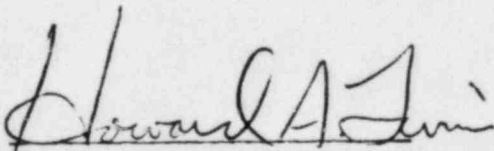


PROJECT QUALITY ASSURANCE PLAN
FOR MIDLAND INDEPENDENT
DESIGN CONSTRUCTION AND
VERIFICATION PROGRAM
CONSUMERS POWER COMPANY
PROJECT 3201

Prepared by:



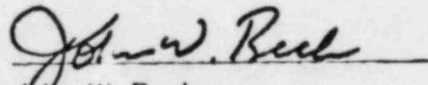
Howard A. Levin
Project Manager
TERA Corporation

Verified by:



Charles E. Lemon
Project Quality Assurance Engineer
TERA Corporation

Approved by:



John W. Beck
Principal-in-Charge
Vice President
TERA Corporation

Approved by:



Robert W. Felton
Executive Vice President
TERA Corporation

Copy No. 018

February 15, 1983

Revision: 2



TERA CORPORATION
QUALITY ASSURANCE PROGRAM

Midland IDCV Program

PQAP

DOCUMENT REVISION RECORD

REV	DATE	DESCRIPTION OF CHANGES
1	1/17/83	Changes made reflect omission of required graphics - no substantive changes in content. Affected pages: PQAP - pg. 19; PIDocument Control Cover Sheet - pg. 3; PI-Engineering Eval. Prep & Control - pg. 3.
2	2/15/83	Pages 12a, 13, 14a: designation of personnel who may potentially participate in the project and their functional areas of expertise.
		Appendix A, ECP-5.2 and 5.2QA, "Calculation Preparation and Control" and "Audit Checklist...", updated to include corporate revision. Includes reformatting, further detail and additional attachments.
		Appendix C, Resumes: addition of resumes for personnel who may potentially participate in the project.



TERA CORPORATION

PAGE REVISION RECORD

CONT. I.D. NO. 3201-004 PREPARED BY S. Alfaro DATE 2/15/83
 REV. 2 DATE _____ CHECKED BY S. Lynd DATE 2/15/83
 SUBJECT PQAP: Midland IDC

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
cover		23		p3	3	p3	3	p3		Att C	
i		Fig 1		ECP-5.3		p4	3	PI-3201-002		PI-3201-010	
ii		Att A		p1	1	Att A	3	p1		p1	
iii		Att B-1		p2	1	Att B	3	p2		p2	
iv		Att B-2		p3	1	ECP-5.15		p3	1	p3	
1		Att B-3		p4	1	p1		p4		Att A	
2		Att B-4		p5	1	p2		Att A		Att B	
3		Att B-5		Att A	1	p3		Att B-1		App C	2
4		Att B-6		Att B	1	p4		Att B-2			
5		Att B-7		Att C 5.3QA		p5		Att B-3			
6		Att B-8		p1	1	p6		Att B-4			
7		Att B-9		p2	1	p7		Att B-5			
8		Att C		p3	1	p8		Att B-6			
9		App A		ECP-5.5		p9		Att C			
10		ECP-5.2		p1	3	p10		p1			
11		p1	3	p2	3	p11		p2			
12		p2	3	p3	3	Att A		p3			
12a	2	p3	3	p4	3	Att B		PI-3201-008			
13	2	p4	3	p5	3	App B		p1			
14		p5	3	p6	3	PI-3201-001		p2			
14a	2	p6	3	p7	3	p1		p3			
15		Att A	3	Att A	3	p2		p4			
16		Att B	3	Att B	3	p3	1	p5			
17		Att C	3	Att B contd	3	p4		p6			
18		Att D	3	Att C	3	Att A		p7			
19	1	Att E	3	Att D	3	Att B		p8			
20		Att E 5.2QA		ECP-5.6		Att C		Rept Flow Chart			
21		p1	3	p1	3	p1		Att A			
22		p2	3	p2	3	p2		Att B			



