UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
TEXAS UTILITIES GENERATING COMPANY, et al.	)	Docket Nos. 50-445 50-446
	)	
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	

NRC STAFF SUPPLEMENTAL TESTIMONY OF SPOTTSWOOD BURWELL, W. PAUL CHEN, JOSEPH I. TAPIA, JAI RAJ N. RAJAN, AND ROBERT G. TAYLOR REGARDING THE CONCERNS RAISED BY MARK A. WALSH AND JACK DOYLE, AND THE NRC CONSTRUCTION APPRAISAL INSPECTION REPORT FOR CPSES

Q.1. Mr. Burwell, by whom are you employed and what is the nature of the work you perform?

A.1. I am a Project Manager in the Division of Licensing of the United States Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached to this testimony.

Q.2. Mr. Burwell, what are your responsibilities regarding the Comanche Peak Steam Electric Station ("CPSES")?

A.2. I am the Operating License Project Manager for CPSES. As such, I am responsible for managing and participating in the safety and environmental reviews, analyses, and evaluation associated with licensing actions regarding the design and operation of CPSES.

Q.3. Please describe your participation in the preparation of Inspection Report 82-26/82-14.

A.3. As project manager, I was responsible for assembling and directing the NRC Staff's ("Staff's") special inspection of the Applicants' engineering program for CPSES. These responsibilities included scheduling, providing direction and administrative guidance to members of the Special Inspection Team, and assembling and directing the production of Inspection Report 82-26/82-14. I also participated in the Special Inspection Team's review and evaluation of the concerns raised by Messrs. Walsh and Doyle, and acted as lead reviewer for paragraph 3, section b, and paragraph 5 (see Answers 19-20).

Q.4. Dr. Chen, by whom are you employed and what is the nature of the work you perform?

A.4. I am manager of the Stress Analysis Unit of the Systems Engineering Department of the Energy Technology Engineering Center ("ETEC"). ETEC is a U.S. Department of Energy ("DOE") laboratory which is operated by the Energy Systems Group ("ESG") of Rockwell International ("RI"). ETEC is under contract with NRC to provide expert technical assistance requested by NRC. A statement of my professional qualifications is attached to this testimony.

Q.5. Dr. Chen, what were your responsibilities regarding CPSES?

A.5. Pursuant to the contract between NRC and ETEC, I supervise and am directly responsible for technical reviews of those sections of the Applicants' Final Safety Analysis Report ("FSAR"), which are the review responsibility of the Mechanical Engineering Branch of the

NRC. In particular, I supervised the review of the Applicants' pipe support stress analyses for CPSES, which are contained in the CPSES FSAR Section 3.9.3. ETEC's review and evaluation of Section 3.9.3 of the FSAR were provided to the NRC Staff, ("Staff") and were incorporated into Section 3.9.3 of the Staff's Safety Evaluation Report ("SER").

Q.6. Mr. Tapia, by whom are you employed, and what is the nature of the work you perform?

A.6. I am a Reactor Inspector in the Engineering Section of the Division of Resident, Reactor Projects and Engineering Programs, Region IV of NRC. In this position, I perform inspections during construction of nuclear facilities, in order to evaluate the status of compliance with design specifications and with the provisions of the construction permit by licensees, and to analyze whether the quality of engineering and construction reviewed is such that the facility can be operated safely. A statement of my professional qualifications was received into evidence as Staff Exhibit 8 at the CPSES operating license hearing session which commenced on June 7, 1982.

Q.7. Mr. Tapia, what were your responsibilities regarding CPSES?

A.7. I have conducted routine and special inspections at CPSES. I participated in the CPSES hearing sessions conducted in June and September, 1983.

Q.8. Mr. Taylor, by whom are you employed and what is the nature of the work you perform?

A.8. I am the Resident Reactor Inspector at CPSES, Glen Rose, Texas. A statement of my professional qualifications was received into evidence as Staff Exhibit 9 at the CPSES operating license hearing session which commenced on June 7, 1982.

Q.9. What is the nature of the responsibilities you have had regarding CPSES?

A.9. I have been the resident reactor inspector for CPSES since 1978. During that time, I have had responsibility for conducting and coordinating all safety-related inspection efforts by the NRC Region at the site. In addition, I maintain a field office, develop and recommend enforcement action, and act as a liaison with regional, state, and local agencies.

Q.10. Dr. Rajan, by whom are you employed, and what is the nature of the work you perform?

A.10. I am a Mechanical Engineer, working in the Mechanical Engineering Branch, Division of Engineering, in the Office of Nuclear Reactor Regulation ("NRR"), U.S. Nuclear Regulatory Commission. A statement of my professional qualifications is attached to this testimony.

Q.11. What were your responsibilities regarding CPSES?

A.11. I am the principal technical reviewer of the sections of the CPSES Final Safety Analysis Report ("FSAR") which are applicable to the Mechanical Engineering Branch.

Q.12. Gentlemen, have you received any additional information regarding the matters raised by Messrs. Walsh and Doyle since the March 30, 1983 filing of your previous testimony?

