOWERS: The testimony that you just referred to, Mr. Stridiron, will be physically incorporated into the record as if read.

SUPPLEMENTAL TESTIMONY

OF

NRC STAFF

ON

EVALUATION OF LIQUID AND GASEOUS EFFLUENTS

WITH RESPECT TO

APPENDIX I OF 10 CFR PART 50

SOUTH TEXAS PROJECT, UNITS 1 AND 2

Docket Nos. 50-498 and 50-499

BY

J. S. BOEGLI

EFFLUENT TREATMENT SYSTEMS BRANCH

DIVISION OF TECHNICAL REVIEW

OFFICE OF NUCLEAR REACTOR REGULATION

Introduction

On July 18, 1975, the NRC Staff (Staff) submitted to the Atomic Safety and Licensing Board affidavits of Messrs. J. Long and J. Boegli and Dr. J. Kastner. Those affidavits were filed in response to the Board's conference call of July 9, 1975 concerning the implementation of Appendix I of 10 CFR Part 50 adopted by the Commission on May 5, 1975, with regard to South Texas Project, Units 1 and 2. The affidavits indicated that the Staff was in the process of reassessing the parameters and mathematical models and that a detailed assessment to determine conformance with Appendix I would be completed in connection with the hearing on radiological safety aspects of the facility. The purpose of this testimony is to present the results of that detailed assessment. The assessment was performed to determine if the proposed South Texas Project, Units 1 and 2 met the numerical design objectives specified in Sections IIA, B, C and D of Appendix I of 10 CFR Part 50.

On September 4, 1975 (F.R. 172), the Commission amended Appendix I of 10 CFR Part 50 to provide persons who have filed applications for construction permits for light-water-cooled nuclear power reactors which were docketed on or after January 2, 1971, and prior to June 4, 1976, the option of dispensing with the cost-benefit analysis required by Paragraph II.D of Appendix I. This option permits an applicant to design his radwaste management systems to satisfy the Guides on Design Objectives for Light-Water-Cooled Nuclear Power Reactors proposed in the Concluding Statement of Position of the Regulatory Staff in Docket RM-50-2, dated

February 20, 1974. As indicated in the Statement of Considerations included with the amendment, the Commission noted it is unlikely that further reductions to radioactive material releases would be warranted on a cost-benefit basis for light-water-cooled nuclear power reactors having radwaste systems and equipment determined to be acceptable under the proposed Staff design objectives set forth in RM-50-2.

In a letter to the Commission dated October 1, 1975, Houston Lighting and Power Company chose to comply with the Commission's September 4, 1975 amendment to Appendix I, eliminating the necessity to perform a cost-benefit analysis as required by Paragraph II.D of Appendix I.

Evaluation

The Staff has evaluated the radioactive waste management systems proposed for South Texas Project, Units 1 and 2, to reduce the quantities of radioactive materials released to the environment in liquid and gaseous effluents. These systems have been previously described in Sections 11.2 and 11.3 of the Safety Evaluation Report, dated August 1975, and in Section 3.5 of the Final Environmental Statement (FES), dated March 1975. Based on information provided by the applicant in the referenced letter, on more recent operating data applicable to the South Texas Project, and on changes in our calculational model, we have generated new liquid and gaseous source terms to determine conformance with Appendix I. These values

are different from those given in Tables 3.6 and 3.7 of the FES for Units 1 and 2 and in Table 1 of Mr. Boegli's affidavit (July 18, 1975).

The new source terms, shown in Attachments 1 and 2, were calculated using the models and methodology described in Draft Regulatory Guide 1.BB, "Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Pressurized Water Reactors (PWRs)," September 9, 1975. These source terms were used to calculate the doses as described in testimony submitted by Mr. Waterfield.

Attachment 3 provides a comparison of the calculated doses, with the design objectives of Sections IIA, B and C of Appendix I and the proposed Staff design objectives set forth in RM-50-2.

Based on the Staff's evaluation of the liquid radwaste management systems, the expected quantity of radioactive materials released in liquid effluents from Units 1 and 2 will be less than 5 Ci/yr/reactor, excluding tritium and dissolved gases, as shown in Attachment 2. The liquid effluents released from Units 1 and 2 will not result in an annual dose or dose commitment to the total body or to any organ of an individual, in an unrestricted area from all pathways of exposure, in excess of 5 mrem.

Based on the Staff's evaluation of the gaseous radwaste management systems, the total quantity of radioactive materials released in gaseous

effluents from Units 1 and 2 will not result in an annual gamma air dose in excess of 10 mrads and a beta air dose in excess of 20 mrads at every location near ground level, at or beyond the site boundary, which could be occupied by individuals (Attachment 3). The annual total quantity of iodine-131 released in gaseous effluents will be less than 1 Ci/reactor (Attachment 1) and the annual total quantity of radioiodine and radioactive particulates released in gaseous effluents from Units 1 and 2 will not result in an annual dose or dose commitment to any organ of an individual in an unrestricted area from all pathways of exposure in excess of 15 mrem (Attachment 3).

Conclusion

Staff testimony demonstrates that the doses associated with the normal operation of South Texas Project, Units 1 and 2 meet the design objectives of Sections II.A, II.B and II.C of Appendix I of 10 CFR Part 50, and that the expected quantity of radioactive materials released in liquid and gaseous effluents and the aggregate doses meet the design objectives set forth in RM-50-2.

Staff's evaluation shows that the applicant's proposed design of Units 1 and 2 satisfies the criteria specified in the option provided by the Commission's September 4, 1975 amendment to Appendix I and, therefore, meets the requirements of Section II.D of Appendix I of 10 CFR Part 50.

Based on the Staff's evaluation the proposed liquid and gaseous radwaste management systems for South Texas, Units 1 and 2 meet the criteria given in Appendix I and are therefore acceptable.

ATTACHMENT 1

CALCULATED RELEASES OF RADIOACTIVE MATERIAL IN GASEOUS EFFLUENTS FROM SOUTH TEXAS, UNITS 1 AND 2

(Ci/yr/reactor)

Nuclides	Waste Gas Processing System	Building Ventilation Reactor	Building Ventilation Auxiliary	Building Ventilation Turbine	Condenser Air Ejector	Total
Kr-83m	a	a	a	a	a	a
Kr-85m	a	6	2	a	1	9
Kr-85	270	1	a	a	a	270
Kr-87	a	1	1	a	a	2
Kr-88	a	9	3	a	2	14
Kr-89	a	a	a	a	a	a
Xe-131m	13	3	a	a	a	16
Xe-133m	a	15	a	a	a	15
Xe-133	30	790	28	a	18	870
Xe-135m	a	a	a	a	a	a
Xe-135	a	27	4	a	2	33
Xe-137	a	a	a	a	a	a
Xe-138	a	a	a	a	a	a
I-131	a	0.14	0.036	0.00028	0.022	0.2
I-133	a	0.092	0.054	0.00043	0.034	0.15
Co-60	7.0(-5)	3.3(-2)	2.7(-2)	c	c	6.0(-2)
Co-58	1.5(-4)	7.2(-2)	6.0(-2)	c	c	1.3(-1)
Fe-59	1.5(-5)	7.2(-3)	6.0(-3)	c	c	1.3(-2)
Mn-54	4.5(-5)	2.1(-2)	1.8(-2)	c	c	3.9(-2)
Cs-137	7.5(-5)	3.7(-2)	3.0(-2)	c	c	6.7(-2)
Cs-134	4.5(-5)	2.1(-2)	1.8(-2)	c	c	3.9(-2)
Sr-90	6.0(-7)	2.9(-4)	2.4(-4)	c	c	5.3(-4)
Sr-89	3.3(-6)	1.6(-3)	1.3(-3)	c	c	2.9(-3)
C-14						8
H-3						760
Ar-41						25

a = less than 1.0 Ci/yr noble gases, less than 10^{-4} Ci/yr for iodine.