TERA CORPORATION

PROJECT QUALITY ASSURANCE PLAN

PQAP- 3201

REV.: 0

DATE: 11/11/82

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PROJECT: Consumers Power Company
Midland Independent Design and
Construction Verification Program

Technical Reviewer

Christian Mortgat

Jorma Arros

Kenneth Campbell

Norman Berube

Frederick Berthrong

Leonard Stout

Susan Sly

Richard MacDonald

Sidney Brown

Functional Areas of Expertise

Engineering mechanics, earthquake engineering

Engineering mechanics

Soil mechanics, earthquake engineering

Design and analysis of mechanical systems, thermal-hydraulics, heat transfer, engineering, analyses

Engineering project management, planning, scheduling and field engineering

Design, construction, start-up and operations project control, schedule and cost control systems

Civil/mechanical design and construction, installation and inspection

Engineering, construction, operation, maintenance and project management systems, nuclear plant start-up and operations

Engineering and construction management, cost and scheduling, quality control, field engineering

PROJECT QUALITY ASSURANCE PLAN

PQAP- 3201

PROJECT: Consumers Power Company
Midland Independent Design and
Construction Verification Program

REV.: 2 DATE: 2/15/83

PAGE 12a of 23

Technical Reviewer

Functional Areas of Expertise

Donald Tulodieski

Project management/control,
start-up testing, engineering
analysis and design, licensing,
plant reliability analysis

Gary Smith

Civil engineering, design and
analysis, hydraulics, project
management

Douglas Witt

Nuclear power plant systems
and mechanical design, safety
analysis, equipment design,
licensing, HELBA, thermal-
hydraulics

Pandy Cleland

Power plant mechanical design,
piping/hanger design and con-
struction, review and inspec-
tion of mechanical systems,
construction supervision and
management, results engineering

Patrick Longstreth

Project and construction
management, administration,
control and planning,
contracting

George Trigilio

Design and analysis of waste
treatment systems, health physics,
radiological engineering

Stephen Schreurs

Engineering analysis
computational methods, ECCS
evaluation, waste
management, licensing

PROJECT QUALITY ASSURANCE PLAN

PQAP- 3201

REV.: 2

DATE: 2/15/83

PAGE 13 of 23

PROJECT: Consumers Power Company
Midland Independent Design and
Construction Verification Program

Technical Reviewer

Farzin Ramezanbeigi

Christian Nelson

Functional Areas of Expertise

Structural and
mechanical engineering,
usage and interpretation of
structural/mechanical
computer codes

Nuclear power plant
operations, design,
safety analysis, seismic
design evaluation, inspec-
tion program development

3.2.3 Staff personnel are controlled and their performance evaluated under direct supervision of the LTRs who provide input to the PM for his review and concurrence.

3.3 Associates

3.3.1 Associates are selected by the LTRs and Project Manager as required to perform activities requiring specific detailed, state-of-the-art knowledge of selected scientific and engineering specialties.

3.3.2 Associates are controlled by direct supervision of the LTRs with assistance as required by other staff personnel.

PROJECT QUALITY ASSURANCE PLAN

PQAP- 3201

REV.: 2

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PAGE 14a of 23

PROJECT: Consumers Power Company
Midland Independent Design and
Construction Verification Program

Associate

Louis Fusco

James Owens

Stanley Kaut

Edward Beck

Robert Reneau

Functional Areas

Nuclear systems engineering and licensing, equipment qualification, engineering and project management, nuclear power plant operations and management

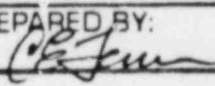

Nuclear and fossil power plant design and construction, nuclear steam supply systems design and construction, project management, control systems, safeguards, licensing

Design review, construction, testing, operation and licensing of electrical power, instrumentation and control systems and equipment; project management, plant procedures development, quality assurance

Nondestructive testing, Level III in radiography, ultrasonics, magnetic particle, liquid penetrant, materials testing

Nondestructive testing, Level II in radiography, ultrasonics, magnetic particle, liquid penetrant, materials testing

TO BE INSERTED WITHIN APPENDIX A OF THE PQAP

ENGINEERING CONTROL PROCEDURE	
ECP- 5.2	SUBJECT: CALCULATION PREPARATION AND CONTROL
REV.: 3 DATE: 1/7/83	
PAGE 1 OF 6	PREPARED BY:  APPROVED BY: 

1. PURPOSE

This procedure shall be followed in the preparation and control of calculations, when required by the PGAP. Calculations are to be prepared to establish or verify designs, design parameters, design criteria, reduce data, establish performance and economic parameters, and otherwise provide quantitative information in accordance with accepted analytical and mathematical methods.

