

INDEPENDENT VERIFICATION OF SAN ONOFRE UNITS 2 & 3 SEISMIC DESIGN

A PROPOSAL TO

SCE *Southern California Edison Company*

DECEMBER 1981



TORREY
PINES
TECHNOLOGY

A DIVISION OF GENERAL ATOMIC COMPANY

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PDR ADOCK 05000361
A PDR



TORREY PINES TECHNOLOGY

P.O. Box 81608
San Diego, California 92138
Telephone: (714) 455-2654

GEORGE L. WESSMAN
Director

December 14, 1981

GACP 12-380A

Mr. Orlando Ortega
Mgr, Material Services
Southern California Edison
2244 Walnut Grove Avenue
Rosemead, CA 91770

Dear Mr. Ortega:

Work is proceeding on the independent verification of the seismic design of SONGS 2 and 3. A program plan has been developed and reviewed with SCE. We have revised our proposal submittal of 30 November 1981 to be more definitive and to reflect the current requirement for an interim report on 8 January 1982. We expect the study to be completed by 31 March 1982. We have included your II TMC (11/28/79) terms and conditions with the five exceptions given in Section 3 of the proposal.

Please contact me if you have any questions. Mr. Richard Ledbetter is our Manager of Contracts if you have any contractual questions. We again request establishing a contract as soon as possible to cover our efforts.

Sincerely yours,

George L. Wessman
Manager, Projects

Enclosures

cc: J. Adrain

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1.0 SUMMARY

Torrey Pines Technology (TPT), the engineering services division of General Atomic Company (GA), is pleased to submit this proposal to conduct an independent review of the San Onofre Nuclear Generating Station Units 2 and 3 seismic design to Southern California Edison Company (SCE).

The purpose of this review is to provide an independent verification of the seismic design of San Onofre Units 2 and 3 from the Nuclear Regulatory Commission (NRC) approved design basis through to implementation at the constructor or fabricator. This effort also includes a review of the effectiveness of the applicable portions of the San Onofre Units 2 and 3 quality assurance program. The statement of work and task descriptions for this program are contained in Section 2.

We propose to complete this review by March 31, 1982. A schedule of the program activities, the project estimates, and the terms and conditions are given in Section 3.

General Atomic Company, through its Torrey Pines Technology engineering services division is eminently qualified to perform this evaluation for Southern California Edison. We operate under the first NRC approved NSS vendor qualified program and have available significant expertise in both design quality assurance procedures and implementation audit. We also have the seismic analysis technical capability to perform detailed seismic calculations starting with the design basis event through soil-building interaction to the dynamic structural responses which simulate the seismic environment that is applied to specific components and, finally, their component dynamic responses to these environments. Our specific qualifications are described in Section 6.

We have not had significant involvement with SCE or with San Diego Gas & Electric Company (SDG&E) in the past five years. Less than 1% of GA revenue for the last two years resulted from work related to San Onofre Units 2 and 3. The majority of this effort for SCE has been related to the qualification of spare parts for safety related equipment. In this same time period we have had no contracts with SDG&E. Our status as an independent reviewer is discussed in Section 5.

Project organization and management is described in Section 4 and the resumes of the key project people are given in Section 7.

2.0 STATEMENT OF WORK

Torrey Pines Technology will conduct a review of the seismic design of San Onofre Units 2 and 3 to:

1. verify that the design process converted the seismic design basis specified in the San Onofre Units 2 & 3 Final Safety Analysis Report (FSAR) into the design documents that are transmitted to the constructor or the fabricator, and
2. evaluate the SCE quality assurance (QA) audit plan and its implementation at the construction site and the fabricators' shops.

The design process performed by the equipment fabricators is not part of this review program.

The proposed work is divided into six major tasks:

1. Design Procedure Review
2. Design Procedure Implementation Review
3. Seismic Design Technical Review
4. Audit Plan Review
5. Processing of Findings
6. Reports

This proposed review will be structured to concentrate on Unit 2. It will include Unit 3 only in those areas where there are significant differences between Unit 2 and Unit 3.

TPT suggests that the following sections be referenced as the Statement of Work in any contract resulting from this proposal.

Task A: Design Procedure Review

Verify compliance of seismic design-related QA procedures and controls to the NRC-approved QA section of the PSAR or to 10CFR-Part 50 App. B. The procedures and controls used by Southern California Edison (SCE), Bechtel Power Corp. (BPC) and Combustion Engineering (CE) will be reviewed.

Task B: Design Procedure Implementation Review

Verify the implementation of design procedures and controls identified in Task A.

Task C: Seismic Design Technical Review

Review the seismic design of selected safety-related structures, components, and systems of San Onofre Units 2 and 3 for compliance with the NRC approved design basis and methodology per FSAR Section 3.7 and 3.8. ANSI N45.2.11, Section 6.3.1, criteria will be used for guidance.

Task D: Audit Plan Review

Review and evaluate the QA audit plan(s) of SCE and BPC, and verify implementation of those plans. The review and evaluation will be restricted to audit plans and audits covering implementation of seismic design output at the construction site or the fabricators' shops.

Task E: Processing of Findings

Review and assess Potential Findings and transmit those that are determined to have a potential for significant impact on the design adequacy of San Onofre Units 2 and 3 (Findings) to Southern California Edison, Bechtel Power Corp., and Combustion Engineering.

Task F: Reports

Prepare the following Reports:

1. A Program Plan to describe in more detail the technical approach and procedures to be used in performing these tasks and to guide the detail review activities.
2. An interim report including a description of the work completed through 31 December 1981 and the interim conclusions drawn from that work. This report will be issued on January 8, 1982.
3. A final report compiling all Potential Findings and Findings, including their description, comments and assessment of impact, the results of the review of SCE proposal corrective actions and the final assessment of the adequacy of the seismic design of San Onofre Units 2 and 3. This report will be issued on March 31, 1982.

3.0 SCHEDULES, ESTIMATES AND TERMS AND CONDITIONS

3.1 Schedules

The proposed project schedule is shown in Figure 3-1.

An interim report including a description of the work completed by December 31, 1981 and conclusions that can be drawn from that work will be issued on January 8, 1982. The majority of the results will be available by early March, and the verification report will be available in April 1982.

This schedule assumes reasonable access by TPT personnel to all required information. If significant problem areas are identified during this review, personnel will be added in an attempt to minimize the effect on the schedule.

3.2 Project Estimates

We propose to perform the tasks in the Statement of Work (Section 2) on a time and material basis at the rates shown in Table 3-1.

Total program estimate is \$1 to \$1.5 million. This estimate represents 100 to 150 man-months effort and associated travel costs. Assumptions used in the estimate include:

- Task A - Assumes 100% coverage of seismic design procedures.
- Task B - Assumes evaluation of 200 items for implementation compliance.
- Task C - Assumes review of 20 selected seismic design analyses.

3.3 Terms and Conditions

Terms and conditions for this contract may be as shown in Attachment I (SCE General Terms and Conditions, II TMC, 11/28/79) with the following exceptions to II TMC:

Under Section 5, COMMERCIAL TERMS, revise Section 5.2 to read:

"Invoices shall be subject to approval by the Edison Representative and shall be paid within thirty days after approval of the invoice."

Under Section 7, CONTROL OF THE WORK, revise 7.2 to read:

- 7.2 Edison Representative shall have the right to accept or reject the Work and the Results of the Work in regards to Purchase Order compliance. For a period of one year following completion of the Work, Contractor shall correct any defective Work or Results of the Work at its sole expense.

Under Section 7, CONTROL OF THE WORK, delete 7.3 and replace with the following:

7.3 Upon completion or termination of the Work, Contractor shall deliver all Documentation to Edison. Contractor may keep copies only for its internal accounting and record keeping purposes and may not use such copies or the contents thereof in any other way without the prior written approval by Edison. Edison recognizes that any Contractor computer programs used in the course of this work are Contractor property and are not a deliverable to Edison as part of this purchase order.

Under Section 8, REPORTS, delete Section 8.3.

Under Section 16, INDEMNITY, delete this section and replace with the following:

When any services furnished hereunder are to be performed on or in connection with any nuclear installation or activity, Contractor and its suppliers and subcontractors shall have no liability for any nuclear damage, injury or contamination to any property located at the site and Edison indemnifies Contractor and its suppliers and subcontractors against any such liability, whether as a result of breach of contract, warranty, tort (including negligence), or otherwise. In addition, Edison warrants that it has entered into an agreement of indemnification as contemplated by Section 170 of the Atomic Energy Act of 1954, as amended, and has obtained nuclear liability insurance from American Nuclear Insurers of MAELU, or both, pursuant to Section 170 of said Act. Any of Contractor's material or equipment which becomes radioactive at the work site, shall, at Contractor's option, become the property of Edison. Any nuclear decontamination necessary for Contractor's performance (including warranty performance) shall be performed by Edison without cost to Contractor.

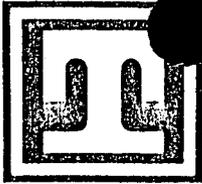


Figure 3-1 Proposed Project Schedule

Independent Verification of San Onofre
Units 2 and 3 Seismic Design

PROJECT TITLE _____

PROJECT MANAGER G. L. Wessman

TASK	1981					1982					COMMENTS		
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		OCT	NOV
A. Design Procedure Review	████████████████████												
B. Design Procedure Implementation	████████████████████												
C. Seismic Design Technical Review	████████████████████												
D. Audit Plan Review	████████████████████												
E. Processing of Findings	████████████████████												
F. Reports	1 ▽	2 ▽		3 ▽									
<u>Reporting Milestones</u>													
1. Program Plan													
2. Interim Report													
3. Final Report													

COMMERCIAL DATA WITHHELD AT THE REQUEST OF
TORREY PINES TECHNOLOGY/GENERAL ATOMIC COMPANY

4.0 PROJECT ORGANIZATION AND MANAGEMENT

General Atomic Company is a matrix organization. Business divisions are responsible for the performance of all contracts. The required resources for contracts are drawn from the various resource divisions. The overall organization of General Atomic is shown on the organization chart, Figure 4-1.

Torrey Pines Technology is the business division responsible for this contract. Mr. George Wessman is the Director of Torrey Pines Technology and will be the project manager with overall responsibility for this independent review. He has individuals from resource division responsible for specific tasks as shown on the project organization chart, Figure 4-2. Mr. Wessman will be the principal contact for the customer and will direct the efforts of the task leaders. He is responsible for performance to contractual scope, cost, schedule and reporting requirements.

An overall plan consisting of specific work scopes, budgets, and schedules will be established at the beginning of the project. Progress will be monitored through frequent review meetings with task leaders. Deviations from the plan will be evaluated and corrective action will be taken. Reviews, at a minimum, will consider:

1. Compliance with specific requirements.
2. Technical quality.
3. Adequacy of documentation.
4. Conformance to schedules and budgets.
5. Problem areas.
6. Corrective actions.

The project will be supported by the comptroller, technical editors, contract administrators, project services, and quality assurance groups as required.