b = exponential notation: 7.0(-5) = 7.0×10^{-5}

c = less than 1% of total for nuclide

ATTACHMENT 2

CALCULATED RELEASES OF RADIOACTIVE MATERIALS IN LIQUID EFFLUENTS FROM SOUTH TEXAS, UNITS 1 AND 2

(Ci/yr/reactor)

Nuclide	Ci/yr/reactor
Corrosion & Activation Products	
Cr-51	0.0001
Mn-54	0.001
Fe-55	0.00009
Fe-59	0.00006
Co-58	0.0049
Co-60	0.0088
Np-239	0.00003
Fission Products	
Br-83	0.00001
Sr-89	0.00002
Y-91	0.00011
Mo-99	0.01
Tc-99m	0.0098
Te-127m	0.00001
Te-127	0.00002
Te-129m	0.00007
Te-129	0.00005
I-130	0.00008
Te-131m	0.00004
I-131	0.1
Te-132	0.00079
I-132	0.0012
I-133	0.028

Nuclide	Ci/yr/reactor
Cs-134	0.015
I-135	0.0031
Cs-136	0.00068
Cs-137	0.025
Ba-137m	0.001
Ba-140	0.00001
La-140	0.00001
All others	0.00004
Total Except Tritium	0.22
Tritium	750

ATTACHMENT 3

COMPARISON OF SOUTH TEXAS PROJECT, UNITS 1 AND 2 WITH APPENDIX I TO 10 CFR PART 50, SECTIONS II.A, II.B AND II.C (MAY 5, 1975)[a] AND GUIDES ON DESIGN OBJECTIVES PROPOSED BY THE STAFF RM-50-2 (FEBRUARY 20, 1975)[b]

Criterion	Appendix I[a] Design Objectives	RM-50-2[b] Design Objectives[c]	Calculated Doses
Liquid Effluents			
Dose to total body from all pathways	3 mrem/yr/unit	5 mrem/yr/site	0.06 mrem/yr/unit
Dose to any organ from all pathways	10 mrem/yr/unit	5 mrem/yr/site	0.08 mrem/yr/unit
Noble Gas Effluents			
Gamma dose in air	10 mrad/yr/unit	10 mrad/yr/site	0.10 mrad/yr/unit
Beta dose in air	20 mrad/yr/unit	20 mrad/yr/site	0.20 mrad/yr/unit
Dose to total body of an individual	5 mrem/yr/unit	5 mrem/yr/site	0.0085 mrem/yr/unit
Dose to skin of an individual	15 mrem/yr/unit	15 mrem/yr/site	0.024 mrem/yr/unit
Radioiodines and Other Radionuclides Released to the Atmosphere			
Dose to any organ from all pathways	15 mrem/yr/unit	15 mrem/yr/site	0.75 mrem/yr/unit

[a] Federal Register V. 40, p. 19442, May 5, 1975.

[b] Concluding Statement of Position of the Regulatory Staff, Docket No. RM-50-2, Feb. 20, 1974, pp. 25-30, U.S. Atomic Energy Commission, Washington D.C.

[c] Design Objectives given on a site basis. Therefore, these design objectives apply to 2 units at the site.

MR. STRIDIRON: Thank you.

BY MR. STRIDIRON:

Q. Mr. Waterfield, do you have a document before you, a document entitled Nuclear Regulatory Commission Staff testimony of Robert L. Waterfield pertaining to Appendix I?

A. (Witness Waterfield) I do.

Q. Was this document prepared by you or under your supervision?

A. It was.

Q. Are the statements contained in this document true and correct to the best of your information and belief?

A. They are.

Q. Would you briefly summarize the document?

A. And evaluation was made of the effluent releases derived by Mr. Boegli, to see if we would meet the low as practicable guidelines of Docket RM 50-2 and Appendix I to Part 50.

The meteorological and atmospheric parameters and deposition, as presented in Mr. Fairobent's testimony, and the assumptions and models were taken from Regulatory Guide 1.AA and the results we obtained indicated that all the expected doses would be far below the guideline values.

MR. STRIDIRON: Mrs. Bowers, I would move at this time that the document entitled Nuclear Regulatory Commission's Staff testimony of Robert L. Waterfield pertaining to Appendix I

be incorporated in the record as if read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Schwarz?

MR. SCHWARZ: Applicant has no objection.

MRS. BOWERS: The document you just identified will be physically incorporated in the transcript as if read.

(The document follows.)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

Houston Lighting and Power Company	)	Docket Nos. 50-498
	)	50-499
(South Texas Project Units 1 and 2	)	

NUCLEAR REGULATORY COMMISSION STAFF'S
TESTIMONY OF ROBERT L. WATERFIELD
PERTAINING TO APPENDIX I

AFFIDAVIT OF ROBERT L. WATERFIELD

RELATIVE TO AN APPENDIX I DOSE EVALUATION

OF SOUTH TEXAS PROJECT UNITS 1 AND 2

Introduction

In an affidavit[1] filed in the site-suitability phase of this proceeding Dr. Jacob Kastner indicated that a detailed assessment of maximum individual doses would be completed in connection with the radiological health and safety hearing after completion of our reassessment of assumptions and models. The purpose of this testimony is to present the results of that detailed assessment. The assessment was performed to determine if the proposed South Texas Project facilities met the design objective contained in the Concluding Statement of Position of the Regulatory Staff, Docket No. RM-50-2 (February 20, 1974),[2] and in 10 CFR 50, Appendix I (May 5, 1975).[3]

In a letter dated October 1, 1975,[4] the Houston Lighting and Power Company indicated that it wished to exercise the option provided by the Commission's September 4, 1975 amendment[5] to Section II.D of Appendix I. The amendment provides that an applicant need not comply with the radwaste system cost-benefit analysis required by Section II.D of Appendix I if the proposed radwaste system satisfies the Guides on Design Objectives contained in the Concluding Statement of Position of the Regulatory Staff (Docket No. RM-50-2), dated February 20, 1974.[2]

Since the Guides on Design Objectives apply to all light-water-cooled reactors at a site, it was necessary to compare the total dose from South Texas Units 1 and 2 with the Design Objectives contained in the Concluding Statement of Position of the Regulatory Staff.[2]

Discussion

The dose models used to perform this analysis are contained in Draft Regulatory Guide 1.AA.[6] These models were revised (with respect to the models contained in reference 1) to be responsive to the mandate contained in the Opinion of the Commission[7] relative to Appendix I which called for realism wherever possible in the definition of input parameters for the dose models.

Included in this analysis are dose evaluations of three effluent categories: 1) pathways associated with liquid effluent releases to the Colorado River 2) noble gases released to the atmosphere, and 3) pathways associated with radioiodines, particulates, carbon-14 and tritium released to the atmosphere.

The dose evaluation of pathways associated with liquid effluents was based on the maximum exposed individual. The dietary and living habits for an adult individual included 1) the consumption of 20 kg/yr of fish and 5 kg/yr of invertebrates harvested in the immediate vicinity of the discharge, and 2) recreational use of the shoreline in the immediate vicinity of the discharge for 10 hr/yr.

The dose evaluation of noble gases released to the atmosphere included a calculation of beta and gamma air doses at the site boundary and total body and skin doses at the residence having the highest dose. The maximum air doses at the site boundary were found at 1.0 mile north (distance and direction) relative to the South Texas facility. The location of maximum total body and skin doses were determined to be at a residence at 2.7 miles NNW.

The dose evaluation of pathways associated with radioiodine, particulates, carbon-14 and tritium released to the atmosphere was also based on the maximum exposed individual. One such individual is a child whose diet included the consumption of 530 kg/yr of crops, 300 ℓ/yr of milk, and 40 kg/yr of beef and poultry produced at the location of the dairy having the highest calculated dose from these and two other pathways noted below. This location is 7 miles east. Another such individual is a child whose diet includes the consumption of 530 kg/yr of crops grown at the location of the residence having the highest calculated dose from this and two other pathways noted below. These maximum exposed individuals were also exposed to inhaled radionuclides in this category, as well as those deposited on the ground at each of the locations described above.