2. PREPARATION

- 2.1 Each calculation shall be prepared following accepted engineering practice and shall include sufficient sketches, notes and explanatory information to allow any person not familiar with the work, but technically qualified, to understand it without extensive additional inquiry and research.
- 2.2 Calculations shall be complete and orderly and shall include problem statement and input requirements such as assumptions, basic criteria, methodology, data and references, and applicable codes and standards. Major equation sources shall be given and the source or derivation of any uncommon equations introduced in the calculation.
- 2.3 References shall be listed and identified sufficiently to allow easy recovery. Title, author, copyright date, edition, etc., shall be included as necessary identification information.



ENGINEERING CONTROL PROCEDURE		
ECP- 5.2	SUBJECT:	
REV.: 3	DATE: 1/7/83	
PAGE 2 OF 6	PREPARED BY: <i>C. E. Jean</i>	APPROVED BY: <i>[Signature]</i>

2.4 All final calculations shall be made on standard Control Sheets (Attachment A) or on sheets stamped in the lower right corner with the Control Stamp (Attachment B) with all required information completed by the originator. A Calculation Cover Sheet (Attachment C) shall also be prepared and attached as sheet 0 of each final calculation prior to verification and approval.

2.5 Computer calculations shall be identified by a Calculation Cover Sheet with attachments as necessary to define the calculation being performed, the assumptions and input data used, basic mathematical models applied and references as appropriate. Computer calculations shall be controlled by ECP-5.4, when implemented by the PQAP.

3. VERIFICATION AND APPROVAL

3.1 Status

Calculations shall be designated as preliminary until verified by checking and approved by the Project Manager or his designated representative, or until he determines that such review and approval are not required. Preliminary calculations not upgraded to final calculation status shall be maintained in a separate file.

3.2 Verification

3.2.1 Each final calculation shall be checked by an individual who has qualifications at least sufficient to originate the calculation. The checker shall not (i) be the originator or



ENGINEERING CONTROL PROCEDURE			
ECP- 5.2		SUBJECT:	
REV.: 3		DATE: 1/7/83	
PAGE 3 OF 6		PREPARED BY:	APPROVED BY:
		<i>[Signature]</i>	<i>[Signature]</i>

the originator's immediate superior, (2) have specified a singular calculational approach, (3) have ruled out certain considerations, or (4) have established the input for a certain aspect being verified.

3.2.2 The extent of verification required is a function of the importance of the calculation, its complexity, degree of standardization and relation to the state-of-the-art. Based on these considerations, the input, assumptions, and method of calculation may be reviewed as well as the reasonableness of the results. The depth of verification can range from a detailed check of the whole calculation to a limited check of the calculation approach and an alternative or simplified calculation technique.

3.3 Documentation of Verification

3.3.1 To provide a basis for project manager approval and future traceability, the extent and method of verification shall be clearly indicated by such methods as check marks on the original calculation and a description of the verification on the Calculation Cover Sheet or a separate sheet. The checker shall flag all errors. However, only the originator may alter the original calculation. In all cases when the propagation of the error is not corrected in the calculation or later in the design process, the originator shall clearly discuss its significance either on the cover sheet or on the original calculation.



ENGINEERING CONTROL PROCEDURE

ECP- 5.2	SUBJECT:	
REV.: 3 DATE: 1/7/83	CALCULATION PREPARATION AND CONTROL	
PAGE 4 OF 6	PREPARED BY: <i>[Signature]</i>	APPROVED BY: <i>[Signature]</i>

3.3.2 In cases where only certain aspects of a calculation were verified either due to the perceived need (Section 3.2) or any limitations in the qualifications of the checker, this shall be stated explicitly on the Calculation Cover Sheet or attachments as necessary.