GENERAL ATOMIC ORGANIZATION

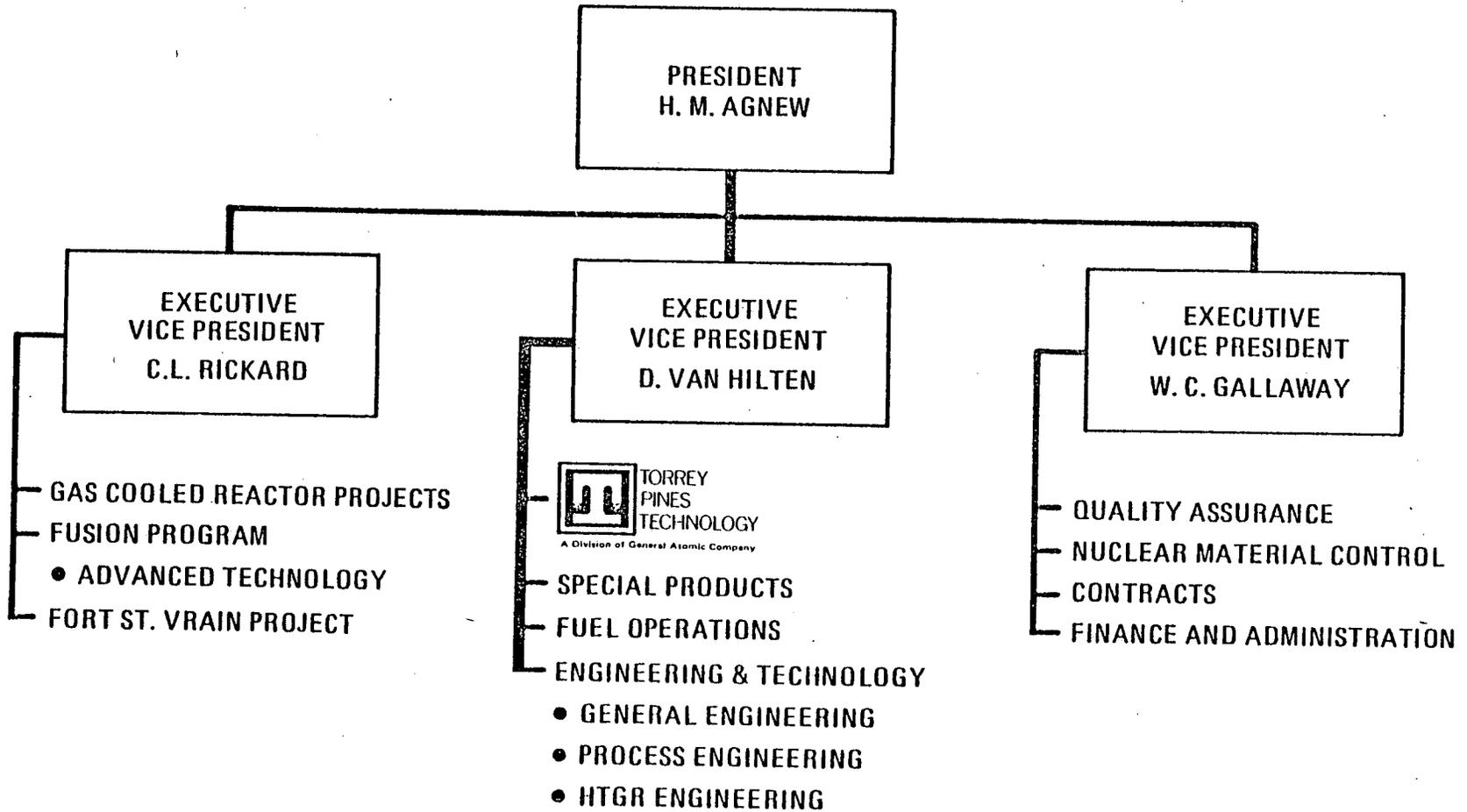


Figure 4-1

PROJECT ORGANIZATION

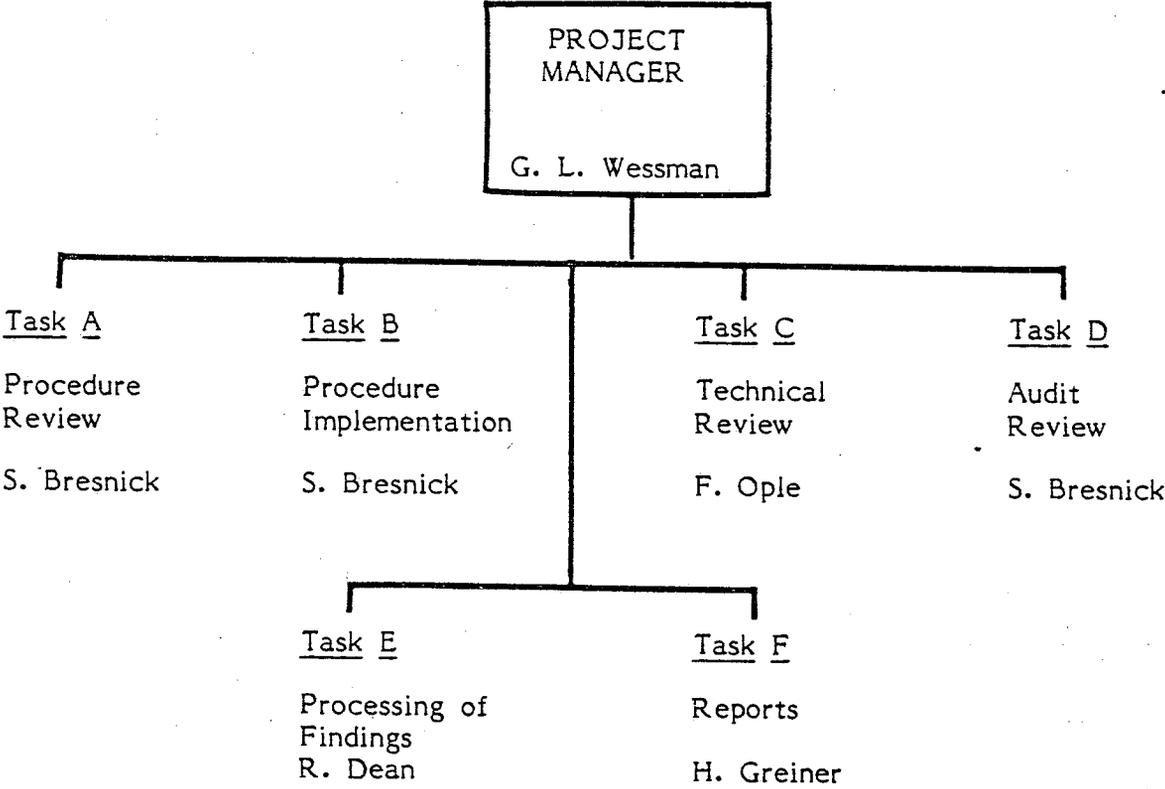


FIGURE 4-2

5.0 INDEPENDENCE

General Atomic, as a company, has obtained less than 1% of its revenue for the last two years from Southern California Edison related contracts. This includes both revenue obtained directly from Southern California Edison and revenue obtained from subcontractors to Southern California Edison.

The individuals involved in this program will be free of substantive conflict of interest. Substantive conflict of interest is defined as:

1. For key project personnel, any work experience in design, construction or quality assurance of the San Onofre Nuclear Generating Station, or with Southern California Edison or San Diego Gas & Electric currently or within the past five years.
2. For short term personnel, currently active on any other San Onofre, or SCE, or SDG&E work.

Note: No single short term personnel shall exceed 20 hours per week and the cumulative effort of all such personnel shall not exceed 10% of the total project effort.

3. An immediate family member who is employed by SCE or SDG&E. For these purposes an immediate family member is defined as one of the following:

Child	Stepbrother	Son-in-law
Stepchild	Stepsister	Daughter-in-law
Mother	Stepmother	or, if related by
Father	Stepfather	blood:
Grandparent	Mother-in-law	Uncle
Brother	Father-in-law	Aunt
Sister	Brother-in-law	Nephew
Grandchild	Sister-in-law	Niece

4. A cumulative ownership and creditor interest in SCE and SDG&E which exceeds 5% of their gross family annual income.

The individuals involved in this program will fill out the attached form 5-1 and 5-2.

Security Questionnaire **SCE**



- Please use **BLACK** ink.
- Type or **PRINT** all answers.
- If space is not adequate for complete answers, attach a supplemental sheet to this form.
- All sections **MUST** be completed.
- Write "**None**" when applicable.

EMPLOYMENT	OCCUPATION CODE	JOB TITLE	WORK LOC.	PAYROLL NO.
------------	-----------------	-----------	-----------	-------------

1 NAME

LAST: _____ FIRST: _____ MIDDLE—IN FULL: _____

OTHER NAMES USED—INCLUDE MAIDEN NAME: _____

SOCIAL SECURITY NO. (VERIFY): _____ DRIVER'S LICENSE (VERIFY): _____

2 ADDRESS

NUMBER: _____ STREET: _____ APT.: _____ WORK STATUS: Permanent Temporary

CITY: _____ STATE: _____ ZIP CODE: _____ AREA CODE: _____ PHONE NUMBER: _____ Inter-mittent Part Time

3 BIRTH DATE

MONTH: _____ DAY: _____ YEAR: _____ BIRTH PLACE: _____ CITY: _____ STATE: _____ COUNTY/COUNTRY: _____

4 PHYS DATA

HEIGHT: _____ WEIGHT: _____ EYES—COLOR: _____ HAIR—COLOR: _____ SEX: _____

MARITAL STATUS: Single Married Divorced Widow(er)

DATE AND PLACE OF LAST MARRIAGE: _____

IF DIVORCED, GIVE DATE AND PLACE: _____

5 FOREIGN BORN Alien Derivative Citizen Naturalized Citizen

ALIEN REGISTRATION NO. (VERIFY): _____

DATE ENTERED U.S.: _____ PORT OF ENTRY: _____

DATE OF FINAL PAPERS: _____ NATURALIZATION NUMBER: _____

COURT GRANTING FINAL PAPERS: _____

6 SELECTIVE SERVICE

BOARD NO.: _____ ADDRESS: _____ AUTHORITY FOR DISCHARGE OR SEPARATION FROM ACTIVE DUTY (VERIFY WITH DD 214): _____

DRAFT CLASSIFICATION: _____ RANK OR RATE WHILE ON ACTIVE DUTY: _____

ACTIVE MILITARY SERVICE: Yes No

BRANCH OF ARMED SERVICE: _____ ENTRY DATE: _____ SEPARATION DATE: _____

CHARACTER OF SERVICE: _____ OCCUPATION IN MILITARY SERVICE: _____

IF/PRESENT MILITARY RESERVE STATUS: Active Inactive RESERVE ORGANIZATION: _____ RESERVE RANK OR RATE: _____

EDUCATION RECORD	SCHOOL NAME	CITY AND STATE	GRADE LEVEL COMPLETED								DID YOU GRADUATE?	DATE LEAVING OR GRADUATION MONTH AND YEAR
			1	2	3	4	5	6	7	8		
LAST ELEMENTARY SCHOOL ATTENDED												
LAST HIGH SCHOOL ATTENDED												
COLLEGE OR UNIVERSITY—LIST ALL			YEARS COMPLETED				DEGREES OBTAINED					
OTHER EDUCATION—IDENTIFY AND DESCRIBE SCHOOL												

12

- Have you believed in or do you now believe in the overthrow of the United States Government by force or by any illegal or unconstitutional methods? Yes No
- Are you now or have you ever been a member of or supported any organization that, to your knowledge, believes in or teaches the overthrow of the United States Government by force or by any illegal or unconstitutional methods? Yes No
- Have you believed in or do you now believe in the use of unlawful and/or violent means in furtherance of your beliefs? Yes No
- Are you now or have you ever been a member of or supported any organization that, to your knowledge, believes in or teaches the use of unlawful and/or violent means in furtherance of its beliefs or objectives? Yes No

13

- Have you ever been convicted of a criminal offense? Do you have a criminal case pending? (Report all cases except minor traffic violations, sealed, or juvenile convictions.) Yes No
- If your answer is "Yes", list all such cases in Item 14. In each case give:
 - (1) The charge or nature of the offense; (2) the date; (3) the place where convicted or case pending; (4) disposition or the penalty imposed, if any.

14

CONVICTIONS

• Include all convictions — omit minor traffic violations, sealed, or juvenile convictions.

CHARGE	DATE	CITY AND STATE WHERE CONVICTED OR SUMMONED INTO COURT	DISPOSITION



This form will be used to perform complete security checks on new employees.

CERTIFICATION

I certify that the above information is correct and complete to the best of my knowledge and belief. I make this statement to the Southern California Edison Company with knowledge that any false or misleading statement or omission of material fact MAY BE SUFFICIENT CAUSE FOR DISMISSAL. Further, I authorize the Southern California Edison Company to verify any of the information I have submitted in this questionnaire.

PRESENT DATE

USUAL SIGNATURE OF PERSON FILLING OUT QUESTIONNAIRE

FORM 5-2

Personnel Guidelines for Project 2408

In order to qualify as an independent reviewer for the Seismic Verification of San Onofre Nuclear Generating Station Units 2 and 3 (TPT Project 2408), all personnel assigned to the project must comply with the following:

1. Key project personnel shall have no present or past work experience in design, construction or quality assurance of the San Onofre Nuclear Generating Station (SONGS) or with Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E).
2. Project personnel shall not be active on any other current SONGS, SCE, or SDG&E work.
3. Project personnel, other than the key personnel, shall not have any substantial prior work experience relating directly to SONGS; particularly in the areas of quality assurance and structural analysis.
4. No project personnel shall have members of their immediate family (parents, spouse, children and grandchildren) who are employed by SCE or SDG&E or are engaged directly or indirectly in the design or construction of SONGS Units 2 and 3.
5. During the term of the project no project personnel and their immediate family shall have cumulative ownership interest in SCE and SDG&E which exceeds 5% of their gross family annual income.

PROJECT 2408 PERSONNEL QUESTIONNAIRE

1. List on the reverse side all of your past or present work experience relating to the San Onofre Nuclear Generating Station (SONGS) or Southern California Edison Company (SCE) or San Diego Gas & Electric Company (SDG&E). Give the types of work and the approximate hours per week and time periods associated with each type.
2. Are any of your parents, spouse, children or grandchildren presently employed by SCE or SDG&E or engaged directly or indirectly in the design or construction of SONGS Units 2 and 3?
3. Do you have a financial interest in SCE or SDG&E? If so, give details on the reverse side.

I hereby certify that the above is correct to the best of my knowledge.