A.12. (Tapia) Yes. As set forth on pages 17 through 22 of the SIT Report, Inspection Report 82-26/82-14, two unresolved items regarding the use of Richmond inserts were identified by the SIT. The first item is Mr. Doyle's concern about high bending stresses in the bolt of the Richmond insert, due to the use of a one-inch washer. The Applicants performed tests of 1 1/2 inch Richmond inserts utilizing one inch washers on March 22, 1983, which were witnessed by two members of the SIT. This testing showed that the introduction of bending stresses in the bolt from the one-inch washer did not change the expected behavior of the Richmond insert assembly. The second item is the concern that there were no test data for the 1 1/2 inch Richmond insert, and that Applicants had extrapolated deflections due to shear loadings from test data for the 1 1/4 inch Richmond insert. The testing of the 1 1/2 inch Richmond inserts performed by Applicants, as described above, provided test data for shear loading for the 1 1/2 insert. The test data showed that the design allowables used at CPSES are based on a safety factor of three.

On page 26 of the SIT Report, the SIT stated that the Staff will verify that floor-to-ceiling support modifications are completed by Applicants in a follow-on inspection as part of the Staff's construction inspection program. The Staff has verified that those floor-to-ceiling supports were modified in a follow-on inspection.

The closure of these three items will be documented in an NRC inspection report to be issued in the near future.

Q.13. Gentlemen, have you read the Construction Appraisal Inspection Report, 50-445/83-18, 50-446/83-12, dated April 11, 1983 which was written by the NRC Construction Appraisal Team ("CAT")?

A.13. (Messrs. Chen, Tapia, Taylor, Rajan and Burwell). Yes.

Q.14. Have you determined which sections of the CAT Report concern pipe supports?

A.14. (Messrs. Chen, Tapia, Taylor, Rajan and Burwell) Yes. We have determined that Sections III, IV and IX of the Report relate in whole or in part to pipe supports.

Q.15. Have you reviewed and evaluated those sections of the CAT Report which you identified in Answer 14 as relating to pipe supports?

A.15. (Messrs. Chen, Tapia, Taylor, Rajan and Burwell) Yes. We have each reviewed and evaluated the CAT Report for which we had "lead"

responsibility (See Answer 20 to our previous Testimony, dated March 30, 1983).

Q.16. What was the purpose and scope of work of the Special Inspection Team's special inspection at CPSES?

A.16. (Messrs. Chen, Tapia, Taylor, Rajan and Burwell) The SIT was formed to investigate the concerns of Messrs. Walsh and Doyle regarding the design of pipe supports. The SIT Report sets forth the SIT's findings and conclusions regarding pipe support design inadequacies which were raised by, or identified as a result of, the testimony of Messrs. Walsh and Doyle.

Q.17. How does the SIT's scope of work, and the SIT Report differ from the CAT's scope of work and the CAT Report, with regard to pipe supports?

A.17. (Messrs. Chen, Tapia, Taylor, Rajan and Burwell). Our review of the sections of the CAT Report and transmittal letter relating to pipe supports indicates that the CAT reviewed the adequacy of pipe support construction. The CAT also reviewed the adequacy of the Applicants' design change controls and quality control procedures related to pipe support construction and verification that the pipe supports have been constructed in accordance with the design drawings. These subject areas inspected by the CAT (and reported in the CAT Report) were not raised by Messrs. Walsh and Doyle. The SIT concludes that the SIT's inspection, as documented in the SIT

Report, did not review and evaluate the subject areas which were within the scope of the CAT inspection.

Q.18. Is there any information in Sections III, IV and IX of the CAT Report which would give you cause to change your previous written testimony, or your findings and conclusions in the SIT Report, Inspection Report 82-26/82-14?

A.18. (Messrs. Chen, Tapia, Taylor, Rajan and Burwell) No. Section III.A. of the CAT Report states that the objective of the CAT's mechanical construction inspection was "to determine if installed and QC accepted safety-related mechanical items conformed to engineering design, regulatory requirements and license commitments." Section IV.A of the CAT Report states that the objective of the CAT's welding and non-destructive examination inspection was to determine "whether field welding activities associated with ... hangers/supports ... are controlled and performed in accordance with NRC requirements, SAR commitments, and applicable codes and specifications." Thus, the CAT inspected and evaluated pipe support constructions. On the other hand, the SIT investigated concerns related to specific allegations expressed by CASE witnesses Messrs. Walsh and Doyle pertaining to deficiencies in the design of pipe supports at CPSES.

Section IX.A of the CAT Report states that the objective of the CAT review of the Applicants' design change controls and corrective action systems was to review these programs' imp'ementation with emphasis on actual safety-related hardware installed in the field.