3.3.3 After checking, the checker shall sign and date the Calculation Cover Sheet and each calculation sheet. Any comments shall be resolved with the originator prior to signoff.

3.4 Approval

The calculation shall then be passed to the Project Manager or his designated representative for approval. The extent and method of verification must be reviewed and determined to be satisfactory prior to signoff. The Manager or his designated representative will sign only the cover sheet.

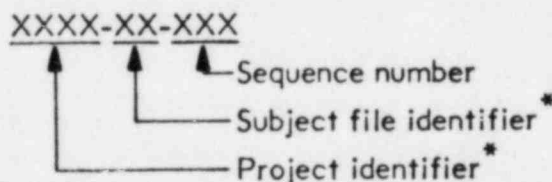


ENGINEERING CONTROL PROCEDURE		
ECP- 5.2	SUBJECT:	
REV: 3	DATE: 1/7/83	
PAGE 5 OF 6	PREPARED BY: <i>CE Jenson</i>	APPROVED BY: <i>[Signature]</i>

4. DOCUMENT CONTROL

4.1 Identification

After all approvals have been obtained, the final calculation shall be assigned a control identification number by the Project Manager or his designated representative in the following format:



*Project and subject file identifiers are established in the PQAP.

The Project Manager or his designee shall insert the control identification number on the cover sheet and each page of the final calculation.

4.2 Retention

The final calculation shall be indexed, Attachment D, and filed in the appropriate subject file. Calculations shall not be stored loosely but shall be filed in binders or contained in folders. Distribution shall not be made unless specific written instructions are issued to the contrary. Filing and distribution of final calculations shall be controlled by the Project Manager or his designated representative. Further controls resulting from contractual agreement or project specific needs may be stated in the PQAP.



ENGINEERING CONTROL PROCEDURE		
ECP- 5.2	SUBJECT:	
REV.: 3	DATE: 1/7/83	
PAGE 6 OF 6	PREPARED BY: <i>[Signature]</i>	APPROVED BY: <i>[Signature]</i>

5. REVISIONS

- 5.1 Revisions to final calculations shall be made, verified, and approved in the same manner as the original calculation.
- 5.2 Superseded final calculations shall be so identified and transferred to a superseded calculation file. This action shall be noted by completing the "Superseded By" blanks on the Calculation Index for the superseded calculation. Superseded final calculations shall either be identified as such on each page or shall be securely bound with at least the cover page so identified.
- 5.3 Calculation packages may be revised by inserting replacement pages or additional pages with the revision number added to the Control I.D. number on these pages. Appropriate page numbers shall be supplied with subpage numbers used if necessary (e.g., 41A, 41B or 41.01, 41.02, etc.). The Page Revision Record, Attachment E, must be used to record all removed, replaced or revised pages and shall be attached to the Calculation Cover Sheet. Superseded pages shall be identified as such and transferred to a separate file.

6. QA AUDIT CHECKLIST

- 6.1 Audits of the implementation of this procedure shall be conducted by the PQAE using Audit Checklist ECP-5.2QA, Rev. 2, Attachment F.



TERA

SUBJECT _____

SHEET _____ OF _____ SHEETS

PROJECT NO. _____

PREPARED BY _____ DATE _____

CONTROL I.D. NO. _____

CHECKED BY _____ DATE _____

CONTROL STAMP

CONTROL ID NO
PREPARED BY DATE
VERIFIED BY/DATE
PAGE ____ OF ____



CALCULATION COVER SHEET

SUBJECT _____

CONT. ID. NO. _____

PROJECT _____

NO. OF SHTS. _____

SUPERCEDES CALC. NO. _____

REV. NO.	REVISION	ORIGINATOR	DATE	VERIFIED BY	DATE	APPROVED BY	DATE

VERIFICATION

PURPOSE/INPUT REQUIREMENTS

SOURCES OF DATA, FORMULAE AND REFERENCES

(References may be listed on a separate sheet)



TERA CORPORATION

ENGINEERING CONTROL PROCEDURE		
ECP- 5.2 QA	SUBJECT: AUDIT CHECKLIST FOR CALCULATION PREPARATION AND CONTROL	
REV: 2	DATE: 1/7/83	
PAGE 1 OF 3	PREPARED BY: <i>C. J. Sams</i>	APPROVED BY: <i>[Signature]</i>

I. PURPOSE

This checklist shall be used by the PQAE to verify the implementation of ECP-5.2, Calculation Preparation and Control, for those calculations directly related to Quality Assured Activities as identified in the PQAP. It shall not be used for any other categories of calculations or types of activities unless instructions to the contrary are established by the PQAP.