Signature

Date

Project 2408 Personnel Agreement

I _____ (print
or type name) hereby agree that:

1. I will treat all information revealed to me in the course of my work on this project as confidential and will not disclose it to others not involved in the project except as directed by the Project Manager, G. L. Wessman.
2. If I identify what I believe to be a defect or noncompliance that may result in a safety hazard I will immediately notify G. L. Wessman and the Director of Licensing, C. Fisher, for evaluation per Company Policy Manual CPM-212.
3. I will notify the Project manager if during the term of this project I, or any member of my immediate family (parents, spouse, children and grandchildren) acquire any financial interest in Southern California Edison Company or San Diego Gas & Electric Company.

Signature

Date

6.0 COMPANY QUALIFICATIONS

6.1 Company Background

Torrey Pines Technology was established as a division of General Atomic Company (GA) through which GA's extensive engineering and scientific resources could be offered to industry. These resources are available through service contracts with Torrey Pines Technology. The scope of these services are individually tailored to meet each customer's special needs which may vary from individual consulting with one of our technical experts to large service contracts for complete engineering or R&D programs.

General Atomic has been actively engaged in the nuclear power industry since 1965 and is one of the largest privately owned centers for diversified energy research, development and engineering in the world. Our activities have centered around the creation of advanced systems of power generation and energy conversion. The company is located on a 418 acre site 20 minutes north of downtown San Diego. Our facilities have grown to nearly one million square feet of office space and include engineering, sophisticated test facilities, precision manufacturing installations, and advanced technology laboratories.

General Atomic employs approximately 2200 people which includes a technical staff of some 1200, comprised of over 200 with Ph.D. degrees and another 800 with B.S. or M.S. degrees. Many of the technical staff are recognized leaders and experts in their field. They have authored numerous technical books, hundreds of papers and filed more than 400 patents. The staff is highly experienced in the nuclear field and has an extensive background in LWR work. Table 6-1 lists Torrey Pines Technology's overall capabilities.

TABLE 6-1

TORREY PINES TECHNOLOGY
Areas of Capabilities

- o Analog/Digital/Hybrid Computer Facilities
- o Analytical Chemistry
- o Carbon & Ceramic Technology
- o Containment H₂ & Pressure/Temperature Analyses
- o Control and Electrical Design
- o Control Room Review and Design
- o Cost Development and Risk Evaluation
- o Dynamic Process Analyses
- o Electron Microscopy
- o Energy Systems Evaluations
- o Emergency Preparedness Evaluation and Planning
- o Emergency Response Facilities
- o Failure Analysis
- o Flow-Induced Vibration Analysis
- o Fluid System, Structural and Mechanism Testing
- o Heat Exchanger Design and Analysis
- o High-Temperature Design, Repair & Replacement
 - Creep & Fatigue Analysis
 - Materials & Properties Testing
- o Hot Cell Services
- o Human Factors Design
- o Licensing of Nuclear Facilities
- o LWR Fuel Services
 - Fuel & Core Design and Operational Analyses
 - Licensing
 - Mixed Oxide Fuel Analysis
- o Materials Selection & Properties
- o Mechanisms and Remote Handling Equipment
- o Metallurgical and Laboratory Services
- o Non-Linear Controls Analysis
- o Nuclear Instrumentation Analysis & Specification
- o Nuclear Plant/Equipment Damage Claim Evaluations
- o Piping Design & Analysis
- o Plant Process Simulations and Operating Procedures
- o Plant Startup and Modifications Support
- o Prestressed Concrete
- o Probabilistic Risk Assessments
- o Program Planning & Scheduling
- o Quality Assurance
- o Radioactive Material Handling
- o Radiation Protection & Shielding Design
- o Reactor Physics & Nuclear Fuel Management
- o Reactor Plant Walkdown Teams

- o Reliability & Maintainability Analysis
- o Rotating Machinery (nonelectrical) Analysis & Design
- o Safety Equipment Identification & Evaluation
- o Seismic and Environmental Equipment Qualification
- o Structural Analysis and Design
- o Systems Design for Steam, Hydraulic, Air, Cryogenic and Inert Gas Systems
- o Thermal Insulation Systems
- o Thermo-Hydraulic Analysis
- o Turbine & Blading Analysis
- o Turbine-Generator Systems

6.2 Relevant Experience

Quality Assurance

The GA Quality Assurance Program is a company-wide system described in GA's Quality Assurance Manual (QAM). This program complies with ANSI/ASME N45.2, the N45.2 series of daughter standards, ANSI/ASME NQA-1, 10CFR50 Appendix B, 10CFR71 Appendix E, Regulatory Guides, the ASME Code, and RDT Standards during design, fabrication, installation, testing, construction, and operation. The Quality Procedures (QPs) in the QAM cover all aspects of quality that would be associated with any given project.

The assigned QA Manager, working with the Project Manager, prepares a Quality Assurance Program Document (QAPD) to invoke the requirements of the QAM and tailor the standard provisions of the QPs to comply with the unique contractual requirements. This flexibility not only assures that provisions for all contractual QA requirements are implemented but also allows a more cost effective QA Program to be utilized in performance of the work for the project. The QAPD is the top GA QA planning document and accomplishes the following:

- a) Invokes the requirements of the QAM for the project.
- b) Provides a vehicle to document the client's QA requirements and the method of implementing activities which satisfy contractual requirements.
- c) Identifies the personnel assigned the responsibility for defining, approving, and implementing the QA program for the project.
- d) Describes the relationships and interfaces of GA's organization with the client on quality matters and references any specific site quality requirements.
- e) Establishes a document approved by GA's project manager and the QA director which is available for customer review and approval. This document also makes provisions for changes as required as projects proceed.

In 1974, GA was the first company in the nuclear industry to have its QA program accepted by the NRC (then the AEC). GA's QA program, described in a topical report, GA document number GA-A13010A, has been amended, reviewed, and accepted annually by the NRC, and is approved for use in future licensing applications without subsequent review. The report demonstrates compliance with various industry codes and government regulations, including ANSI/ASME N45.2, and daughter standards.

GA was resurveyed in early 1980, and the ASME has renewed GA's Certificates of Authorization and the right to continue to apply the N, NPT, PP, U, and U2 stamps on work at GA's manufacturing facilities. Overall responsibility for the construction of items under ASME Section III Division 2 rules has also been renewed.

GA's Quality Assurance Division has had extensive experience in developing and implementing QA programs in both nuclear and non-nuclear energy projects. GA's QA program has been effectively implemented on projects as diverse as advanced materials development, nuclear fuels, power plant design and construction, advanced fusion, and solar power design and construction. Design and fabrication have met the most rigorous regulating codes and standards and specially imposed criteria (10CFR50 Appendix B, 10CFR71 Appendix E, ANSI, ASME, and RDT).

The Quality Assurance staff is composed of 38 highly qualified people. Twenty-three of these are either ASQC certified quality engineers or registered professional engineers in quality engineering or in other disciplines. ASME/ANST level II and III NDE inspectors are also available, as are inspectors and test personnel qualified to ANSI N45.2.6, and lead auditors to ANSI N45.2.23.

Structural Engineering

General Atomic Company has the capability for design and analysis of any type of engineering structure. The staff includes civil and mechanical engineers with experience in nuclear and non-nuclear applications. The staff has performed much of the structural analysis of the Peach Bottom pilot power plant and Fort St. Vrain power plants. This entailed developing the basic plant dynamic models, defining seismic input, generating seismic output and in-structure response data, combining seismic loads, conducting component dynamic analysis and performing ASME Nuclear Pressure Vessel Code, Section III analysis for steel vessels and structures, analyzing the prestressed concrete reactor vessel, the liners and closures, steam generator, tubes and structures, refueling equipment, and piping systems. More recently, the large HTGR project has provided experience with the latest NRC regulation guides for seismic qualification and provided applicable sections of the Preliminary and Final Safety Analysis Report for these plants.

In addition to the routine seismic and dynamic analysis performed at GA, major development of analytical methods and computer codes have been accomplished. The basic dynamics code used in General Atomic now is MODSAP, which is an in-house modification of the U.C.-Berkeley SAP code. This code contains two- and three-dimensional elements, plates and shells, pipe elements, asymmetric loads on solids of revolution, modal superposition and direct integration and limited non-linear capability.

The MODSAP program is capable of computing seismic response due to multi-directional earthquake input using either the response spectrum approach or the time-history solution. It can handle three-dimensional plant seismic model of arbitrary shape. The code has also been used for component seismic analysis. Other industry codes such as FLUSH which employs the transmitting boundary in conjunction with finite-element representation of soil has also been used extensively in parallel with MODSAP.

In the area of plant seismic analysis, GA personnel has been active in soil-structure interaction analysis development based on both linear and nonlinear soil representation. The more recent work includes the consideration of coupling effects between adjacent structures via soil medium, nonsymmetric pattern of plant structures on common base subjected to translational and rotational ground motion input, and travelling seismic wave effects in the presence of soil nonlinearity. The GA staff members are among the major contributors in the field of dynamic analysis techniques of structures consisting of loose blocks and separate elements. Extensive development has also been carried out in the two- and three-dimensional finite element analysis codes for both linear and nonlinear analysis. In the component seismic analysis area, studies have been conducted to determine the dynamic interaction between seismic input and rotating machinery excitation on the response of piping systems with multiple supports under non-uniform support input.

GEORGE L. WESSMAN
Director
Torrey Pines Technology

PROFESSIONAL SPECIALTY

Project, functional, and business management, multi-discipline management and engineering design and development.

EDUCATION

B.S., Chemical Engineering, University of Minnesota, 1958
M.S., Chemical Engineering, University of Minnesota, 1964

EXPERIENCE

Currently responsible for overall direction and performance of Torrey Pines Technology, the engineering services division of General Atomic. Responsible for all phases of organization, marketing, project management and profitability.

Currently active at all levels in the development of codes and standards in the United States. This includes chairmanship of the Nuclear Standards Management Board, American National Standards Institute, Member of the American Nuclear Society's Standards Steering Committee and Member of the American Nuclear Society's Nuclear Power Plant Standards Committee.

Responsible for the integration of all technical effort during the final three years of construction and startup of the Fort St. Vrain Nuclear Power Plant. This included the technical effort in mechanical, electrical, control, systems and fuel engineering and licensing. It included the aspects of analysis, design, field startup, field problem solving and document control.

Directed company's Licensing Division during the period of time it was in the commercial nuclear steam supply system business. This included responsibility for all phases of federal and state licensing matters including discernment of trends, reviewing and commenting on draft regulatory documents, establishing licensing strategy, identifying licensing risks and assisting clients to obtain the necessary permits and licenses at both state and federal levels.

Managed the Plant Engineering Department for General Atomic while the design for the large commercial nuclear steam supply system was developed. This included responsibility for organization, staffing, technical adequacy of the department's work and setting departmental policies and procedures for engineering planning, scheduling and budgeting, fluid system design, control, electrical and instrumentation design, system performance, safety and analysis. The project engineers for all projects were also included in the department.

Program manager for the AEC study of the large HTGR design. This program was directed toward optimizing the design of a large HTGR power plant.

Responsible for various aspects of management of the Peach Bottom project during final construction, startup, and initial operation. This included responsibility as project engineer, site manager and project manager. As project manager responsible for steam generator repair and the design, licensing, production, delivery and installation of second core for the Peach Bottom Atomic Power Station Unit #1.

Technical work performed as a shielding design engineer, fluid system design engineer, nuclear engineer responsible for fuel element design and development of chemistry data required for fuel element design.

PROFESSIONAL ASSOCIATIONS

Registered Professional Nuclear Engineer, California, 1977
Member, ANS
Chairman, ANSI NSMB
Member, ANS SSC
Member, ANS NUPPSCO
Chairman, ANS-40

STUART BRESNICK
Department Manager

PROFESSIONAL SPECIALTY

LWR fuel manufacturing and technology; quality assurance programs for nuclear fuel processing.

EDUCATION

B.E., Metallurgical Engineering, Cornell University, 1962
M.S., Materials Science, Northwestern University, 1965
M.B.A., Organizational Development, Iona College, 1973

EXPERIENCE

Nineteen years of engineering experience in nuclear power and quality assurance.

Responsible for management of GA's LWR reload fuel obligations. These obligations involve long-term deliveries of fabricated fuel through subcontractors.

Also active as an LWR fuel consultant providing such services as an assessment (technical/financial) of the TMI-2 fuel core damage, QA audits of Leibstadt initial core fuel manufacturing, and development and presentation of a course on LWR fuel technology. The latter is an ongoing program presented to utilities, industry, and NRC personnel on a periodic basis. Previous activities include QA audits of subcontractors, subcontractor bid evaluation, and negotiation of reload fuel subcontracts.