In addition to the dose estimates for the adult individual, estimates were also made for the teen (12-18 years), the child (1-11 years) and the infant (1 year), with appropriate values of consumption as given in Regulatory Guide 1.AA.[6] For the pathways associated with liquid effluents, the adult individual received the highest dose. The doses

from noble gases released to the atmosphere constituted external exposure, and were therefore not age-dependent. For the pathways associated with radioiodine and the other radionuclides released to the atmosphere, the child located at the residence received the highest dose at this site.

All of the doses in this analysis were based on the radionuclide releases presented in Mr. Boegli's testimony. The dispersion of radionuclides in and the deposition of radionuclides from the atmosphere were based on the analysis presented in Mr. Fairobent's testimony.

Comparison of Doses with RM-50-2 Design Objectives

As indicated earlier, a comparison with RM-50-2 Design Objectives involves all LWR's at a site. Accordingly, using the procedure described above, a calculation was made to determine the doses associated with combined 2-unit operation. The results are shown in Table 1 and are compared with the RM-50-2 design objectives. This table replaces Table 5.8 of the FES.[8]

Comparison of Doses with Appendix I Design Objectives

In order to make a comparison with Appendix I design objectives, a calculation similar to the one mentioned in the previous paragraph was performed. This computation, however, was performed on a per-unit basis. The results of the calculation are presented in Table 2.

Conclusion

It is concluded, based on the values presented in Table 1, that the aggregate doses associated with South Texas Project Units 1 and 2 operation meet the RM-50-2 design objectives. The maximum dose is slightly less than one tenth of the design objective.

It is also concluded, based on the values presented in Table 2, that the per unit doses associated with South Texas Project Units 1 and 2 operation meet the 10 CFR 50, Appendix I design objectives. The dose closest to the design objective is the dose to the thyroid from gaseous effluents.

Table 1

Comparison of Calculated Doses from
Operation
with Guides on Design Objectives
Proposed by the Staff on February 20, 1974[a]
(Doses to Maximum Individual from all Units on Site)

Criterion	RM-50-2 Design Objective	Calculated Doses
Liquid Effluents		
Dose to total body or any organ from all pathways	5 mrem/yr	0.17 mrem/yr
Noble Gas Effluents		
Gamma dose in air	10 mrad/yr	0.20 mrad/yr
Beta dose in air	20 mrad/yr	0.40 mrad/yr
Dose to total body of an individual	5 mrem/yr	0.017 mrem/yr
Dose to skin of an individual	15 mrem/yr	0.047 mrem/yr
Radioiodine and Particulates[b]		
Dose to any organ from all pathways	15 mrem/yr	1.5 mrem/yr

[a]From "Concluding Statement of Position of the Regulatory Staff," Docket No. RM-50-2, Feb. 20, 1974, pp. 25-30, U. S. Atomic Energy Commission, Washington, D. C.

[b]Carbon-14 and tritium have been added to this category.

Table 2

Comparison of Calculated Doses from
Operation
with Sections II.A, II.B and II.C
of Appendix I, 10 CFR 50[a]
(Doses to Maximum Individual per Reactor Unit)

Criterion	Appendix I Design Objective	Calculated Doses
Liquid Effluents		
Dose to total body from all pathways	3 mrem/yr	0.06 mrem/yr
Dose to any organ from all pathways	10 mrem/yr	0.08 mrem/yr
Noble Gas Effluents		
Gamma dose in air	10 mrad/yr	0.10 mrad/yr
Beta dose in air	20 mrad/yr	0.20 mrad/yr
Dose to total body of an individual	5 mrem/yr	0.0085mrem/yr
Dose to skin of an individual	15 mrem/yr	0.024 mrem/yr
Radioiodines and Particulates[b]		
Dose to any organ from all pathways	15 mrem/yr	0.75 mrem/yr

[a]As presented in the Federal Register V. 40, p. 19442, May 5, 1975.

[b]Carbon-14 and tritium have been added to this category.

References

1. Affidavit of Jacob Kastner (Relative to an Upper Bound Estimate of Radiological Impact on the General Public), Docket Nos. 50-498 and 50-499, July 18, 1975.

2. U. S. Atomic Energy Commission Concluding Statement of Position of the Regulatory Staff (and its Attachment) - Public Rulemaking Hearing on: Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criteria "As Low As Practicable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactors, Docket No. RM-50-2, Washington, D. C., February 20, 1974.

3. Title 10, CFR Part 50, Appendix I. Federal Register, V. 40, p. 19442, May 5, 1975.

4. Letter, G.W. Oprea, Houston Lighting and Power Company to Benard C. Rusche, U.S. Nuclear Regulatory Commission, "South Texas Project Units 1 and 2, Paragraph II.D. of Appendix I," October 1, 1975.

5. Title 10, CFR Part 50, Amendment to Paragraph II.D of Appendix I. Federal Register V. 40, p. 40918, September 4, 1975.

6. Staff of the U.S. Nuclear Regulatory Commission. Draft Regulatory Guide 1.AA, "Calculation of Annual Average Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Impelementing Appendix I," September 23, 1975.

7. Opinion of the Commission in the Matter of: Rulemaking Hearing - Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Practicable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, Docket No. RM-50-2, April 30, 1975, Nuclear Regulatory Commission Issuances, NRCI-75/4R.

8. Staff of the U. S. Nuclear Regulatory Commission. "Final Environmental Statement Related to the Construction of South Texas Project Units 1 and 2," Docket Nos. 50-498 and 50-499, NUREG-75/019. Washington, D.C., March 1975.

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MR. STRIDIRON: Thank you. As I stated, Mr. Fairobent who also participated or coauthored the document on Appendix I is not available and therefore by your leave Mr. Dromerick will respond to his testimony if nobody has any objection.

MRS. BOWERS: Let me check. Mr. Pendergraft?

MR. PENDERGRAFT: No objection.

MRS. BOWERS: Mr. Schwarz?

MR. SCHWARZ: No objection.

MRS. BOWERS: The Board will accept this presentation, then.

BY MR. STRIDIRON:

Q. Mr. Dromerick, do you have a document before you entitled Testimony of J. E. Fairobent concerning the Appendix I evaluation of atmospheric transport and dispersion at the South Texas Project site?

A. (Witness Dromerick) Yes.

Q. Was this project prepared by you or under your supervision?

A. Under my direction.

Q. To the best of your estimation, is the document true and correct?

A. Yes.

MR. STRIDIRON: I move the one-page document entitled Testimony of J. E. Fairobent concerning independent evaluation of dispersion and transport at the South Texas site be incor-

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porated in the record as if read.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: I have no objection.

MRS. BOWERS: Mr. Schwarz?

MR. SCHWARZ: Applicant has no objection.

MRS. BOWERS: The document you just identified will be physically incorporated in the transcript as if read.

(The document follows.)

TESTIMONY OF J. E. FAIROBENT CONCERNING THE APPENDIX I EVALUATION OF ATMOSPHERIC TRANSPORT AND DISPERSION AT THE SOUTH TEXAS PROJECT SITE

An evaluation of the atmospheric transport and dispersion conditions at the South Texas Project site has been made using the models and methodology described in Draft Regulatory Guide 1.DD, "Methods For Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases From Light Water Reactors", September 22, 1975.

The meteorological data used in this evaluation, consisting of joint frequency distributions of wind speed and direction measured at the 33-ft level by atmospheric stability defined by the vertical temperature gradient measured between the 33-ft and 195-ft levels, were collected onsite by the applicant during the period July 20, 1973 through July 20, 1974. The applicant also provided information concerning topography out to a distance of ten miles from the plant which was considered in the evaluation.

Information on gaseous effluent sources considered in the evaluation, such as source height above plant grade, efflux velocity, and release point configuration, was provided by the Effluent Treatment Systems Branch of the Office of Nuclear Reactor Regulation.