2. CHECKLIST

- 2.1 References? _____
- 2.2 Calculation Cover Sheet and each page properly prepared and identified _____
- 2.3 Verification and approval signatures or initials? _____
- 2.4 Control and identification number per PQAP? _____
- 2.5 Extent of verification indicated? _____
- 2.6 Calculation indexed and filed in loose leaf binder or contained in folders? _____
- 2.7 Revisions processed in same manner as original? _____
- 2.8 Superseded calculations identified on index sheet properly identified and filed separately? _____



ENGINEERING CONTROL PROCEDURE	
ECP- 5.2 QA	SUBJECT:
REV.: 2 DATE: 1/7/83	AUDIT CHECKLIST FOR CALCULATION PREPARATION AND CONTROL
PAGE 2 OF 3	PREPARED BY: <i>[Signature]</i> APPROVED BY: <i>[Signature]</i>

3. COMMENTS

3.1 Identify calculation(s) used in preparing this checklist, state specific cause of any unsatisfactory ratings, and recommend corrective action, if any.

3.2 Prepared by: _____ Date: _____



ENGINEERING CONTROL PROCEDURE	
ECP- 5.2 QA	SUBJECT: AUDIT CHECKLIST FOR CALCULATION PREPARATION AND CONTROL
REV: 2 DATE: 1/7/83	
PAGE 3 OF 3	PREPARED BY: <i>C. J. J. J.</i> APPROVED BY: <i>[Signature]</i>

4. FOLLOWUP

4.1 Recommended corrective action of item 3.i
satisfactorily implemented? _____

4.2 If not, state other action taken to resolve the deficiency, or state
rationale justifying no corrective action taken, and if this item is
open or closed.

4.3 Prepared by: _____ Date: _____

TO BE INSERTED WITHIN APPENDIX C OF THE PQAP

DOUGLAS M. WITT
Senior Mechanical Engineer

Education

M.S. Mechanical Engineering, Illinois Institute of Technology
B.S. Mechanical Engineering, Illinois Institute of Technology

Summary of Experience

Mr. Witt has more than 15 years of experience in the nuclear engineering and consulting field. His project work in this area has included safety sequence analysis, licensing, system design, equipment design, pipe rupture analysis, and procurement. He has managed and participated in numerous projects for several corporate organizations with responsibility for technical services and financial management. In addition, he has provided special technical services for an advanced analysis group performing thermal hydraulic analysis for nuclear and fossil power plants, and has served as technical manager for a design organization of more than 100 engineers.

1983 Senior Mechanical Engineer, TERA Corporation.

1973-1982 Manager, Structural Design Division, EDS Nuclear. Responsible for structural design services for operating nuclear plant backfit and for design modification and analytical qualification associated with licensing upgrades.

Manager, Advanced Analysis Section, EDS Nuclear. Managed analysis efforts to define thermal hydraulic forcing functions for plant structures and systems subjected to transients associated with both abnormal occurrences and anticipated operational conditions.

Project Manager, EDS Nuclear. Provided technical direction on multi-discipline projects for construction-stage and operating nuclear plants. Projects included both PWRs and BWRs with integrated design and analysis activities including safety sequence analysis, licensing, system design, pipe rupture mitigation, piping system qualification and design.

1972 - 1973 Industrial Consultant, Argonne National Laboratory. Designed mechanical test facilities, and test programs for equipment and components utilized in the sodium fast breeder program.

1971 - 1972 Mechanical Engineer, Projects Group, Sargent and Lundy. Directed interfacing mechanical design efforts for safety-related systems within the NSSS vendor scope of supply.