Gulf Nuclear Fuel Company - QA Manager responsible for developing, managing, and auditing corporate QA programs for compliance with customer and AEC regulatory requirements. Responsibilities covered all aspects of fuel design and fabrication at Gulf United Nuclear Fuels. From 1966 to 1971, was responsible for production support and process development for LWR reload fuel fabrication.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Quality, California

DR. F. S. OPLE
Department Manager

PROFESSIONAL SPECIALTY

Civil/structural engineering management. Design and development of prestressed concrete pressure vessels/structures; concrete technology; scale model tests.

EDUCATION

B.S., Civil Engineering, University of the Philippines, 1958
M.S., Civil Engineering, Lehigh University, 1960
Ph.D., Civil Engineering, Lehigh University, 1963

EXPERIENCE

Currently Manager of the Structural Engineering Department of the General Engineering Division with responsibility for structural design and analysis (pressure vessels and piping, elevated temperature components and structures) and structural mechanics (dynamic-seismic analysis, structural methods development, and seismic qualification-testing). Previously held positions as Manager of Structural Engineering responsible for Gas-Cooled Reactor components and structures (pressure vessels, thermal barrier, and reactor internals), and Manager of Vessels Engineering and Plant Structures Branches.

Responsible for design of first-of-a-kind prestressed concrete reactor vessel (PCRIV) for the Fort St. Vrain Nuclear Generating Station. &RD included scale model tests, time-temperature dependent concrete tests, preplaced aggregate concrete construction techniques and large capacity prestressing system development. Provided technical support during construction and startup of the Fort St. Vrain plant, including directing the proof pressure and leak tests of the PCRIV. Prepared input to Safety Analysis Reports and made presentations to NRC and ACRS. Has been closely associated with the advancement of PCRIV technology as an active participant in the GCR International Cooperative Program between the U.S. and European countries. Through code committee work, has been involved in the codification of design and construction rules for concrete reactor vessels and containments.

Participated as a consultant in technical panels, the latest being a member of a panel assembled to evaluate the results of sodium concrete reaction tests for the Clinch River Breeder Reactor Project and to provide recommendations for additional analysis and testing to explain structural and chemical effects associated with sodium spills on concrete containments.

Prior to joining General Atomic Company, he was a structural engineer for the Rust Engineering Company in Pittsburgh, where he was involved in prestressed concrete and steel design of industrial plant structures (food processing plants, paper mills, steel mills).

PROFESSIONAL ASSOCIATIONS

Member, ACI/ASME Joint Technical Committee on Concrete Reactor Vessels and Containments (ASME Section III, Division 2); Member, Subgroup on Design. Past Chairman, Working Group on Concrete Reactor Vessels.

Member, ACI Committee 361 and ASME SWG on Composite Concrete and Steel High Pressure Vessels for General Industrial Use.

Member, Federation Internationale Precontrainte (FIP), Task Group on PCPVs for Non-Nuclear and Thermal Processes.

Past Member, ACI Committee 444 on Structural Concrete Models.

Registered Professional Engineer in California and the Philippines.

ADDITIONAL INFORMATION

Publications

"Probable Fatigue Life on Plain Concrete with Stress Gradient," ACI Journal, 1966.

"Comparison of Experimental Results with Response Analysis for a Model of a Pressure Vessel," Proceedings International Conference on Model Techniques, British Nuclear Society, London, 1969.

"Effects of Temperature on a Prestressed Concrete Reactor Vessel Model," ACI SP 25-6, 1971.

"Fort St. Vrain Unit 1 PCRV Pressure Test Report for the Public Service Company of Colorado," Gulf-GA-A10839, 1971.

"Preplaced Aggregate Concrete Application on Fort St. Vrain PCRV Construction," International Conference on Experience in the Design, Construction, and Operation of PCPVs and Containments for Nuclear Reactors, York, England, Institute of Mechanical Engineers, 1975.

"Construction, Testing, and Initial Operation of Fort St. Vrain PCRV," *ibid.*

"Structural Evaluation of the Localized Elevated Temperatures in the Thermometer Penetration of the Fort St. Vrain PCRV," GA-A13616, 1975.

"Latest Developments in Prestressed Concrete Vessels for Gas-Cooled Reactors," 5th SMIRT International Conference, Berlin, Germany, 1979.

ION T. ALMAJAN
Staff Engineer

PROFESSIONAL SPECIALTY

Applied mechanics, structural dynamics.

EDUCATION

B.S., Mechanical Engineering, Polytechnical School of Engineering, Bucarest-Romania, 1963.

M.S., Mechanical Engineering, Northeastern University, Boston, Mass. 1973.

Ph.D. course, University of California at San Diego, Mechanics/Mathematics, required program complete with average 3.9/4.0.

EXPERIENCE

Seismic design analysis of mechanical (pumps, refueling machine, etc.), electric (cabinets, plants, electrical motors) and various piping systems using finite element approach (MODSAP).

Provide consultation services to groups within General Atomic concerning seismic analysis and computer program usage.

Conducted static and seismic analysis of large piping system for Fort St. Vrain Nuclear Power Plant.

Conducted seismic analysis of the boiling water reactor nuclear power plant (Project: James Fitzpatrick, New York). The task included selection of the analytical technique (finite element - STARDYNE, STRUDL, SAP IV); mathematical modeling, time history response, response spectrum, and detailed stress analysis.

Prepared nuclear safety analysis reports.

Static and dynamic analysis of various equipment and piping systems for PASNY nuclear power plant using finite element approach (STRUDL, STARDYNE, PIPE code).

Responsible for overall structural and heat balance of industrial boilers.

PROFESSIONAL ASSOCIATIONS

Member, American Society of Mechanical Engineers.

CHARLES T. BEAL
Senior Quality Engineer

PROFESSIONAL SPECIALTY

Development of Nondestructive Examination (NDE) procedures and techniques, training and certification of NDE personnel, and providing technical support to engineering regarding NDE inspectability of nuclear components.

EDUCATION

College: Approximately 36 units completed in pre-engineering and industrial technology courses. Also have completed courses in radiation safety and radiographic film interpretation. All courses taken at San Diego City College.

Other: Formal training and on-the-job instruction in radiography, ultrasonic, magnetic particle, liquid penetrant, helium leak detection, and hydrostatic/pneumatic testing. Also have attended both ASNT and ASQC National Conferences.

EXPERIENCE

A total of eighteen years of quality related experience, including thirteen years in the field of nuclear power and quality assurance.

Senior Quality Engineer - Quality engineering responsibilities include the review and comments on engineering and customer drawings, specifications, and procedures for the manufacture of nuclear components such as: heat exchangers, sodium cold traps, nuclear fuel dissolvers, and fuel transfer casks.

NDE Level III Examiner - Responsible for the organization, planning, technical direction, personnel training and certification, and implementation of the entire NDE effort which includes radiography, ultrasonics, magnetic particle, liquid penetrant, mass spectrometer leak testing, and proof pressure testing on the high temperature gas cooled reactor (HTGR) and related nuclear components.

AWS Certified Weld Inspector - Responsible for development of training courses, technical direction, personnel training, and certification of weld inspectors in accordance with AWS and ASME Codes.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Quality, California
Member, American Society for Nondestructive Testing
Member, American Welding Society
Certified Weld Inspector Certificate No. 80110361

GEORGE W. CHANDLER
Staff Quality Engineer

PROFESSIONAL SPECIALTY

Manufacturing and research and development quality engineering and industrial management.

EDUCATION

B.S., Industrial Engineering, University of Florida, 1952
Graduate, General Electric Manufacturing Training Program, 1957
Graduate courses in: NDE, Statistics, Reliability Engineering, ASME Code and Position Tolerancing

EXPERIENCE

Twenty-seven years of experience in manufacturing and quality assurance.

Staff Quality Engineer - On Research and Development Projects in fuel reprocessing and fusion.

Senior Quality Engineer - For nuclear power plant components such as graphite core and fuel element assemblies, control rod drives and pressure vessels.

Staff Instructor - For consulting course in Quality Assurance Codes and Standards.

Manufacturing Engineer, jet aircraft assembly, Convair Division.
Manufacturing Engineer, atomic weapon components, Sandia Corporation.
Production Foreman, oil circuit breakers, General Electric Company.
Aircraft Maintenance, Captain, United States Air Force.
College Instructor, San Diego Evening College.
Statistical Quality Control and Quality Engineering.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Quality, California, 1975
Registered Professional Engineer, Industrial, 1968
Certified Quality Engineer, American Society for Quality Control, 1976
Certified Reliability Engineer, American Society for Quality Control, 1976
Senior Member ASQC, 1970
Teacher's Credential (Jr. College), California, 1977

CHARLES M. CHARMAN

PROFESSIONAL SPECIALTY

Structural mechanics methods development, finite element techniques, high-temperature creep-fatigue analysis, seismic and dynamic analysis, heat transfer and thermal stress analysis. Also, ASME Section III code analysis and stress reports.

EDUCATION

B.S., Engineering, San Diego State University, 1965

M.S., Civil Engineering, Massachusetts Institute of Technology, 1966

EXPERIENCE

Responsible for developing, verifying and maintaining state-of-the-art analytical techniques in the areas of structural mechanics and structural dynamics; seismic design criteria, HTGR core and core support structure seismic design loads and design review (1979-present).

Assigned to special project to assist in the startup of the Fort St. Vrain nuclear power plant. Performed seismic qualification testing and analysis on safety-related equipment. Performed high-temperature creep fatigue and crack propagation analysis of steam piping subjected to rapid thermal shutdown transients. Investigated the cause of primary closure seal leakage on the helium circulator and determined the structural adequacy of a successful fix. Performed structural analysis of a spent fuel shipping cask including 30' impact onto an unyielding surface. Investigated the cause of temperature fluctuations in the reactor core (1976 - 1979).

Performed three-dimensional structural analysis of gas turbine and gas-cooled fast breeder reactor prestressed concrete pressure vessels. Developed computer program for the analysis of toroidal field coils for the Doublet III fusion device. Analyzed sodium cold traps for the Fast Flux Test Facility program. Supervised development of a three-dimensional nonlinear structural and thermal analysis program and a thick-shell analysis program (1974-1976).

Developed computer program for thermal, elastic, plastic and creep response of two-dimensional and axisymmetric structures (1971 - 1974).

Developed computer programs for the thermal analysis and thermal stress analysis of axisymmetric thin-shell pressure vessels and for the analysis of loads and stresses in helical wound steam generators for the 1100-MW(e) HTGR (1970-1971).

PROFESSIONAL ASSOCIATIONS

Professional Engineers License, Civil Engineering, California, 1970

THOMAS R. COLANDREA
Director
Quality Assurance

PROFESSIONAL SPECIALTY

Analysis/assessment, development/implementation, and management of QA Programs. Trouble-shooting of quality and metallurgical problems.

EDUCATION

B.S., Metallurgical Engineering, University of Missouri, 1959
M.S., Engineering Science, RPI (Hartford Graduate Center), 1965
M.B.A., Management, Western New England College, 1972

EXPERIENCE

Twenty years of engineering and management experience in a series of increasingly responsible positions.

Director, Quality Assurance Division - Responsible for administering, coordinating and directing the QA functions of the company. These include Quality Systems Department, Manufacturing Assurance, Fort St. Vrain QA activities, as well as quality program management on such programs as HTGR Technology and Fusion.

Manager, Quality Systems Department - Responsible for managing nuclear quality systems and quality program management activities. This included quality systems development, QA procedures, QA auditing, corrective action, training, qualification, quality engineering management, source surveillance/inspection, special processes QA (welding, heat treating, nondestructive examination), and quality program management.

Quality Systems Manager, Nuclear and fossil steam systems, Combustion Engineering.

Materials Engineering Supervisor, Nuclear R&D, Combustion Engineering.

Materials Development Group Supvr., Nucl. submarines, Electric Boat.

Metallurgical Engineer, Jet engine materials and quality problems, Pratt & Whitney Aircraft.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Metallurgical, Connecticut, 1967
Certified Quality Engineer, American Society for Quality Control, 1973
Qualified Evaluator of Nuclear Suppliers to CASE Procedure, 1974
Qualified QA auditor to ANSI N45.2.23. 1974
Registered Professional Engineer, Quality Engineering, California, 1975
Certified Reliability Engineer, American Soc. for Quality Control, 1976
Member, ASME Nuclear Quality Assurance Main Committee, ASME Sub-Committee on Personnel, and ASME/ANSI N45.2.23 Work Group on Lead Auditor Qualification

BILLY L. COLEMAN
Project Engineer, QA

PROFESSIONAL SPECIALTY

QA Manual and QA System Development; Auditing; Supplier Control

EDUCATION

B.A., (Economics), San Diego State University, 1964

EXPERIENCE

Eighteen years of quality assurance experience, including six years in the field of nuclear power.

Project Engineer-QA - Responsible for verifying that applicable quality-related requirements for activities in the Special Products Division have been correctly identified and adequately planned in a timely manner, and that the necessary quality has been achieved and documented. Responsibilities include overseeing the activities of the two QA organizations within the Special Products Division, directing the performance of overcheck inspections on nuclear and commercial electronic hardware and software, and development of needed procedures, manufacturing operations, or quality system elements. Results of these verifications, procedure/system development, and pursuit of corrective action are reported to QA Division and Special Products Division management.