A "Straight-Line Trajectory Model", as described in Draft Regulatory Guide 1.DD was used in evaluating atmospheric transport and dispersion characteristics. Due to the configuration of the release points with respect to adjacent solid structures, a ground level release was assumed. An estimate of maximum increase in calculated relative concentration (X/Q) values due to recirculation of airflow, not considered by the straight-line trajectory model, was also considered using the guidance of Draft Regulatory Guide 1.DD.

Based on the available onsite meteorological data and on the atmospheric transport and dispersion model and guidance provided in Draft Regulatory Guide 1.DD, relative concentration values for noble gases and radioiodines and relative deposition values (D/Q) for radioiodines were calculated for the locations presented in Mr. Waterfield's testimony.

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MR. STRIDIRON: The Staff has just one other piece of testimony which we will have Mr. Domerick sponsor. It is the Staff's responses to the Board's questions.

BY MR. STRIDIRON:

Q. Do you have before you a document entitled NRC Responses to Questions of the Safety and Licensing Board Concerning Health and Safety Matters, South Texas Project Units 1 and 2, Docket STN 50-498 and STN 50-499?

A. Yes, I do.

Q. Was the document prepared by you or under your direction?

A. Yes, it was.

Q. Are the statements contained in this document true and correct to the best of your information and belief?

A. Yes, they are.

MR. STRIDIRON: Mrs. Bowers, I will move at this time that the document entitled NRC Staff Responses to Questions of the Atomic Safety and Licensing Board Concerning Health and Safety Matters, South Texas Porject Units 1 and 2, Docket Numbers SNT 50-498 and SNT 50-499 be incorporated into the record as if read.

MRS. BOWERS: Mr. Pendergaft?

MR. PENDERGAFT: No objection.

MRS. BOWERS: Mr. Schwarz?

MR. SCHWARZ: Applicant has no objection.

MRS. BOWERS: The document you have just identified will be physically inserted in the transcript as if read.

(The document follows.)

NRC STAFF RESPONSES TO QUESTIONS OF ATOMIC SAFETY AND LICENSING BOARD CONCERNING HEALTH AND SAFETY MATTERS SOUTH TEXAS PROJECT UNITS 1 AND 2 DOCKET NOS. STN 50-498 AND STN 50-499

QUESTION 1

The increased length of the 14 ft. core renders it slightly less stable to axial-xenon oscillations, especially late in the fuel cycle: RESAR-41 suggests (Section 4.3.1.6) that the part length rods may be relied on to assure stability but the SER, (Sec. 4.3.1) notes a DNB problem associated with the use of PLR's and says that use of such rods in Westinghouse reactors is forbidden. Please discuss the alternate control strategy (Westinghouse Mode A) and its implications from the standpoints of operational flexibility and safety.

RESPONSE

The restriction on use of part-length control rods in Westinghouse reactors is expected to be removed in early 1976 following completion of and review by the staff of analytical DNB studies being conducted by Westinghouse.

In practice, control of the power distribution in Westinghouse reactors with constant axial offset control (CAOC) procedures (with or without the part-length control rods) effectively prevents xenon oscillations from occurring, even in a potentially unstable reactor. This is because constant axial offset control maintains a relatively constant axial power shape during load following maneuvers, so that xenon oscillations are not induced. Being restricted to mode A operation (i.e., without use of part-length rods), therefore, will not make the reactor more susceptible to xenon oscillations. It does limit operational flexibility, however, because the requirements to maintain the axial flux shape constant dictates that load changes be made primarily with boron. This is a slower means of maneuvering, especially near the end of core life.

It is important to note that it is not necessary to use part-length control rods to surpress xenon oscillations. Full-length control rods can be used for this purpose (see letter to J. F. O'Leary, AEC, from E. E. Utley, Carolina Power & Light Company, "H. B. Robinson Unit 2 axial Xenon Oscillations", October 16, 1972, a copy of which is attached).

To assess the impact on safety we have evaluated the consequences of xenon oscillation. For example, we may postulate that a xenon oscillation does occur regardless of the constant axial offset control procedures designed to prevent it. During the oscillation the axial flux difference (top minus bottom split excore detector readings) will undergo large swings. The constant axial offset control Technical Specifications prescribe a power reduction to 90% if the flux difference cannot be maintained in a $\pm$ 5% band around the target value, and reduction to 50% power if the flux difference is out of the $\pm$ 5% band for more than one hour. The reactor will be safe at half power because the power densities will be reduced by 50 percent. In an extreme case, even if the Technical Specifications and alarms were ignored, the overpower temperature difference trip would trip the reactor on excessive flux difference before fuel damage occurs.

QUESTION 2

The SER at p. 4-12 states that the design limit peaking factor for the 14 ft. core is 2.50; the SER supplement, at p. 6-1, states that the analyses of ECCS performance assumed a peaking factor of only 2.45. Is the ECCS analysis conservative from this standpoint?

RESPONSE

It is indeed not conservative if the design peaking factor is greater than that assumed for the ECCS analysis. The correct design peaking factor for RESAR-41, however, is 2.45 as stated on page 4.3-242 of Amendment 15 to the RESAR-41 Preliminary Safety Analysis Report. The figure 2.50 in the Safety Evaluation Report was in error. All the relevant analysis and the staff's conclusions set forth in the Safety Evaluation Report and Supplement 1 were based on a peaking factor of 2.45.

QUESTION 3

The SER (loc. cit.) also asserts that the higher value of the peaking factor for the longer core is associated with the effect of the PLR's:

(a) If the PLR's are not used, will the limit still be 2.50?

(b) If a lower limit is established, will control of peaking by simple axial offset observations still be possible at 100% power?

RESPONSE

As discussed in our response to Question 2 the design peaking factor for RESAR-41 is 2.45.

(a) Yes, the limiting peaking factor will still be 2.45. The limiting peaking factor is established by the loss-of-coolant accident analysis not the use of part-length rods.

(b) A lower limit has not been established because as stated above the use of part-length rods will not affect the design peaking factor limit.

QUESTION 4

The Board notes that one of the consequences of the new (RESAR-41) refueling system is that fuel will be handled at a shutdown margin of only 5%. How does this margin compare with that generally allowed for fuel handling in reactors and critical facilities at present?

RESPONSE

Historically, the designs of refueling systems (including refueling procedures) and fuel storage facilities have provided that the k_{eff} would be 0.90 or less. This has not been a regulatory requirement, but industry practice. More recently industry has been departing from this practice and we have indicated that fuel may be stored such that k_{eff} does not exceed 0.95 in pure water when all physical and calculational uncertainties are included.

With regard to 5% shutdown margin for refueling we find this is acceptable on the basis that with all the control rods removed from the core, there is no longer any credible physical change that can be made rapidly on the core that will substantially increase its reactivity. Continuous flux and frequent boron concentration monitoring is required during refueling. In practice, boiling water reactors employ a shutdown margin of 5% during refueling.

QUESTION 5A

The SER, at p. 15-8, stated that a revision of the dilution path flow alarms would be required in order to assure adequate warning of potential boron dilution. Supplement 1, at p. A-8, suggests that this will not be required, but that locking out of valves and reliance on nuclear instrumentation will be substituted.

(a) Is this actually the plan?

(b) How many minutes warning will the operator have of impending criticality if reliance is placed entirely on nuclear instrumentation for warning of such criticality when it occurs by the most rapid postulated reactivity addition mechanism during refueling?

RESPONSE 5A

The plan adopted by Westinghouse for RESAR-41, and committed to by South Texas Project, is to lock closed valves FCV-110B, FCV-111B, 8338, 8355, and 8361 in the chemical and volume control system, as identified on drawing 9.3-1, Sheet 3, of RESAR-41. This procedure will eliminate all possible direct paths for addition of fresh water to the reactor coolant system. The only remaining path is via the reactor water storage tank. The Technical Specifications will require sampling of the boron concentration following makeup to the tank before addition of this water to the reactor coolant system. As an additional precaution, the high count rate will be alarmed in both the containment and the control room, and a high source range flux level will be alarmed in the control room to indicate an approach to criticality due to any unforeseen dilution occurring. Typically, the source range high flux alarm will be activated one decade above the count rate setting being used. Thus, not only is addition of fresh water prevented, but an increase in the subcritical multiplication factor is alarmed. Since all credible dilution accident flow paths have been eliminated, the need for postulating operator action following a warning alarm has been eliminated.