1967 - 1971 United States Navy, Nuclear Power Program. Completed tour of duty as Director, Heat Transfer and Fluid Flow Division at the nuclear training command with responsibility for establishing qualifications and implementing a training and testing program to qualify personnel.

(1/83)1



TERA CORPORATION

Registrations

Registered Professional Engineer - Mechanical Engineering, California and Illinois

Professional Affiliations

American Society of Mechanical Engineers



RANDY S. CLELAND
Project Engineer

Education

M.A. Business Administration, Sangamon State University
B.S. Mechanical Engineering, Purdue University

Summary of Experience

Mr. Cleland has over ten years of experience in the design, construction, operation, and maintenance of power generation facilities with emphasis on mechanical engineering, construction management and results engineering.

1983 - Present Project Engineer - TERA Corporation. Responsible for providing construction management and plant operations support services.

1975 - 1983 Results Engineering Supervisor, Coffeen Power Station, Central Illinois Public Service Company. Responsible for coal fired power plant operating efficiency, instrument and control maintenance, and laboratory activities. Developed performance test procedures, periodic testing programs, equipment inspection procedures, and preventive maintenance programs. Recommended improvements in operating procedures and managed plant betterment projects.

Mechanical Engineer, Power Plant Construction. Responsible for review and monitoring of mechanical design portion of a major fossil fueled power plant and other operating station additions.

Area Construction Engineer, Power Plant Construction. Responsible for contractor management and monitoring of various construction activities for a major fossil fueled power plant.

1971 - 1975 Cooperative Engineer, Sargent and Lundy Engineers. Completed work-study program which included positions as draftsman, designer, assistant engineer, and mechanical engineer on nuclear and fossil power plant design projects.

Registration

Registered Professional Engineer - Illinois

Professional Affiliations

American Society of Mechanical Engineers
Tau Beta Pi, Engineering Honorary Society
Pi Tau Sigma, Mechanical Engineering Honorary Society



TERA CORPORATION

PATRICK LONGSTRETH

Senior Engineer - Project and Construction Management

Education

M.B.A. Management, Golden Gate University, San Francisco
B.S. Industrial Construction Management, Colorado State University

Summary of Experience

Mr. Longstreth has more than fourteen years experience in project and construction management. He has worked on a variety of projects including power plants, a fuel maintenance and examination facility, and a hazardous waste management facility. His experience has involved project management, administration, control and planning as well as contracting and claims. Mr. Longstreth also developed and implemented an Integrated Computerized Cost Reporting System for the Fast Flux Test Facility; the system included all Field Cost and Control Reports.

1981 - Present Senior Engineer, TERA Corporation.

1967 - 1981 Assistant Estimator to Project Services Manager, Bechtel Group of Companies.

1980 - 1981 Project Engineer and Project Services Manager. Project Engineer for a Department of Energy Breeder Reactor Program at a fuel maintenance and examination facility. The project was a mechanical/electrical contract worth \$40 million. As Project Services Manager was responsible for project services--accounting, administration, cost and schedule engineering, legal, and insurance--for IT Corporation's Louisiana Hazardous Waste Management Facility.

1977 - 1980 Manager of Planning and Scheduling, Hydro and Community Facilities Division. Was responsible for all aspects of planning and control on numerous hydroelectric, transportation, community, commercial, and infrastructure projects.

1974 - 1977 Manager of Planning and Scheduling, San Francisco Power Division. Responsible for planning functions on numerous power plant projects. Developed System Basis Scheduling Engineering/Procurement methods for the San Francisco Power Division.

1967 - 1974 Cost Engineer, Estimator. Worked on numerous power industry projects involving contracting, change orders, and claims.