Staff Quality Engineer - Coordinated and directed the quality system auditing and supplier control functions for the QA Division. Developed QA manuals for GAC suppliers and customers as part of the QA consulting program.

QA Engineer/Test Data Analyst - Analyzed factory acceptance analog and binary test data to determine acceptability of the Telemetry, Hydraulic and Electrical systems on aerospace missiles.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Quality, California, 1977
Certified Quality Engineer, American Society for Quality Control, 1972

MICHAEL G. DUNLAP
Senior Quality Engineer

PROFESSIONAL SPECIALTY

Application of Quality Engineering Technology

EDUCATION

Master of Arts in Industrial Arts, San Diego State University, 1979
Bachelor of Arts, San Diego State University, 1974 - Major Industrial Arts,
Areas Mechanical Drafting and Metalworking
Associate of Arts, San Diego Mesa College, 1973, Major Biology

EXPERIENCE

Ten years of combined experience in the fields of Nuclear Fuel Manufacturing, Nuclear Material Control, Materials Research and Development (nuclear graphite) and Quality Assurance.

Senior Quality Engineer - Responsibilities include performing internal and external audits of various project and supplier quality systems. In addition, provide surveillance for fabrication and test activities at the Doublet III (Fusion) facility, prepare Receiving Inspection Plans, Source Inspection Plans, and provide technical guidance to Inspection Planning. Also review and approve drawings, test plans and procurement documents.

Quality Engineer - Responsible for coordinating the quality assurance training program. Also responsible for the design and implementation of the operator qualification program at the General Atomic nuclear fuel manufacturing facility.

Staff Research and Development Technician - Responsibilities included performing mechanical tests on different grades of nuclear graphite. The types of tests included straight tensile, straight compression, fatigue, stress-strain and four point bend. The testing involved writing test plans, machining test specimens, set-up and calibration of the equipment, logging of the test results, and reporting the results.

Staff Instructor - Quality Assurance training programs.

PROFESSIONAL ASSOCIATIONS

Member American Society for Quality Control
Certified Quality Engineer, American Society for Quality Control
Certified Lead Auditor to ANSI N45.2.23
Member Epsilon Pi Tau, Beta Alpha Chapter, San Diego State University
Community College Teaching Credential (California 1979)

JOHN M. KRASE
Senior Technical Advisor

PROFESSIONAL SPECIALTY

Design, development and licensing of nuclear power plants. Program and project management. Technical and economic evaluations and decisions.

EDUCATION

B.S., Mechanical Engineering, Princeton University, 1943.
Post graduate courses in Nuclear Engineering, University of Cincinnati.

EXPERIENCE

Directed task force including German industrial participants which investigated alternate design features including natural convection cooling to improve safety and maintainability of nuclear reactor plants.

Completed technical and economic evaluations of advanced fossil generation systems including coal fired MHD and advanced gas turbines. Interfaced with and negotiated with government and consultants in their evaluations of nuclear power concepts.

Managed an advanced reactor program responsible for negotiations with and satisfying government and utility sponsors, direction of major subcontracts to General Electric and United Technology Corporation, coordination of test facility planning with NASA, and coordination of international cooperative programs involving industries and national laboratories in Germany, Switzerland, France and the United States.

Developed outside sponsorship of an advanced reactor program through proposals, presentations, and performance on contracts to achieve gross revenue totaling about \$15 million over six-year period.

Led program to develop economical and licensable design of advanced reactor. Preapplication licensing program included preparation of Preliminary Safety Information Document (PSID) covering essentially same scope and format as a PSAR which was submitted to and partially reviewed by NRC.

Managed reactor component engineering including responsibility for engineering, development and licensing of circulators, fuel handling equipment, control rod drives and steam generators built and operating in Fort St. Vrain plant.

Managed organizations responsible for design and development of prestressed concrete reactor vessels (PCRVS): reactor internals design including core support systems and insulation for Fort St. Vrain plant.

Managed reactor nuclear analysis, reactor physics and gas turbine design and development at General Electric Company.

J. M. Krase
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EXPERIENCE (Continued)

Design, analysis and testing of steam turbines and gas turbines at Allis-Chalmers Manufacturing Company.

PROFESSIONAL ASSOCIATIONS

Registered Professional Nuclear Engineering, California, 1976.
Member, American Nuclear Society.

TEH H. LEE
Senior Staff Engineer

PROFESSIONAL SPECIALTY

Dynamic analysis of linear and nonlinear structural systems. Stress analysis of structures due to static and dynamic loading. Research in soil-structure interaction and thermal-flow-dynamics interaction.

EDUCATION

B.S., Mechanical Engineering, Oregon State University, 1961
M.S., Mechanical Engineering, University of California at Berkeley, 1964
Ph.D., Applied Mechanics, University of California at Berkely, 1969

EXPERIENCE

Conducted research in soil-structure interaction study for seismic analysis. Engaged in methods development in thermal-flow-structure interaction of nonlinear structures consisting of stacked prismatic elements. Developed computer programs for studying the three-dimensional seismic response of structures on linear and nonlinear soil media.

Developed computer programs for determining the dynamic loads on nuclear reactor core structures due to earthquake disturbances. Analyzed the dynamic response of structures consisting of thick grid plates supporting many slender rods. Also studied the ultimate strength of reactor core structures under accident conditions via dynamic elasto-plastic analysis considering the coupling between equations of motion and equations of state.

Served as visiting professor for National Taiwan University teaching graduate courses in earthquake engineering and nonlinear vibrations. Served as industry consultant to Sinotech Engineering Consultants and Taiwan Power Company, Taipei, Taiwan and part-time lecturer at San Diego State University, San Diego, California.

Conducted dynamic load study on aircraft structures considering interaction between elastic structures and rotating machinery. Studied vibration and shimmy phenomena of aircraft and landing gear structures. Performed stress analysis for structures of commercial airplanes and space vehicles.

PROFESSIONAL ASSOCIATIONS

Member, ASME and AIAA

ADDITIONAL INFORMATION

Invited reviewer for Shock and Vibration Digest
Invited reviewer for seminars held at Asian Institute of Technology, Bangkok, Thailand and at universities in Republic of China, Taiwan
Reviewer for National Science Foundation

FREDERICK T. LIN
Senior Engineer

PROFESSIONAL SPECIALTY

Structural design and analysis, piping analysis, seismic analysis of nuclear power plants, structural design.

EDUCATION

B.S., Agriculture Engineering, national Taiwan University, 1955.

B.S., Civil Engineering, University of Missouri, 1959.

M.S., Structural Engineering, Purdue University, 1961.

EXPERIENCE

Performed stress analysis of Class 1 piping safety injection lines for San Onofre Nuclear Generating Station and Palo Verde Nuclear Generation Station.

Performed seismic analysis and prepared a Design Report of underground prestressing concrete pipes for nuclear service cooling water system, Korea Nuclear Units 5 & 6.

Author of design reports (equivalent to FDAR & FSAR) on structural design of containment building and fuel building, Korea Nuclear Units 5 & 6.

Performed structural analysis of nuclear core support structures using three dimensional finite element analysis code.

Acted as structural project engineer for Japan EPDC nuclear project study.

Designed nuclear power plant structures and facilities.

Designed commercial and residential buildings.

Directed and supervised the construction of material handling storage rack structures.

Designed industrial plant and highway bridges.

F. T. Lin
Page 2

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Civil, California, 1968.
Registered Professional Engineer, Structural, Illinois, 1965.
Registered Professional Engineer, Civil, Illinois, 1964.
Member, American Society of Civil Engineers.

ADDITIONAL INFORMATION

Speak and write fluent Japanese and Chinese. Understand Spanish for daily conversational use.

FRED H. LOFFTUS
Senior Quality Engineer

PROFESSIONAL SPECIALTY

Quality Assurance Engineer for Nuclear Reactor Site Work, Nuclear Fuel Fabrication, and Research & Development in nuclear fuels.

EDUCATION

B.S., Mining Engineering (Metallurgy option), Texas Western, El Paso, Texas, 1956
Quality Engineering Courses, Mesa College, San Diego, California

EXPERIENCE

Twenty-five years of engineering experience, including eleven years in the field of nuclear quality assurance.

Senior Quality Engineer - Lead Auditor and Senior Quality Engineer as associated with the Segment 8 and 9 fuel. Responsible areas are Quality Engineer with regard to (a) Calibration; (b) Process Control; (c) Procedural update; (d) Nonconformance Reports preparation and file; (e) Independent review of fuel rod lot packages and raw material releases.

Staff Associate - Research and development in nuclear and nuclear ceramic fuels.

Staff Associate - Defense system and development program involving shielding research for re-entry vehicle systems.

Quality Assurance Engineer - Engineering Quality Assurance associated with the fabrication of the Fort St. Vrain nuclear fuel elements.

Senior Quality Assurance Engineer - Site Quality Assurance and audits during construction of the Fort St. Vrain nuclear generating station at Platteville, Colorado.

PROFESSIONAL ASSOCIATIONS

Member, American Society for Quality Control
Certified Quality Engineer, American Society for Quality Control
Registered Professional Engineer, Quality, California
Certified Lead Auditor per ANSI N45.2.23
CASE Auditor

A. A. SCHWARTZ
STAFF ENGINEER

PROFESSIONAL SPECIALTY

Design and analysis of pressure vessels and piping.

EDUCATION

B. of Architecture, University of Illinois.

M.S., Civil Engineering, Massachusetts Institute of Technology.

MBA, University of Santa Clara.

EXPERIENCE

Prepared conceptual designs of piping systems and their supports. Performed detailed ASME Code analysis of nuclear piping systems and established support loads using the computer program NUPIPE. Determined pipe rupture locations per NRC criteria and necessity of pipe restraints. Evaluated piping system design criteria for adequacy and licensability.

Responsible engineer for filter related modifications to Rancho Seco power plant. This effort was oriented toward reducing radiation exposure to plant personnel in six filter areas of the plant auxiliary building. It included design and analysis of new filter piping, vessel supports, shield structures and filter cartridge handling systems.

Responsible engineer for design of liners, penetrations, closures, and cooling water systems in concrete pressure vessels. Supervised a group of 5 engineers and 5 designers who executed the designs of ASME Class 1, 2, and 3 vessel components. Coordinated engineering/fabrication/construction problem solutions, activities, and schedules. Generated safety analysis reports and supported licensing activities. Major vessel component cost reductions were achieved as a result of these efforts.

Developed designs for high temperature pressure vessels housing large heat exchangers. Specified the extent of vessel insulation for the larger diameter shell sections, and the requirements for application of the insulation. Designed the smaller diameter shell sections to high temperature code case rules.

Lead engineer for development and qualification testing of a circumferential prestressing system for large concrete pressure vessels. Designed anchor elements and concrete embedments, and coordinated this activity with material suppliers and equipment designers to ensure that prestressing forces could be economically and safely applied, anchored, monitored, and recorded.

Performed stress and seismic analysis of pressure vessel shells, nozzles, heads, external supports, and internal equipment supports.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer
American Society of Civil Engineers

RU-TSUNG SUN
Senior Engineer

PROFESSIONAL SPECIALTY

Very familiar with finite element stress analysis on mechanical and thermal loading. Familiar with ASME Boiler and Pressure Vessel Code, Section III. Familiar with piping analysis.

EDUCATION

B.S., Civil Engineering, National Cheng Kung University, Taiwan, 1963.
M.S., Civil Engineering, Wayne State University, 1966.
M.S., Engineering Mechanics, University of Michigan, 1969.
Ph.D., Civil Engineering, University of Michigan, 1974.

EXPERIENCE

Five years of experience in design and analysis of prestressed concrete reactor vessels. Work involved in the following areas: Design and analysis of PCRV in compliance with ASME Code, Section III, Division 2; perform 2-D and 3-D finite element stress analysis under various environmental conditions; perform 2-D and 3-D thermal and thermal stress analyses; 2-D axisymmetric crack analysis for PCRV; PCRV ultimate load analysis; correlations between analytical creep results and measured sensor data for Fort St. Vrain PCRV structural response; develop a new concrete creep model by using Maxwell and Kelvin elements in series, use non-linear curve fitting to determine the material variables from the test data, computer material subroutine for three dimensional finite element analysis was developed and verified, test data was used again to validate the theoretical development; PCRV model design and analysis.

PROFESSIONAL ASSOCIATIONS/HONORS

Chi Epsilon, University of Michigan
Member of American Concrete Institute
Registered Professional Civil Engineer, California

R. W. THOMPSON
Staff Engineer

PROFESSIONAL SPECIALTY

Structural dynamic analysis, systems simulations, structural loads.

EDUCATION

B.S., Aeronautical Engineering, University of Alabama, 1959.