QUESTION 5B

What precautions (such as secondary water treatment and tube inspection) are now envisaged to assure steam generator tube integrity under all conditions at STP?

RESPONSE 5B

The NRC staff has evaluated the measures that will be taken to assure that the steam generator tubes in the South Texas Project facility will not be subjected to conditions that will cause degradation of integrity. We have also evaluated the provisions made by the applicants to detect such degradation, should it occur, before it has progressed far enough to affect the safety of the plant.

The facilities, steam generators, and operating procedures described in this construction permit application for the South Texas Project are of more recent design than those facilities that have experienced steam generator tube degradation. This response is directed to the South Texas Project construction permit application.

Regarding the newer plants, including South Texas Project, nuclear steam supply vendors of pressurized water reactors that have experienced significant steam generator tube corrosion have redesigned steam generators and made significant changes in the secondary system water chemistry. The affected nuclear steam supply system vendors are obtaining experimental data on tube material compatibility in simulated secondary coolant conditions so that the new pressurized water reactor plants should not have extensive localized corrision.

For the South Texas Project steam generators, current regulatory requirements are considered sufficient to insure plant safety at the construction permit stage of review. If future NRC staff action on this issue or future inspections of operating Westinghouse steam generators develop significant

safety issues concerning design features of systems or components for which preliminary designs are proposed in this application, post construction permit design changes may be required of the applicants.

We have concluded that these measures are adequate. There is no reason to believe that plant safety will be compromised by steam generator tube degradation. Our conclusions are based on the following considerations:

1. The steam generators will be of advanced design with improved secondary water flow characteristics, providing more tolerance for occasional lack of water chemistry control.

2. The applicants will use an all volatile type of water chemistry that has been shown by service experience to minimize the probability of tube degradation.

3. Provisions for monitoring the secondary water chemistry will be included. These will be used to detect the presence of deleterious impurities before significant tube degradation can occur.

4. Provisions for monitoring reactor coolant leakage to the secondary side are included in the design, and the limits on such leakage that will be imposed will ensure that tube degradation, should it occur, will be detected before it develops into serious deterioration of integrity.

5. The design of the steam generators permits inservice inspection of the tubes by methods that will detect incipient tube degradation. Tubes that could further degrade to marginal conditions can be taken out of service by plugging.

QUESTION 6

The SER at p. 10-4 states that information will be forthcoming regarding the means by which the Applicant proposes to preclude water hammer in the steam generator feedwater system. Is such information available? What steps are presently proposed to deal with the problems?

RESPONSE

The steam generator feedwater piping water hammer problem is being investigated by the staff on a generic basis. Work is planned which includes investigation of water hammer phenomena to date in operating pressurized water reactor plants, analytical means to study mechanisms that may cause water hammer, recommendations for corrective action, including modifications to design and operating procedures to preclude recurrence of such phenomena. The staff plans to use a consultant to assist in this work. Tests at certain plants on this subject are being closely followed by the staff.

We have discussed this problem with the applicants and have prepared a request for additional information which will be forwarded to the applicants in the very near future. We will evaluate the applicants' response and, in conjunction with the generic investigation described above, determine the necessary steps to preclude this problem for the South Texas Project. We have determined that appropriate modifications of the feedwater system can be made if necessary prior to finalizing the design.

QUESTION 7

What is the status and general plan of the program mentioned in Supplement 1 (at p. 18-2) to review design features intended to prevent fires or limit the safety consequences of fires?

RESPONSE

The staff is formulating a program to conduct a comprehensive review and evaluation of the fire potential in all nuclear power plants. The review will consider experience gained from the Browns Ferry fire, recommendations from the Nuclear Energy Liability-Property Insurance Association (NELPIA) and from other qualified fire protection consulting agencies. The fire protection systems will be upgraded if the results of our evaluation so dictates.

The staff is preparing a technical position which eventually will be used as a Regulatory Guide, giving the guidelines for fire protection system design for nuclear power plants. When completed, we will send this technical position to all licensees and applicants of nuclear power plants requesting that they review their systems with respect to our guidelines, and propose modifications if required. We plan to review each plant individually, and to issue an evaluation with conclusions and/or recommendations for each plant.

QUESTION 8

It is not clear to the Board whether the statement at page 11-2 of Supplement 1 to the effect that air doses will not exceed 10 mrad/yr and 20 mrad/yr include contributions from gas stream releases of ^{14}C, ^{3}H, and particulates.

(a) Are we to rely on the implication in the July 18, 1975 affidavit of J. S. Boegli that such doses due to ^{14}C and particulates are negligible? If so, is the dose from ^{3}H also negligible?

(b) Are the releases on which the staff's present air dose assessment is based those of Boegli or those of the FES Table 3.7 (as implied in the SER at page 11-7)?

RESPONSE

(a) The air dose assessment provided in the affidavit of Dr. Kastner (July 18, 1975) was based only on the noble gas emissions. In supplemental testimony presented on November 5, 1975 by the NRC staff on Evaluation of Liquid and Gaseous Effluents with Respect to Appendix I of 10 CFR Part 50, for the South Texas Project, the dose contributions from carbon 14, tritium and particulates were presented in the category "Radioiodines and Other Radionuclides Released to the Atmosphere".

(b) The air dose assessment provided in the affidavit of Dr. Kastner was based on the noble gas releases provided in Table 1 attached to the July 18, 1975 affidavit of Mr. Boegli.

Carolina Power & Light Company

Raleigh, North Carolina 27602

October 16, 1972

Mr. John F. O'Leary
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

H. B. ROBINSON UNIT NO. 2
LICENSE DPR-23
AXIAL XENON OSCILLATIONS

Dear Mr. O'Leary:

In the interest of keeping the Commission informed of any unusual events connected with the normal operation of a nuclear power station, Carolina Power & Light Company is reporting, by this letter, the presence of divergent axial xenon oscillations in the H. B. Robinson Plant. Continued operation with this condition existing in the plant is not in violation of any Technical Specifications or safety requirements (FSAR, page 3.1.2-3), and the magnitude of the power oscillation produced by the xenon oscillation is easily controlled by existing plant equipment. This letter is merely to inform the Commission of such a condition, and Carolina Power & Light's method of successfully controlling it.

The normal operation of the Robinson Plant over the last several months has been base load at full power, with only minor deviations due to forced outages, small load changes as required by the system dispatcher, and a weekly test of the turbine stop and governor valves. This valve test is normally the most significant variation from full power operation, and is instrumental in producing significant xenon-iodine imbalances in the axial direction of the core. The power level of the plant is reduced to 70% of full load and the valves are exercised in turn to determine any sticking of the valves. This exercise is performed to fulfill the warranty requirements of the turbine manufacturer. The power reduction is accomplished by inserting Control Bank D to approximately 100 steps and then compensating for the increase in negative xenon reactivity by the removal of control rods and boron dilution. The time required to return to full power is determined by the successful functioning of the valves, and has been as short as one hour and as long as twelve hours or more.

Upon return to full power, the axial offset of the core, as measured by the excore long ion chambers, is normally positive, and continued operation leads to a substantial variation in offset (as much as 30% between positive and negative limits) during the first cycle of the oscillation. The axial stability index of the core has been measured as +0.008, indicating an unstable condition. With this value of stability index, the offset difference mentioned above will increase by approximately 23% from cycle to cycle, eventually leading to a turbine runback as overpower and overtemperature setpoints are exceeded.