Design change controls and corrective action systems programs are not part of the design process per se. Proper functioning of the Applicant's design change controls and corrective action systems programs are required to assure that all necessary design inputs are taken into account in the Applicants' iterative design process for pipe supports. If the Applicants' design change controls and corrective action systems for pipe supports, and the iterative design process for pipe supports are properly functioning, then proper pipe support designs and construction will result. The SIT did not review the adequacy of the Applicants' design change controls and corrective action systems programs. The SIT did review the Applicants' iterative design process for pipe supports to determine if the applicable design criteria are properly being taken into account in the pipe support design process. SIT Report, paragraph 4. The SIT's findings did not indicate a failure of the Applicants' design verification program to identify and correct supports to assure compliance with applicable design criteria.

W. P. CHEN

MANAGER, STRESS ANALYSIS UNIT,

ENERGY TECHNOLOGY ENGINEERING CENTER (ETEC)

EDUCATION:

B. Eng. Civil Engineering & Applied Mechanics
McGill University, 1959

M. Eng. Civil Engineering & Applied Mechanics
McGill University, 1962

Ph.D. Theoretical and Applied Mechanics
University of Illinois, 1965

EXPERIENCE:

1965-1971 Simon Fraser University, Burnaby, B.C., Canada

Teaching and research in the Mechanics of Deformable Media with particular emphasis on problems of limit analysis and contained plastic flow of elastic-plastic media.

1972-1974 Basic Technology, Inc., Pittsburgh, Pa.

Thermal Stress Analysis of Components

1974-Present Energy Technology Engineering Center

ASME B&PVC compliance analysis of piping and components. NRC LWR licensing support and snubber research activities. Technical support for Solar Central Receiver and Ocean Thermal Energy Conversion projects.

PUBLICATIONS:

1. A Complementary Linear Theory of Plasticity for Plane Strain, Arch. Mech. Stos., Vol. 18, P. 731-749, 1966.

2. On Classes of Complete Solutions for Rigid Perfectly Plastic Truncated Wedges in Plane Strain, Arch. Mech. Stos., Vol. 21, P. 469-494, 1969.

3. On Uniqueness of the Limit Load for Unbound Regions, Arch. Mech. Stos., Vol. 21, P. 679-699, 1969.

4. On the Collapse of Rigid Perfectly Plastic Tapered Cantilever Beams Under End Shear, Acta. Mech., 1972.

5. On Torsion of Elastic - Perfectly Plastic Cylinders of Polygonal Cross Section (In Preparation).

PROFESSIONAL QUALIFICATIONS

JAI RAJ N. RAJAN

U.S. NUCLEAR REGULATORY COMMISSION

MECHANCIAL 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 generic water hammer problems in the piping systems and components of nuclear facilities.

I received a B.S. degree in 1953 from Lucknow University, India, where I majored in Physics, Mathematics and Chemistry. In 1956 I received a B.S. in Civil Engineering from Roorkee University, India, where I majored in Structural and Hydraulic Engineering. In 1962 I received a M.S. degree from Duke University majoring in Applied Mechanics, and a Ph.D degree in 1966 from the same university with a major 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 information 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 at the graduate and undergraduate levels in the fields of mechanics of materials, fluid mechanics and applied mechanics.

I have published papers in the Journals of AIAA and ASME. I am an associate member of Sigma Xi honor society.

SPOTTSWOOD B. BURWELL

PROFESSIONAL QUALIFICATIONS

LICENSING BRANCH NO. 1

DIVISION OF LICENSING

OFFICE OF NUCLEAR REACTOR REGULATION

U.S. NUCLEAR REGULATORY COMMISSION

I am a senior project manager assigned to Licensing Branch No. 1, Division of Licensing, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. I have been employed as a project manager since 1969 by the Nuclear Regulatory Commission and its predecessor the Atomic Energy Commission.

In this position I am responsible for managing and participating in the safety and environmental reviews, analyses, and evaluations associated with licensing actions regarding the design and operation of assigned nuclear power reactors. The plants for which I have this responsibility include the Comanche Peak Steam Electric Station.

I graduated from North Carolina State College with a Bachelor of Mechanical Engineering degree in 1948 and received a Master of Science degree in Mechanical Engineering from the same school in 1949. Following college I accepted employment with the Newport News Shipbuilding and Drydock Company and worked on piping analysis and process system design for two years. In 1951, I joined the David Taylor Model Basin (currently U.S. Naval Ship Research and Development Center) where I performed vibration tests on ships and shipboard machinery. In November 1952, I joined John I. Thompson and Company, consulting

engineers, where I was responsible for the preparation of instructions for the acceptance inspection and field assembly of naval ordinance.

In 1956, I joined the Nuclear Energy Products Division of ACF Industries, Incorporated. In May 1959, that division was sold to Allis-Chalmers. I remained with the Atomic Energy Division of Allis-Chalmers until 1967. While employed by ACF Industries and Allis-Chalmers, I served as project engineer, project manager and section leader for a series of design studies on research, military and commercial power reactors. In 1967, I joined NUS Corporation where I performed safety reviews of commercial power plants and equipment standards. I joined the Commission in June 1969.

Since joining the Commission I have attended courses on Nuclear Power Reactor Safety, Fire Protection for Nuclear Power Plants, and Pressurized Water Reactor (PWR) Systems.

I am a Registered Professional Engineer (1963, No. 4936) in the District of Columbia.