M.S., Operations Research, California Western University, 1965.

Graduate, U.S. Army Ranger School, 1955.

Graduate, U.S. Army Field Artillery Officer Candidate School, 1954.

EXPERIENCE

Performed seismic qualification review on mechanical and electrical equipment for nuclear power plants.

Responsible for analytical development of methods and computer programs for seismic analysis of nuclear reactor core. Responsible for seismic test programs used for correlation of analytical methods. Finite element model development for soil structure nuclear plant siting. Performed elastic plastic and creep analyses.

Developed methods and computer programs in areas of structural dynamics, structural loads, simulation, aerodynamics, performance, and various other dynamic disciplines as a group leader for an advanced design group.

Lead engineer on various Atlas missile systems.

Structural loads engineering on B-70 aircraft.

PROFESSIONAL ASSOCIATIONS

Registered Professional Engineer, Mechanical, California. 1975.

DANNY TOW
Staff Engineer

PROFESSIONAL SPECIALTY

Research and development; structural and seismic analysis and design of nuclear and conventional structures, systems and components.

EDUCATION

B.S., Civil Engineering, University of California, Berkeley, 1961
M.S., Structural Engineering and Structural Mechanics, University of California, Berkeley, 1963
Certificate, Advanced Study on Computer Methods in Structural Dynamics, University of Southern California, 1969

EXPERIENCE

Industrial experience in stress and dynamic analysis and design on nuclear power plant structures, systems and components, nuclear rocket and reactor systems, and facility engineering.

Conducted structural and seismic analysis on nuclear steam supply systems (NSS) structures and components; developed plant seismic design criteria for various plant projects; performed R&D tasks in the field of structural method and computer programming development.

Performed in nuclear rocket and reactor systems, spacecraft, missile, pressure vessels, reinforced concrete and rigid-frame steel and aluminum structures, and facility engineering in the field of stress, dynamic and seismic analysis, and structural design.

PROFESSIONAL ASSOCIATION

Registered Professional Engineer, Civil, California, 1966
Past Committee Member, ASME Section III Special Working Group on Dynamic Analysis (SWG-DA)

ADDITIONAL INFORMATION

Chi Epsilon Fraternity (National Civil Engineering Honor Society), Lifetime Member
Performance Award, Aerojet General Corporation, 1966

RICHARD G. WUNDERLICH
Department Manager

PROFESSIONAL SPECIALTY

Engineering management, planning, task scheduling, establishing goals and evaluating performance.

EDUCATION

B.S., Mechanical Engineering, Marquette University

EXPERIENCE

Manager of the Mechanical and Electrical Engineering Department. The department consists of the following branches: Mechanisms Design, Rotating Machinery, Control and Electrical Engineering, Auxiliary Process Systems Design and Experimental Engineering. (3/79 to present).

Manager of the Fort St. Vrain Design Engineering Department. Responsible for all plant related engineering involved in supporting the start-up and rise-to-power of the Fort St. Vrain Nuclear Generating Station. (1/76 - 3/79).

Manager of the Systems Engineering Department. Department consisted of the following branches: Auxiliary Process System Design, Control and Electrical Engineering, Plant Computers, and Thermal and Fluid Mechanics. (11/72 - 12/75).

Director of the Quality Assurance Division. (10/71 - 10/72)

Site Manager, Quality Assurance, Fort St. Vrain Nuclear Generating Station. (12/70 - 9/71).

Various engineering positions involved in the design of Prestressed Concrete Reactor Vessel liners, penetrations and internal structures. (6/64 - 11/70).

Various engineering positions involved with the design and fabrication of pressure vessels and heat exchangers for the oil, chemical and nuclear industries.

PROFESSIONAL ASSOCIATIONS/HONORS

Registered Professional Engineer, Wisconsin, California, Mechanical
California, Nuclear

Member: ASME, ANS, NSPE, CSPE, American Management Association

ATTACHMENT I

SCE General Terms and Conditions

II TMC
11/28/79

DOCUMENTATION (con't)

- Quality Assurance Plan
- Procedures for Classifying and Specifying Safety-Related Spare and Replacement Part
- Special Parts Requirements developed as a result of this project
- Work Schedule
- Monthly Status Reports Including Progress Chart
- Final Report

TERMS AND CONDITIONS

Terms and conditions identified as II TMC dated November 28, 1979, with Supplemental Nuclear Provisions for San Onofre Units 1, 2 and 3, coded SO1, 2 & 3 Nuc-Sup 8/25/80 and attached to this Purchase Order shall apply with the following exceptions to II TMC:

Under Section 5, COMMERCIAL TERMS, revise Section 5.2 to read:

"Invoices shall be subject to approval by the Edison Representative and shall be paid within thirty days after approval of the invoice."

Under Section 7, CONTROL OF THE WORK, revise 7.2 to read:

- 7.2 Edison Representative shall have the right to accept or reject the Work and the Results of the Work in regards to Purchase Order compliance. For a period of one year following completion of the Work, Contractor shall correct any defective Work or Results of the Work at its sole expense.

Under Section 7, CONTROL OF THE WORK, delete 7.3 and replace with the following:

- 7.3 Upon completion or termination of the Work, Contractor shall deliver all Documentation to Edison. Edison's data shall not be used by TPT for other activities without the prior written consent of Edison. Edison recognizes that the TPT computer programs, as delivered to Edison, are TPT property and shall not be resold or transmitted to other companies by Edison without the expressed permission of TPT. TPT reserves the right to use these computer programs with other clients.

Under Section 8, REPORTS, revise Section 8.3 to read:

"Draft copy of final report shall be submitted for review for contractual compliance, comments and approval prior to due date of final report."

SOUTHERN CALIFORNIA EDISON COMPANY
Rosemead, California

GENERAL TERMS AND CONDITIONS

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1.12 Work: The performance of the obligations of Contractor pursuant to the Purchase Order.

1.13 Work Assignment: A letter issued by Edison Representative to Contractor to modify the Statement of Work, and to control the Work.

2. SCHEDULE: Completion of the Work by the Work completion date is essential to maintain Edison schedules. If performance of the Work falls behind the schedule, Contractor shall accelerate its performance of the Work until performance of the Work is commensurate with such schedule.

3. SITE INVESTIGATIONS: Contractor shall have satisfied itself as to the nature and location of the Work, the general and local conditions, the environmental and physical conditions, and requirements, the character of any furnished or necessary equipment, facilities, safety and security precautions, and all matters which may affect the timely performance of the Work and its cost.

4. PERMITS, STATUTES AND CODES: Contractor shall comply with the applicable requirements of all statutes, acts, ordinances, regulations, codes and standards of legally constituted authorities having jurisdiction as of the date of the Purchase Order as applicable to the Work.

5. COMMERCIAL TERMS

5.1 Contractor shall sign the "Acceptance Copy" of the Purchase Order and return it to Edison prior to the start of the Work. No payment shall be made until Edison has received such "Acceptance Copy."

5.2 Invoices shall be subject to approval by the Edison Representative and shall be paid within thirty days after both the receipt of the invoice and the completion of the Work.

5.3 Payment

Payment shall be made in accordance with the Purchase Order and the applicable paragraph below.

5.3.1 Labor: The labor portion of the Work shall be paid at the hourly rates set forth in the Purchase Order. Such rates shall include all related costs, including but not limited to, bare payroll costs, payroll additions, overhead costs, profit, and small tools and personal supplies.

5.3.2 Travel and Subsistence Costs: Reasonable travel and subsistence costs incurred by Contractor in performance of the Work shall be paid by Edison without any profit or overhead allowance. Travel other than local travel

1 shall have prior approval of Edison Representative
2 unless identified specifically in the Statement of
3 Work.

4 5.3.3 Material: Material costs and subcontract costs shall
5 be paid by Edison on the basis of Supplier invoiced
6 costs to Contractor (including freight charges and all
7 applicable taxes) plus a percent of such costs as set
8 forth in the Purchase Order for all applicable overhead
9 and handling costs. No profit shall be paid by Edison
10 for Material costs.

11 5.3.4 Other Charges: Edison shall pay only those other
12 charges which are set forth at specific rates in the
13 Purchase Order.

14 5.3.5 Invoices: Contractor shall submit invoices monthly
15 which include an itemization of (i) labor hours by
16 type, the applicable rate and total dollar amount,
17 (ii) Material costs plus handling costs, (iii) travel
18 and subsistence costs, (iv) computer charges and
19 other costs separately identified, for each task in
20 the Statement of Work. Invoices shall be subject to
21 approval by the Edison Representative and shall be
22 paid within thirty days after receipt. Edison reserves
23 the right to audit the accounts of Contractor related
24 to such invoiced charges.

25 6. CHANGES

26 6.1 Edison may at any time or from time to time make changes
27 to the Work or add, delete, change or suspend any portion
28 or all of the Work and its schedule by issuing a Change
Order.

6.2 If such changes result in a change in the price of the Work
Contractor shall promptly notify Edison of such and Edison
and Contractor shall negotiate an equitable adjustment in
the price due to such change. Contractor shall not imple-
ment such change nor invoice Edison for such price adjust-
ment prior to issuance of a Change Order.

6.3 Changes to the terms and conditions of the Purchase Order
shall be made by mutual agreement of the parties and shall
be set forth in a Change Order.

6.4 Contractor's implementation of a Change Order shall imply
acceptance of all of the provisions contained therein unless
Contractor notifies Edison within fifteen calendar days
after receipt of Change Order, of Contractor's specific
objections to such provisions. The objections shall be
resolved between Edison and Contractor and a revised Change
Order shall be issued.

1 7. CONTROL OF THE WORK

- 2 7.1 Contractor shall promptly notify Edison Representative of
3 the intended reassignment of key personnel associated with
4 the Work.
- 5 7.2 Edison Representative shall have the right to accept or
6 reject the Work and the Results of the Work in regards to
7 Purchase Order compliance and appropriate professional
8 standards. For a period of one year following completion
9 of the Work, Contractor shall correct any defective Work
10 or Results of the Work at its sole expense.
- 11 7.3 Upon completion or termination of the Work, Contractor shall
12 deliver all Documentation to Edison. Contractor may keep
13 copies only for its internal accounting and record keeping
14 purposes and may not use such copies or the contents there-
15 of in any other way without the prior written approval by
16 Edison.
- 17 7.4 Edison Representative shall have the right of access to
18 Contractor's facilities and/or locations at reasonable time
19 during regular business hours relating to the Work during
20 and after the Work.
- 21 7.5 Use of overtime to be charged to Edison shall have prior
22 approval by Edison Representative.
- 23 7.6 All subcontracts shall be submitted to Edison Representa-
24 tive for approval prior to their issuance.

25 8. REPORTS

- 26 8.1 Contractor shall provide monthly status reports to Edison
27 Representative and additional reports as set forth in the
28 Statement of Work.
- 8.2 Such status reports shall identify by tasks the labor hours
expended and total dollars charged as follows: (i) expended
for current month, (ii) accumulated to date, (iii) budgeted
to date, (iv) forecast at completion, (v) percent complete,
and (vi) reasons for variances.
- 8.3 Draft copy of final report shall be submitted for review
for contractual compliance, satisfaction of Edison needs
and good professional practices, comments, and approval
prior to due date of final report.

9. INSURANCE: With respect to liabilities arising out of perform-
ance of the Work on Edison Property or the property of a third
party, Contractor shall maintain, and shall require that each
Subcontractor maintain, insurance as described below. Contrac-
tor shall furnish certificates of insurance to Edison prior to
performance of the Work. Such certificates shall provide that

1 such insurance shall not be terminated nor expire except after
2 thirty days prior written notice to Edison.

3 9.1 Workers' Compensation Insurance with statutory limits, as
4 required by the state in which the Work is to be performed,
5 and Employer's Liability Insurance with limits of not less
6 than \$500,000.

7 a. For Work performed in the State of Nevada, Contractor
8 shall maintain Workers' Compensation Insurance with
9 the Nevada Industrial Commission.

10 b. Contractor shall require its carriers furnishing such
11 insurance to waive all rights of subrogation against
12 Edison, its officers, agents, and employees.

13 9.2 Comprehensive Bodily Injury and Property Damage Liability
14 Insurance including owner's and contractor's protective
15 liability, product/completed operations liability, contrac-
16 tual liability and automobile liability with a combined
17 single limit of not less than \$500,000 each occurrence.
18 Such comprehensive insurance shall (i) name Edison as an
19 additional insured, but only for Contractor's acts or
20 omissions, (ii) be primary for all purposes, and (iii)
21 contain standard cross-liability provisions. Any deduct-
22 ible shall be at Contractor's expense.

23 9.3 Contractor shall report immediately to Edison and confirm
24 in writing any losses or damages incurred by Contractor or
25 any of its Subcontractors, or its receipt or notice of any
26 claim by a third party, or of any occurrence that might
27 reasonably be expected to give rise to such claim in con-
28 nection with or arising out of the Work.