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In order to avoid this occurrence, a straightforward method of control of the oscillation involving only movement of Control Bank D has been employed. Although part length rods have been provided in the plant for such a purpose, they have not been employed for any plant operations since initial startup, and are not required for the control of the power oscillations discussed here.

This control procedure is known as First Overtone Control[1/], and has been tested successfully on the Robinson Plant and is currently being used in operation. The procedure employs a carefully timed Bank D insertion to attack simultaneously the first harmonics of the xenon and iodine axial distributions. First Overtone Control is terminated and Control Bank D is withdrawn when the first axial overtones in xenon and iodine have been very significantly reduced and the xenon-iodine oscillation is almost entirely eliminated. The attached figure shows the result of the test performed at Robinson in terms of axial offset and Bank D movement, and the success of the procedure in reducing large variations in axial offset in a simple, reliable manner. Continued use of the procedure is required due to the continued and increasing instability of the core as end of cycle lifetime approaches, and there is every reason to expect that this type of procedure will be required during every subsequent cycle of operation as well. However, it is emphasized again that there is no violation of safety requirements, and that a simple, straightforward procedure involving current plant equipment is entirely adequate to maintain control of the power oscillations.

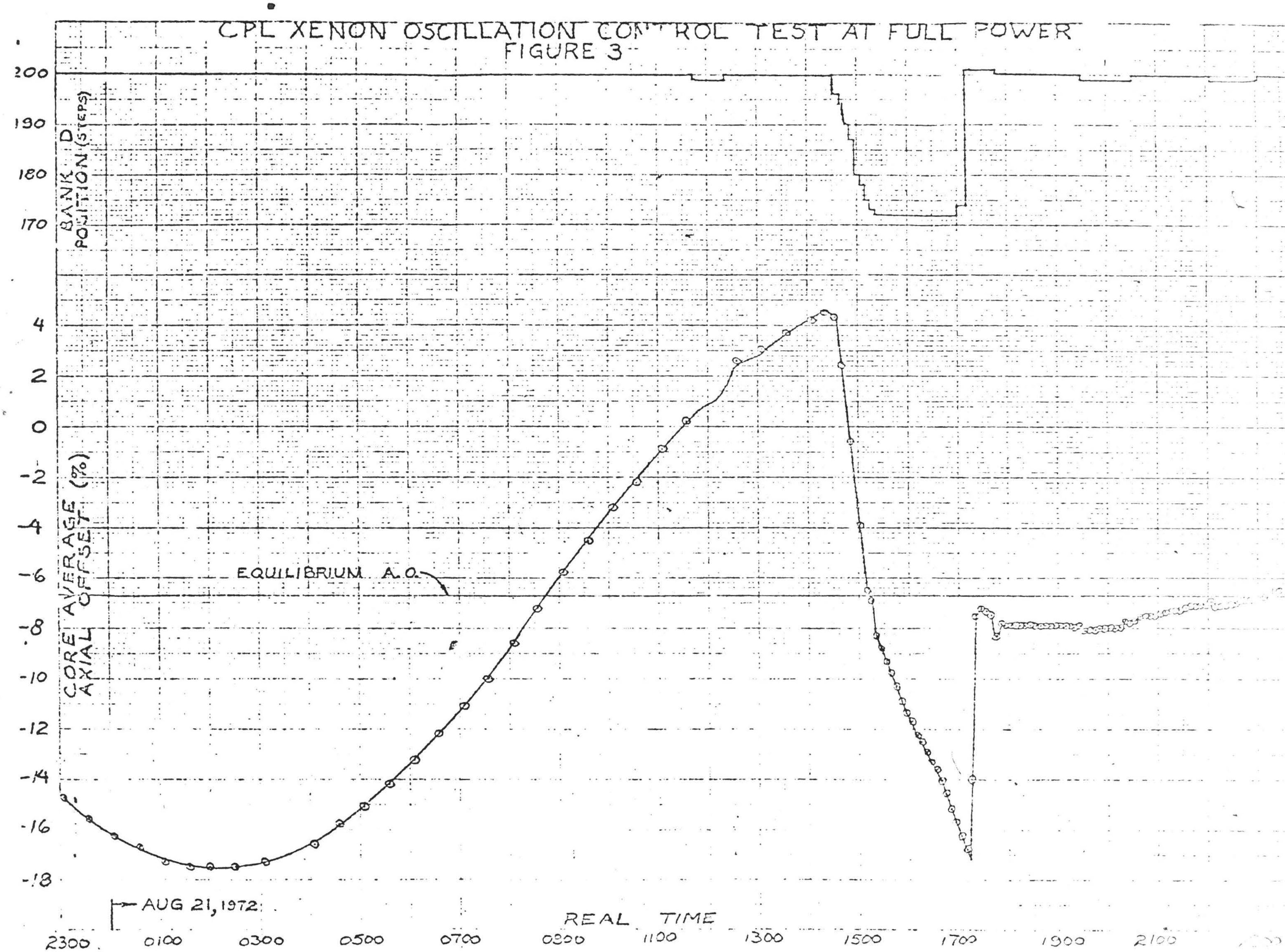
Yours very truly,

E. E. Utley
Vice President
Bulk Power Supply

DBW/za

cc: Mr. C. D. Barham
Mr. N. B. Bessac
Mr. B. J. Furr

1/ Bauer, D.C., "Practical Control Procedure for Xenon Spatial Oscillations", Vols. I and II, PhD Thesis, Carnegie-Mellon University, 1972.



CPL XENON OSCILLATION CONTROL TEST AT FULL POWER
FIGURE 3
BANK D POSITION (STEPS)
200
190
180
170
CORE AVERAGE AXIAL OFFSET (%)
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
EQUILIBRIUM A.O.
AUG 21, 1972
REAL TIME
2300
0100
0300
0500
0700
0900
1100
1300
1500
1700
1900
2100

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MR. STRIDIRON: Thank you.

I might add the Staff has its witnesses available who can respond to any further questions the parties or the Board might have on these questions or answers.

MRS. BOWERS: Does that conclude your direct case?

MR. STRIDIRON: It does conclude our direct presentation.

MRS. BOWERS: As previously agreed, the parties were going to withhold any cross-examination and the Board was going to withhold questions as well if all the direct presentation was in.

Unless the parties have objections, I think we should have a luncheon recess and we will resume at 1:30 and start out then with cross-examination.

(Whereupon at 12:10 p.m., the hearing was recessed, to reconvene at 1:30 p.m. this same day.)

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AFTERNOON SESSION

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(1:30 p.m.)

MRS. BOWERS: According to the agenda, we are now at Item 8, which is cross-examination by the parties and questions by the Board.

At the luncheon break the Board was asked if we could start immediately with matters concerned with Appendix I, because of witnesses that would like to leave as soon as possible, and the parties agreed to that,who were here at the time.

Mr. Pendergraft, I don't believe you were here. Is that all right with you?

MR. PENDERGRAFT: We will agree.

MRS. BOWERS: Fine. Well, first I will invite the parties to proceed with any cross-examination of, first, the -- well, Applicant's and Staff's witnesses are here. They have been sworn and, so, Mr. Pendergraft, do you have questions of either Applicant or Staff witnesses in the Appendix I area?

MR. PENDERGRAFT: No. We don't We don't have any cross-examination on that.

MRS BOWERS: Mr. Stridiron, do you have cross-examination questions of the Applicant's witnesses, in the Appendix I area?

MR. STRIDIRON: No, Mrs. Bower, we have no questions

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on that.

MRS. BOWERS: Mr. Schwarz, do you have questions of the Staff witnesses?

MR. SCHWARZ: We have none, Mrs. Bowers.

MR. SHON: I have a couple of questions.

MRS. BOWERS: The Board has questions.

(Whereupon, the Witnesses resumed the stand.)

MR. SHON: I would like to direct one question to Mr. Waterfield, on page 1 of his testimony, regarding the revised models that were used, revised presumably by Regulatory Guide 1.8(a), in a manner that should result in a poor realistic rather than a pessimistic answer.