9.4 If Contractor fails to comply with all the insurance provi-
sions of this Section 9 or causes such insurance to become
uncollectible, Contractor shall indemnify and hold harmless
Edison and its officers, agents, employees, assigns, and
successors in interest from and against any and all liabil-
ity, damages, costs including attorney's fees and expenses,
losses, or any of them, resulting from the death or injury
to any person or damage to any property of Edison, to the
extent caused by Contractor's non-compliance with this
Section 9 or caused by the uncollectibility of such
insurance.

10. SUBCONTRACTORS: Contractor shall at all times be responsible
for the acts and omissions of Subcontractors and persons
directly or indirectly employed by them. Nothing in the Pur-
chase Order shall create any contractual relationship between
a Subcontractor and Edison or any obligation on the part of
Edison to pay or to be responsible for the payment of, any
sums to any Subcontractor.

1 11. TITLE AND RISK OF LOSS

2 11.1 With respect to all Material, field or research equipment,
3 and laboratory models procured or fabricated under this
4 Purchase Order, title shall pass to Edison when procured
or fabricated and such title shall be free and clear of
any and all encumbrances whatsoever.

5 11.2 Edison shall have title to project related data and Docu-
6 mentation and Results of the Work when they are developed.
Contractor shall have use of such data, Documentation and
7 Results of the Work pursuant to the Purchase Order.

8 11.3 Contractor shall have risk of loss on any Material or
Edison owned equipment of which it has custody.

9 11.4 Contractor shall dispose of items to which Edison has
10 title as directed in writing by Edison Representative.

11 12. INFRINGEMENT

12 12.1 If any action or proceeding brought against Edison is
13 based on a claim of infringement arising out of Edison's
14 use of the Work and, if Edison promptly notifies Contractor
15 in writing of any such action or proceeding, Contractor
16 shall, at its own expense, do the following to assure con-
17 tinued use of the allegedly infringing Work: (i) defend
18 such action or proceeding and pay all damages, costs,
19 losses, claims, awards, settlements, attorney's fees and
20 expenses, or any of them, arising out of such action or
proceeding, (ii) procure for Edison the right to continue
to use the Work affected by such action or proceeding, or
replace or modify, with Edison's approval, any Work deter-
mined to be infringing so that the infringement is removed
(iii) if in such action or proceeding a temporary restrain-
ing order or preliminary injunction be granted, Contractor
shall, by giving satisfactory bond, or otherwise, secure
the suspension of such restraining order or preliminary
injunction against Edison's use of the Work.

21 12.2 To the extent that the Work is (i) supplied according to
22 Edison's special design or specific instructions wherein
23 compliance therewith has caused Contractor to deviate from
24 its normal course of performance, or (ii) modified by
25 Edison after delivery, or (iii) combined by Edison with
26 other equipment or discrete parts (except to the extent
27 that Contractor is a contributory infringer or that Edison
follows the written direction of Contractor) and by reason
of Edison's said design, instruction, modification, or
combination, an infringement action or proceeding is
brought against Edison, Edison agrees to release Contracto
from liability under Section 12.1.

28 12.3 Edison shall cooperate with Contractor in any defense of
the actions and proceedings referred to in Section 12.1.

1 12.4 Contractor shall give Edison prompt written notice of any
2 potential infringement problems.

3 12.5 Any delays caused by infringement actions in which Contract-
4 tor is found liable shall not be considered to be delays
5 caused by uncontrollable forces.

6 12.6 The foregoing states the entire liability of Contractor
7 with respect to infringement.

8 13. SUSPENSION

9 13.1 The Edison Representative may at any time and from time
10 to time direct Contractor to suspend performance of all
11 or any part of the Work by issuance of a Work Assignment
12 or Change Order. A suspension does not include normal
13 rescheduling or rephasing portions of the Work.

14 13.2 An equitable adjustment in the expenditure limitation and
15 Work completion schedule shall be made if required by such
16 suspension.

17 14. TERMINATION

18 14.1 Edison may at any time terminate the Purchase Order.

19 14.2 Any charges resulting from such termination shall be
20 equitably negotiated by the parties or shall be per a
21 schedule of termination charges as set forth in the Pur-
22 chase Order. The provisions of this Section 14 shall be
23 Contractor's sole remedy resulting from such termination.

24 15. CONSEQUENTIAL DAMAGES

25 15.1 Except as otherwise provided herein, Contractor shall not
26 be liable to Edison for any consequential damages includin-
27 but not limited to, loss of use of or under-utilization of
28 Edison's facilities, loss of revenue, cost of replacement
power, and claims of any customer of Edison arising out
of Edison providing electric service to such customer,
resulting from Contractor's performance or nonperformance
of its obligations under the Purchase Order.

15.2 Edison shall not be liable to Contractor for any consequen-
tial damages including, but not limited to loss of antici-
pated profits, and loss of use of or under-utilization of
labor or facilities, resulting from Edison's performance
or nonperformance of its obligations under the Purchase
Order or in the event of suspension of the Work, or ter-
mination of the Purchase Order.

16. INDEMNITY

Contractor shall, at its own cost, defend, indemnify, and hol

1 harmless Edison, its officers, employees, agents, assigns and
2 successors in interest from and against any and all liability
3 damages, losses, claims, demands, actions, causes of action,
4 costs including attorney's fees and expenses, or any of them,
5 resulting from the death or injury to any person or damage to
6 any property, including Edison Property and Edison personnel,
7 to the extent caused by the negligence of Contractor, Contrac-
8 tor's officers, employees, agents, Subcontractors, Subcontrac-
9 tors' employees, or any of them, arising out of the performan-
10 or nonperformance of Contractor's obligations pursuant to the
11 Purchase Order.

12 17. UNCONTROLLABLE FORCES: Contractor shall not be liable for a
13 delay in the Work completion date or for inability to perform
14 the Work due to any causes beyond its reasonable control such
15 as flood, fire, lightning, epidemic, quarantine restriction,
16 war, sabotage, act of a public enemy, earthquake, insurrec-
17 tion, riot, civil disturbance, strike, material availability,
18 work stoppage caused by jurisdictional and similar disputes,
19 restraint by court order or public authority and action or
20 nonaction by or inability to obtain authorization or approval
21 from any governmental agency or authority, which by the exer-
22 cise of due diligence and foresight Contractor could not
23 reasonably have been expected to avoid and which by exercise
24 of due diligence it is unable to overcome.

25 18. LIENS: If a lien of any nature shall at any time be filed
26 against the Work or Results of the Work or Edison Property,
27 or all of them, by any person or entity which has supplied
28 Material or services at the request of Contractor or Subcon-
tractor, Contractor shall promptly, on demand by Edison and
at Contractor's own expense, take any and all action necessary
to cause any such lien to be released or discharged therefrom

19. COPYRIGHTS

19.1 Contractor agrees that it shall not include any copyrighted
material in any written or copyrightable documentation
furnished or delivered under the Purchase Order, without
a license as provided for in Section 19.2 below or with-
out the consent of the copyright owner, or potential copy-
right owner, unless the prior written approval of Edison
consenting to the inclusion of such copyrighted material
is secured.

19.2 If any such copyrighted material is included, Contractor
agrees to secure for Edison a license for Edison's use
of any and all copyrighted or copyrightable material not
first produced or composed by Contractor in the performance
of the Purchase Order but which is incorporated in the
documentation furnished under the Purchase Order, provided
that such license shall be only to the extent Contractor
now has, or prior to completion or final settlement of
the Purchase Order, may acquire the right to grant such

1 license without becoming liable to pay compensation to
2 others solely because of such grant.

3 19.3 If any copyrightable material is furnished or delivered
4 under this Purchase Order, Contractor agrees to and does
5 hereby grant to Edison a royalty-free, non-exclusive, irre-
6 vocable license to reproduce, translate, publish, use and
7 dispose of, and to authorize others to do so, all copyright
8 able documentation or any part thereof first produced or
9 composed under the Purchase Order by Contractor, its employ-
10 ees or any individual or concern specifically employed or
11 assigned to originate and prepare the documentation.

12 20. NONDISCLOSURE BY CONTRACTOR

13 20.1 Contractor recognizes that Edison has developed or is
14 developing various techniques, procedures, data, studies,
15 machines, drawings, documents, tabulations, processes,
16 formulas, patterns, and devices relating to the Work which
17 Edison owns or shall own and which are in themselves pro-
18 prietary and confidential information which give Edison
19 a competitive advantage over other persons, firms, corpor-
20 ations and organizations engaged in activities relating
21 to those of Edison.

22 20.2 Contractor shall make reasonable efforts to keep in confi-
23 dence and not to disclose to any third party nor use for
24 the benefit of any party other than Edison the confidential
25 and proprietary information of Edison which is or has been
26 disclosed to Contractor in a drawing or other document
27 which has been designated by Edison to be confidential or
28 proprietary. Such information shall be examined by and
disclosed to only such persons as may require such infor-
mation in the course of their duties, and Contractor shall
obtain from such persons written undertakings not to engage
in any unauthorized copying, examination or disclosure,
and Contractor shall treat such information upon such con-
fidential basis.

20.3 Contractor agrees that all matters contained in the pro-
prietary and confidential information disclosed by Edison
include the trade secrets of Edison and information sensi-
tive to Edison and shall be so treated unless shown by
Contractor through tangible proof that:

20.3.1 Such information was in the public domain prior to
Contractor's receipt of the same hereunder or has
subsequently become part of the public domain by
publication or otherwise, except by Contractor's
wrongful act.

20.3.2 Such information was in Contractor's possession prior
to its receipt of the same hereunder and was not
acquired directly or indirectly from Edison.

1 20.3.3 Such information was received by Contractor from a
2 third party which Contractor reasonably believes has
no obligation of secrecy with respect thereto.

3 20.4 Contractor's obligations as to confidence and non-use shall
4 terminate at the expiration of five years from the comple-
5 tion of the Work unless Edison gives its written consent
to reduce the period.

6 21. NONPUBLICATION

7 21.1 Contractor shall not publish any information from or about
the Work without prior written consent of Edison. Such
8 consent will not be withheld unreasonably.

9 21.2 Publication shall include but not be limited to disclosure
10 made in technical papers, articles, speeches, news
releases, advertising, and any and all other forms of
publicity or disclosure.

11 22. ASSIGNMENT

12 22.1 Neither the Purchase Order nor any interest in it shall
13 be assigned without the prior written consent of Edison.

14 22.2 The Purchase Order shall not be deemed an asset of Con-
15 tractor. If Contractor enters into any voluntary or
16 involuntary receivership, bankruptcy, or insolvency pro-
ceedings, the Purchase Order may be cancelled at Edison's
option upon written notice to Contractor.

17 23. NOTICES: Any notice pertaining to the Purchase Order shall
18 be in writing and sent registered or certified mail; postage
prepaid to Edison or to Contractor as appropriate at their
respective addresses as shown in the Purchase Order.

19 24. GOVERNING LAW: The Purchase Order shall be interpreted, gov-
20 erned and construed under the laws of the State of California
as if executed and to be performed wholly within the State of
21 California.

22 25. NON-WAIVER: The failure of Edison to enforce any of the
23 terms and conditions, or to exercise any right or privilege
in the Purchase Order, shall not be construed as thereafter
24 waiving any such terms and conditions or right or privilege
and the same shall continue and remain in force and effect
25 as if no such failure to enforce or exercise had occurred.
No waiver by Edison shall be valid unless the waiver was
made by a Change Order.

26 26. EMPLOYMENT PRACTICES: Provisions pertaining to employment
27 practices are preprinted on the back of the Purchase
28 Order.

1 27. DISPUTES: Any dispute that cannot be resolved between Con-
2 tractor and Edison Representative shall be referred to
3 Edison's Manager of Material Services and Contractor's repre-
4 sentative for resolution. If the Manager of Material Service:
and Contractor's representative cannot reach an agreement
within a reasonable period of time, Contractor and Edison
may pursue any other remedies available to them.

5 28. ENTIRE AGREEMENT

6 28.1 The Purchase Order and documents referenced therein con-
7 stitute the sole only and entire agreement and understand-
8 ing between Edison and Contractor as to the subject matter
9 of the Purchase Order. Prior agreements, commitments or
representations, express or implied, and discussions be-
tween Edison and Contractor shall not be construed to be
a part of the Purchase Order unless contained herein.

10 28.2 Any agreement between employees of the parties which is
11 not incorporated into the Purchase Order by a Change Order
12 shall not be a contractual provision of the Purchase Order

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PURCHASE ORDER

Southern California Edison Company



ORDER DATE DEC 23 81	ORDER NUMBER S4100185
SUPPLIER CODE 79190	COM/SERV. CODE 016000
REQN. NO. 1277K	ACCT. LOC. NUMBER 1812

SHIP TO: **See Below**

DEBITOR OF THE ORDER

Edison's order number as shown above **MUST** be indicated on all invoices, packages, correspondence, shipping papers and inquiries.

MARK FOR: Mail one copy of all shipping papers to destination shown above.

If in any way unable to comply with the requirements of this order, notify the Buyer in writing immediately.

**Torrey Pines Technology
Div. of General Atomics
P.O. Box 81608
San Diego, CA 92138**

MAIL INVOICES IN DUPLICATE TO: **See Below**

~~XXXXXXXXXXXXXXXXXXXX~~
~~XXXXXXXXXXXX~~
~~XXXXXXXXXXXX~~

BUYER W. R. CARLS (213) 572-1316	TELEPHONE NUMBER	F.O.B.
VIA	APPLICABLE TERMS/COND.—DATE See Below	TERMS OF PAYMENT See Below
REQUIRED AT EDISON LOCATION BY	CONFIRMED WITH AND DATE	

rh1261c

QUALITY CLAES NON-SAFETY RELATED

GENERAL DESCRIPTION

Perform an independent verification of San Onofre Nuclear Generating Station Units 2 and 3 seismic design and effectiveness of Quality Assurance Program.

**JOB LOCATION: San Onofre Nuclear Generating Station
4 Miles South of San Clemente, California 92672**

TERMS AND CONDITIONS

Work shall be performed on a Time and Material basis in accordance with the Terms and Conditions coded II-1MC, dated November 28, 1979, with Supplemental Nuclear Provisions for San Onofre, Units 1, 2 and 3 dated August 25, 1980, as modified by those exceptions which are defined in the Purchase Order section entitled "Deviations."

TOTAL COST OF ORDER

Total cumulative charges to be billed against this Purchase Order are not to exceed \$1,500,000.00 without authorization by a Change Order.

SCHEDULING INSTRUCTIONS

Work shall be performed under the general direction of Mr. David J. Fogarty, or his designated representative.

**ACCEPTANCE
COPY**

Southern California Edison Company

By W.R. Carls
FOR THE MANAGER OF MATERIAL SERVICES
Accepted by George R. Wessman
Date Dec 26, 1981

Please signify your acceptance and return this copy promptly

INVOICE INSTRUCTIONS

Submit invoices in duplicate to:

San Onofre Nuclear Generating Station
Units 2 and 3
Box 700
San Clemente, California 92672
Attention: R. Quarve

SCOPE OF WORK

Torrey Pines Technology (TPT) shall conduct a review of the seismic design of San Onofre Units 2 and 3 to:

1. verify that the design process converted the seismic design basis specified in the San Onofre Units 2 and 3 Final Safety Analysis Report (FSAR) into the design documents that are transmitted to the constructor or the fabricator, and
2. evaluate the Edison Quality Assurance (QA) audit plan and its implementation at the construction site and the fabricators' shops.

The design process performed by the equipment fabricators is not part of this review program.

This proposed review shall be structured to concentrate on Unit 2. It shall include Unit 3 only in those areas where there are significant differences between Unit 2 and Unit 3.

The proposed work is divided into the following six (6) major tasks:

Task A: Design Procedure Review

Verify compliance of seismic design-related QA procedures and controls to the NRC-approved QA section of the PSAR or to 10CFR-Part 50 Appendix B. The procedures and controls used by Southern California Edison (Edison), Bechtel Power Corporation (BPC) and Combustion Engineering (CE) shall be reviewed.

Task B: Design Procedure Implementation Review

Verify the implementation of design procedures and controls identified in Task A.

Task C: Seismic Design Technical Review

Review the seismic design of selected safety-related structures, components, and system of San Onofre Units 2 and 3 for compliance with the NRC approved design basis and methodology per FSAR Section 3.7 and 3.8. ANSI N45.2.11, Section 6.3.1, criteria shall be used for guidance.

SCOPE OF WORK (continued)Task D: Audit Plan Review

Review and evaluate the QA audit plan(s) of Edison and BPC, and verify implementation of those plans. The review and evaluation shall be restricted to audit plans and audits covering implementation of seismic design output at the construction site or the fabricators' shops.

Task E: Processing of Findings

Review and assess Potential Findings and transmit those that are determined to have a potential for significant impact on the design adequacy of San Onofre Units 2 and 3 (Findings) to Edison, Bechtel Power Corporation, and Combustion Engineering.

Task F: Reports

Prepare the following Reports:

1. A Program Plan to describe in more detail the technical approach and procedures to be used in performing these tasks and to guide the detail review activities.
2. An interim report shall be issued by January 8, 1982, to cover all work completed in accordance with the Program Plan.

A final report compiling all Potential Findings and Findings, including their description, comments and assessment of impact, the results of the review of Edison proposed corrective actions and the final assessment of the adequacy of the seismic design of San Onofre Units 2 and 3. This report shall be issued by March 31, 1982.

NOTE: Edison shall not edit the interim or final reports prior to their issuance.

DOCUMENTATION REQUIREMENT

Forms 5-1 and 5-2 as identified on Pages 11-17 of TPT's Proposal No. GACP 12-380A, dated December 1981, shall be completed and returned to Edison as soon as the TPT personnel are identified to work on this contract.

INSURANCE REQUIREMENTS

Should any Work be performed at the jobsite which is not under escort by Edison personnel, TPT shall submit or verify that a Certificate of Insurance for Workers' Compensation and Comprehensive General Liability is on file with the following:

Southern California Edison Company
P.O. Box 800
Rosemead, California 91770
Attention: M. Roossien (213) 572-3650
Insurance, Room 374

RATES

The following rates are effective until revised by Change Order.

COMMERCIAL DATA WITHHELD AT THE REQUEST OF
TORREY PINES TECHNOLOGY/GENERAL ATOMIC COMPANY

DEVIATIONS

The following revisions shall apply to the Work performed under Edison's Terms and Conditions, coded II-TMC, dated November 28, 1979:

Under Section 5, COMMERCIAL TERMS, revise Section 5.2 to read:

"Invoices shall be subject to approval by the Edison Representative and shall be paid within thirty days after approval of the invoice."

VIATIONS (continued)

Under Section 7, CONTROL OF THE WORK, revise 7.2 to read:

- 7.2 Edison Representative shall have the right to accept or reject the Work and the Results of the Work in regards to Purchase Order compliance. For a period of one year following completion of the Work, Contractor shall correct any defective Work or Results of the Work at its sole expense.

Under Section 7, CONTROL OF THE WORK, delete 7.3 and replace with the following:

- 7.3 Upon completion or termination of the Work, Contractor shall deliver all Documentation to Edison. Edison's data shall not be used by TPT for other activities without the prior written consent of Edison. Edison recognizes that the TPT computer programs, as delivered to Edison, are TPT property and shall not be resold or transmitted to other companies by Edison without the expressed permission of TPT. TPT reserves the right to use these computer programs with other clients.

Under Section 8, REPORTS, delete Section 8.3.

Under Section 16, INDEMNITY, delete this section and replace with the following:

When any services furnished hereunder are to be performed on or in connection with any nuclear installation or activity, Contractor and its suppliers and subcontractors shall have no liability for any nuclear damage, injury or contamination to any property located at the site and Edison indemnifies Contractor and its suppliers and subcontractors against any such liability, whether as a result of breach of contract, warranty, tort (including negligence), or otherwise. In addition, Edison warrants that it has entered into an agreement of indemnification as contemplated by Section 170 of the Atomic Energy Act of 1954, as amended, and has obtained nuclear liability insurance from American Nuclear Insurers of MAELU, or both, pursuant to Section 170 of said Act. Any of Contractor's material or equipment which becomes radioactive at the work site, shall, at Contractor's option, become the property of Edison. Any nuclear decontamination necessary for Contractor's performance (including warranty performance) shall be performed by Edison without cost to Contractor.

APPLICABLE CONDITIONS

Work performed under this Purchase Order shall be in accordance with the independence criteria specified in Section 5.0 of TPT's Proposal No. GACP 12-380A, dated December 1981.

All Work shall be performed under the applicable General Atomic/Torrey Pines Technology Quality Assurance programs and procedures.

APPLICABLE CONDITIONS (continued)

Notwithstanding any provisions to the contrary contained herein, this Purchase Order is issued for purchases made by Southern California Edison Company, San Diego Gas & Electric Company, City of Riverside and City of Anaheim, acting through Southern California Edison Company as principal in its own behalf and as agent for San Diego Gas & Electric Company, City of Riverside and City of Anaheim having undivided interests in Purchase Orders for Units 2&3 and the Common Facilities as follows:

	<u>Units 2&3</u>	<u>Common Facilities</u>
Southern California Edison	76.55%	77.12%
San Diego Gas & Electric	20.00%	20.00%
City of Riverside	1.79%	1.49%
City of Anaheim	1.66%	1.39%

ACCEPTANCE COPY REQUIRED

Acceptance of this Order and its terms and conditions is required by signing the Acceptance Copy without qualification. Any changes, exceptions or different terms proposed by seller are hereby rejected unless expressly agreed by the Buyer and confirmed by Change Order. Return the signed Acceptance Copy to the Buyer at the following address:

Southern California Edison Company
 Procurement Division
 Post Office Box 800
 Rosemead, California 91770

1.0 INTRODUCTION

General Atomic Company, Torrey Pines Technology Division has been engaged by Southern California Edison Company to perform an independent verification of the seismic design of selected systems for San Onofre Nuclear Generating Station, Units 2 and 3. General Atomic will prepare a record of verified findings of the review and will transmit these to SCE as the work progresses. The purpose of this administrative procedure is to define the process SCE will follow to accomplish prompt review and corrective action on the findings.

2.0 PROCEDURE

2.1 Transmittal of Findings

Upon identifying and verifying any condition which, in the opinion of the General Atomic Reviewer, would have an impact on the seismic design, General Atomic will prepare and transmit the Findings to the Senior Vice President of Southern California Edison Company. General Atomic will categorize these findings into two levels as to the degree of potential for impact on the seismic design.

2.2 Referral of Findings

The Senior Vice President will transmit the Report of Finding to the Vice President, Advanced Engineering with a request to obtain documented corrective action. Concurrently, copies of the Findings will be transmitted to the Vice President, Nuclear Engineering and Operations, and the SCE Project Manager for San Onofre Units 2 and 3, and the NRC.

2.3 Requesting Documented Corrective Action

The Vice President, Advanced Engineering shall transmit the Finding to the Manager, Quality Assurance who shall initiate a Nonconformance Report (NCR) or Corrective Action Request (CAR), as appropriate, in accordance with established SCE quality assurance program procedures. The Findings, as submitted by General Atomic, shall be attached to the NCR or CAR and shall refer to the Findings by assigned number, descriptive title, revision number and/or date of issue. In addition to the distribution established by procedure, copies of NCR's and CAR's shall be sent to General Atomic and to the Manager, Generation Engineering and Design.

2.4 Corrective Action Response

The Manager of the responsible organization shall, in responding to the CAR or NCR, provide a plan and schedule for remedial and corrective action to be undertaken and shall, in addition to the distribution established by procedures, send copies to General Atomic and to the Manager, Generation Engineering and Design.

2.5 Review of Findings For Reportability to the NRC

Immediately upon receiving a copy of the Findings from General Atomic, the Manager of the organization responsible for the activity in which the condition was identified shall initiate a review of the condition to determine whether it meets the criteria for reporting to the NRC in accordance with 10CFR21 and/or 10CFR50.55(e). The Manager of the responsible organization shall provide notification to the SCE Manager, Quality Assurance as soon as possible but within 14 days of receipt of the Findings, of the status or results of the review for reportability. The Manager, Quality Assurance shall follow established quality assurance program procedures for notification and reporting to the NRC regarding potential or verified significant deficiencies.

2.6 References

The SCE quality assurance program documents listed below shall govern the disposition of conditions identified by General Atomic. The SCE Quality Assurance Organization shall assure that responsible external organizations process and document corrective actions in accordance with SCE-approved quality assurance program procedures.

- A. Quality Assurance Manual - San Onofre Nuclear Generating Station, Units 2 and 3.
- B. Quality Assurance Procedure (QAP) N2.08 Reporting to the NRC in Accordance with 10CFR21.
- C. QAP N2.10 Identification and Resolution of NRC Action Items.

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- D. QAP N15.01 Instructions for Completing the Nonconformance Report (NCR).
- E. QAP N15.04 Reporting to the NRC of Deficiencies Found in Design and Construction.
- F. QAP N16.03 Instructions for Completing the Corrective Action Request (CAR).
- G. Engineering and Construction QA Reference Procedure E&C 24-10-10 Processing Corrective Action Requests.
- H. E&C 26-10-6 Processing SCE Nonconformance Reports for SONGS 2 & 3 Activities.
- I. E&C 40-9-9 Documenting, Evaluating and Reporting Problems Pursuant to 10CFR21 and 10CFR50.55(e) and SONGS Technical Specifications.


D. J. Fogarty

12/23/81
Date