I note you said the models were revised to be responsive to the mandate of the Commission. It that revision a change with respect to the version of these these models that the Commission had before it when it issued the September 4 notice? Do you know?

WITNESS WATERFIELD: Yes. I believe that would believe that would be correct.

MR. SHON: Then, as I understand the situation, the Commission issued the September 4th notice saying that an Applicant could opt to conform to Guide 1 AA, that is a concluding statement. And thereafter you changed something, when you made this calculation and changed it in a way that would make the answers less conservative or

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or less pessimistic. Is that right?

WITNESS WATERFIELD: No. I don't think the changes were that substantive.

MR. SHON: Could you give us a little bit about what the nature of the change was?

WITNESS WATERFIELD: Only one I have a definite recollection of in that area is that there is one heading for effluent release classifications, which had been jsut the term "gaseous effluents." We felt this was not specific enough and it was changed to "noble gas effluents."

MR. SHON: I see. Then that would specifically have borne upon the substance of one of the Board's questions also?

WITNESS WATERFIELD: That is right.

MR. SHON: And I think you wrote the answer to that, too; is that correct?

WITNESS WATERFIELD: Yes, sir.

MR. SHON: In particular, then, if there is a substantive change there, it is with respect to counting only noble gases, rather than particulates and carbon 14 and tritium; is that correct?

WITNESS WATERFIELD: The particulates were never included in that class, I don't believe, because there was another class called "radioiodine and particulates."

MR. SHON: Yes. I recall that is true.

bw4

The other question I had, on your tables 1 and 2. I know table 2 was calculated on the basis of a single reactor unit and table 1 on the basis of two units; is that right?

WITNESS WATERFIELD: That is right.

MR. SHON: I also know that eventually all the numbers in the calculated doses are, as one might expect, in a simpleminded fashion, double for two units what they would be for one, except for one and that is the liquid effluent dose for the body from all pathways. It seems to more than double. Why is that?

WITNESS WATERFIELD: I think there must be a typo in this.

MR. SHON: Table 1 under "Liquid Dose to Total Body from All Pathways," calculated doses lists 0.27. Table 2 lists 0.16. That is a factor of very nearly three rather than two.

MR. STRIDIRON: May we have a moment?

WITNESS WATERFIELD: Yes. Now I see what the difference is. In table 1 the dose is quoted as being to total body or any organ. In table 2 the total body is in one category and all the other organs are in another category. It turned out that the total body dose for two units was .12 millirems per year and a half of that is .06.

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MR. SHON: I see. It is because you have included total body for any organ, and the half of the other is the .08? Is that correct?

WITNESS WATERFIELD: That is correct. The reason for changing the categories is, we were attempting to follow the categories that had been originally laid out in the two Commission documents. The RM 50-2 had the once classification, whereas Appendix I has a different classification of the way to apportion the doses.

MR. SHON: I see That clears it up.

I just got your response to our questions this morning, but I think if I understand it correctly, what you are saying is that the ten millirad gamma and twenty millirad beta per year do not include things other than the noble gases; is that right?

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WITNESS WATERFIELD: Yes. That is right.

MR. SHON: Why can we assume that that is what the Commission meant when it said "air dose"? Don't these things contribute to an air dose? Don't they, indeed, cause ionization?

WITNESS WATERFIELD: Yes. They do. But I think the original intent was the air dose should bear some fairly close relationship to tissue dose and in the case of these nuclides, why that just doesn't happen. And we felt it was more appropriate to include them in the other

bw6

category with radioiodines and particulates and account for their effect there.

MR. SHON: I see.

I heard the Applicant's response to this question, in which you said that he felt the other sources, I think the ones that we specifically mentioned were carbon 14 and tritium particulates, would contribute only a tiny fraction, up to three percent, fractions of a percent; that is also in line with your experience?

WITNESS WATERFIELD: I am sure that would be, yes.

MR. SHON: Thank you.

That's the only questions I have there.

MRS. BOWERS: Mr. Stridiron, you may want to proceed with redirect following this, if you have witnesses that are anxious to be excused.

MR. STRIDIRON: Mrs. Bowers, we have no redirect.

MRS. BOWERS: Have these questions generated any questions on the part of the Applicant, Mr. Schwarz?

MR. SCHWARZ: No, Mrs. Bowers.

MRS. BOWERS: And the State of Texas?

MR. PENDERGRAFT: None for the State.

MRS. BOWERS: As far as the Board is concerned, those witnesses who are here solely on Appendix I matters

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may be excused.

MR. STRIDIRON: Thank you, Mrs. Bowers.

MRS. BOWERS: Well, my questions originally on cross-examination were limited to Appendix I matters, so let me check.

Mr. Pendergraft, do you have questions in other areas of either Applicant's or Staff's witnesses?

MR. PENDERFRAFT: No. We don't.

MRS. BOWERS: Mr. Stridiron, do you have questions in other areas of the Applicant's witnesses?

MR. STRIDIRON: No, Mrs. Bowers, we have no questions.

MRS. BOWERS: Mr. Schwarz?

MR. SCHWARZ: No, Mrs. Bowers, we have no questions.

MR. SHON: I had a couple of small questions of Dr. Rodger on his testimony at table 19 in the very nicely prepared little booklet here.

The statement starting on page 5 of the testimony and running through page 6, says that the vapor from the blowdown tank is condensed in feed water heaters and all of the liquid is returned to condenser hot well. It may be you are not exactly the person to answer this, I am not sure, but are there no noncondensables? Nothing results in the form of a gas at all from that?

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WITNESS RODGER: I believe these things will also vent back to the condenser hot well and the non-condensables will be vented along with the noncondensables from the secondary system and, therefore the contribution is accounted for.

MR. SHON: I see.

It all goes out the air ejector of the system.

On page 9, in several places it is noted that distillants and other materials are released, released with further processing after analysis. Previous paragraphs mention a similar sort of practice. What kind of control does one have to assure that a thing is not released without being analyzed first, that it is held onto? Is it purely an administrative control?

WITNESS RODGER: I am not sure that that aspect of this plant has been fully addressed as yet, but normally, and in this case, too, the liquids for release are collected in tanks and these tanks are always in at least pairs, so that you can stop putting into tank after you take the samples for analysis.

There is always a lot of paperwork associated with it, and one has to get the results back from the analytical laboratory, and it is the normal practice, and I presume will turn out to be the operating practice of this plant, too, that the lines or valves through which liquids are

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are discharged into the discharge channel are locked and under administrative control. It has not turned out to be a problem in operating plants in the past, when one is able to stay on top of this, and things do get recorded before they are turned loose.

In the case of this plant, there is going to be an effort made to review as much of the water as possible, so I guess a specific answer to your question has to be, there, indeed, has to be some aspect of administrative control to assure that that happens.

MR. SHON: Lastly, on page 15 of your testimony --

MRS. BOWERS: Mr. Schwarz, if you want any other witness to also respond, be sure and so indicate.

MR. SCHWARZ: Thank you. I will, Mrs. Bowers.

Es10

MR. SHON: You make a statement that, well, certainly interests me. In the middle of the page it says, "In general, the average dose over 50 miles is found to be 1 percent of the maximum individual dose."

It would seem to me that there wouldn't be any general figure for that, that it would vary very much from situation to situation. Where did this 1 percent come from?

WITNESS RODGER: Indeed it does vary. It can vary from less than 1 percent or 2 or 3 or several percent. It is indeed a function of what is the particular meteorology in the site and what is the population distribution around a site.

The number comes from some work that we did in the course of developing Appendix I in the first paragraph, and it came out of the initial presentation of the Staff in the initial Appendix I hearings in which we took the initial population distributions which they had averaged for a number of sites and the meteorology for the same number of sites and worked out, if you would like a histogram of dose versus population, and in those particular cases the number was slightly less than 1 percent.

I think it was a factor of 150 in the case of PWRs and 250 in the case of BWRs. In the case of South Texas, the population in close is quite sparse and you have to get out pretty much to the outer part of the 50 mile

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radius to start picking up large numbers of people, so I think it is reasonably conservative in this case. I don't suggest that number is hard and fast. I was merely trying to cut back a little further on the upper bound calculation of Dr. Kastner and show there is good expectation that the numbers will be significantly less than those presented by Dr. Kastner.

I am in no way criticizing his upper bound calculation. I am just trying to say as far as the site is concerned, it will be bounded more so.

MR. SHON: It is just something you got from experience.

WITNESS RODGER: That's correct.

MR. SHON: That is all I have on that one. I take it we are discussing all of the material we heard this morning.

Is that right?

On the Staff's response to Question 5B, which concerned steps taken to insure steam generator tube integrity, we noted that you mentioned that the South Texas project will be using all volatile treatment.

Have there been any other PWRs that have used exclusively all volatile treatement for a very long period of time, say, years?

WITNESS GAMBLE: Maine Yankee.

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MR. SHON: Maine Yankee has used it for how long?

WITNESS GAMBLE: I am not sure of the number of years. I can check.

MR. SHON: Has used it exclusively since start-up?

WITNESS GAMBLE: Yes, it has. I don't have the exact date. My best guess would be somewhere around 1967.

MR. SHON: I see. That is the only one?

WITNESS GAMBLE: No. There are others that have used all volatile exclusively.

MR. SHON: But not for a long period of time?

WITNESS GAMBLE: Not longer than Maine Yankee.

MR. SHON: For years, or a couple of months?

WITNESS GAMBLE: I would say 2 years.

MR. SHON: 2 years. I understand the Staff is looking more closely at this matter right now, and has some sort of special task force looking at that. Is that correct?

WITNESS GAMBLE: Yes. The Staff is evaluating this consideration.

MR. SHON: I trust anything they find out will be applied, will it not?

WITNESS GAMBLE: Yes.

MR. STRIDIRON: May we have just one moment, Mrs. Bowers, so the Staff can discuss a matter?

MRS. BOWERS: Yes.

MR. STRIDIRON: Mrs. Bowers, we are now ready.

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MRS. BOWERS: Why don't you proceed?

WITNESS GAMBLE: A correction has been pointed out to me. I was in error when I said Maine Yankee used this in '67, although treatments have been used in some plants and I don't know the names since '67. Maine Yankee partially started up since '73 and has used all volatile.

MR. SHON: That sounds like a more correct answer.

WITNESS GAMBLE: There are a number of dates. I just don't have them.

MR. SHON: I see. Thank you.

I guess my next question could be directed to you, or to one of the Applicant's witnesses who have had something to do with the preparation of testimony on the matter of steam generator tubes.

I know there will be a condensate polishing system, but I am not sure if that is a full demineralization system, or is it just part?

MR. MOONEY: My name is John Mooney.

The answer to that, Mr. Shon, it is a full blown demineralizer.

MR. SHON: Thank you.

I am not quite sure who to address this to, but it has to do with Appendix E-3 on the matter of financial responsibility, Appenidx E-3 to SER Supplement 1.

On the 3 tables that are presented here, 4 tables,

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pardon me, one for each of the Applicant's organizations, each of the organizations that are participating, we added up the numbers listed for each year under subject nuclear plant, and they seem not to add to the participants total share.

Is this right? Is this because they will be putting money in for years that are not contested there, or why is that?

MR. DROMERICK: Can I point out an example, Mr. Shon?

MR. SHON: Take city public service.

MR. STRIDIRON: What page?

MR. SHON: Page 3-9.

If one adds the bottom line here, subject nuclear plant for each year, one comes up with something like $375 million, and their share is listed as $450 million on page 20-2.

MR. DROMERICK: What was that first number?

MR. SHON: $375 million, or $3,739,000, I think was the number I actually got.

MR. DROMERICK: I think the reason why that doesn't come out is because, if you know, we have an asterisk on construction expenditures and that is exclusive of AFDC cost, which is an allowance for funds used during construction.

MR. SHON: In other words, the difference would be the AFDC.

MR. NEWMAN: Mrs. Bowers, could we have just a
minute, please.

MRS. BOWERS: Why don't we take a 5-minute recess?

(Recess.)

MRS. BOWERS: May I have your attention, please?

Mr. Stridiron, do you want to proceed?

MR. DROMERICK: Mr. Shon, on page E-9, those costs
that you were referring to, the reason, the difference the
costs mentioned on E-9 do not include the transmission cost,
fuel cost or the AFDC cost.

MR. SHON: I see. All 3 of them.

MR. DROMERICK: That's right.

MR. SHON: Thank you.

MRS. BOWERS: Mr. Schwarz, did you have any
further iformation on this?

MR. SCHWARZ: Simply confirming what Mr. Dromerick
said, if the Board would like for us to present a statement
on it, we can. But our information is identical to what
Mr. Dromerick just said.

MRS. BOWERS: The Board has no further questions.

Let me check with the parties and see if the ques-
tions have generated any redirect?

Mr. Schwarz?

MR. SCHWARZ: We have no further questions?

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: We have no further questions.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: We have no further questions.

MRS. BOWERS: The next item on the agenda is to talk about post-hearing procedures and schedules. And we will want to talk about the time for the proposed findings of fact and conclusions of law.

Mr. Schwarz, do you have a statement in this area?

MR. SCHWARZ: Mrs. Bowers, we have been in communication with counsel for the Staff, and anticipate the filing of a joint proposed findings just as promptly as the Board may -- well, promptly. We would appreciate any comment the Board might have on what their wishes are.

MRS. BOWERS: Well, we would like to have them as promptly as possible.

MR. SCHWARZ: Thank you, Mrs. Bowers.

MRS. BOWERS: The Board does have other commitments until the first part of December. Like the 2nd of December. So anything that would come in prior to that date would not be acted on.

Do you think you can meet that date or soon thereafter?

MR. SCHWARZ: The Applicants, I feel, can meet that date. Mr. Stridiron would like to speak for the Staff.

MR. STRIDIRON: Yes, I believe the Staff can be

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ready with joint proposed findings by December 2nd.

MRS. BOWERS: Mr. Pendergraft, are you going to be participating in this?

MR. PENDERGRAFT: We will review the findings when they are filed, but we don't want to delay unnecessarily. We are agreeable to what counsel has already proposed. We have talked to them about it.

MRS. BOWERS: You would perhaps be in on an early draft so that when the Board receives the joint proposed findings, we will feel free to act on them, both Applicant and Staff and the State of Texas have done their final position.

Are you shaking your head yes, Mr. Pendergraft?

MR. PENDERGRAFT: I am saying yes, that is agreeable to us. I am sure we can work that out among counsel.

MRS. BOWERS: Are you saying in our hands by December 2nd, or it will be in the mail by December 2nd?

MR. SCHWARZ: We would anticipate it being in your hands, Mrs. Bowers.

MRS. BOWERS: The Board has nothing further.

Let me check with each party and see if there is any other unfinished busines that needs to be taken care of. Mr. Schwarz?

MR. SCHWARZ: We have nothing, Mrs. Bowers.

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MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: We have nothing.

MRS. BOWERS: Mr. Stridiron?

MR. STRIDIRON: The Staff has no further matter to put before the Board.

MRS. BOWERS: And there are no matters that the record needs to be kept open for. All testimony and all evidence is in. Is that correct, Mr. Schwarz?

MR. SCHWARZ: I believe that is correct, Mrs. Bowers.

MRS. BOWERS: Mr. Pendergraft?

MR. PENDERGRAFT: That's correct.

MRS. BOWERS: Mr. Stridiron.

MR. STRIDIRON: On the Staff's side, that is correct.

MRS. BOWERS: Then the record will be closed and this proceeding will adjourn.

We would like to thank you and the audience for your very cooperative participation in this proceeding and we will look forward to receiving the proposed findings and conclusions of law December 2nd.

(Whereupon, at 2:15 p.m., the hearing was adjourned.)