Professional Associations

American Association of Cost Engineers
International Association of Professional Planners and Schedulers
Project Managers Institute



TERA CORPORATION

GEORGE JOSEPH TRIGILIO, JR.
Engineering Manager

Education

B.S. Chemical Engineering, Northeastern University, Boston, Massachusetts

 Chemical Engineering Technology, Franklin Institute of Technology, Boston, Massachusetts

Summary of Experience

Mr. Trigilio has held numerous management and technical positions of increasing responsibilities. He is presently directs a multi-disciplined team of senior level professionals. Mr. Trigilio's technical expertise is in the design of waste treatment systems. He has worked extensively in the design and analysis of radioactive waste treatment systems for nuclear power plants and has been involved in the design, specification and purchase of waste treatment system components for numerous utility plants. In addition, he has supervised a research and development department and managed the technical and licensing requirements for a fleet of radioactive waste shipping casks used in the transportation of power plant wastes.

- 1979 - Present Engineering Manager - Waste Management Services Division, TERA Corporation. Responsibilities include all engineering aspects of the radwaste generation and disposal cycle with extensive involvement in the design and analysis of radwaste treatment systems, low-level waste storage facilities and the economic and engineering viability of volume reduction systems. During this time period a study was begun for the Nuclear Regulatory Commission which resulted in his authoring NUREG-2206 which represents a comprehensive completion and data base of volume reduction techniques for low-level radioactive waste.
- 1977 - 1979 Engineering Group Manager, Hittman Nuclear & Development Corporation, Columbia, Maryland. Responsibilities included department budgetary control, technical direction, and personnel supervision of: the Engineering Design; Research, Development and Testing; and the Planning/Scheduling and Document Control sections. Additionally, was Project Manager for a Shipping Cask project, with direct responsibility for all corporate radioactive waste shipping container design, safety analyses, and Nuclear Regulatory licensing certification.
- 1975 - 1977 Analysis Group Lead Engineer, Brown & Root, Incorporated, Houston, Texas. Responsible for supervising the development of a major program to simulate the operation of a Radioactive Waste Treatment system. Assisted in the preparation of an Environmental Report for licensing of a multiple-unit nuclear site, involving economic evaluation of power production alternatives and calculation of isotopic dispersion.



1972 - 1975 Engineer, Stone & Webster Engineering Corporation, Boston, Massachusetts. Responsible for determining the capital cost and operating economics of three processes for BTX extraction from reformed and/or pyrolysis feed stocks.

Assistant to the Head of Computational Methods Specialist. Prepared the specification for the purchase and assisted in the design of an Off-Gas treatment system. Co-authored a curve fitting program.

Professional Affiliations

American Institute of Chemical Engineers

American Nuclear Society

National Energy Coordinating Committee of the American Institute of Chemical Engineers (past member)

Board of Directors of Harris County Municipal Utility District #5 (past President)



STEPHEN F. SCHREURS
Project Manager, Waste Management Services Division

Education

B.S. University of Massachusetts, Chemical Engineering

Summary of Experience

Mr. Schreurs has nine years of nuclear experience in the area of radwaste processing, design, analysis and disposal. This experience has included both engineering analysis and group managerial responsibilities for private and governmental organizations. He has developed computerized analytical models of ECCS, CSS, and boron recovery systems. Mr. Schreurs has been involved in all facets of the nuclear waste problem, especially the immobilization and disposal of high-level and transuranic wastes and the solidification, packaging and disposal of low-level radioactive wastes.

- 1980 Project Manager, Waste Management Services Division, TERA Corporation. Primary responsibilities include radwaste system evaluation and analysis.
- 1977 - 1980 Project Manager, Performance Analysis Section, High-Level Waste Licensing Branch, Division of Waste Management, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission. Responsibilities included developing a capability to analyze the performance of a deep geologic nuclear waste repository. Mr. Schreurs assisted in the development of the proposed 10 CFR 60 regulation, along with the accompanying regulatory documents (i.e. regulatory guides and staff technical positions), and interfaced with other government agencies on matters concerning the performance assessment of repositories. He also monitored the technical aspects of contracts related to deep geologic repositories which were sponsored by other NRC offices.
- 1976 - 1977 Computational Methods Specialist and Sampling Systems Specialist, Process Engineering Specialty Group, Nuclear Industries Division, Stone and Webster Engineering Corporation. Major activities consisted of reviewing and updating specifications for buying sampling systems; laboratory testing of simulated nuclear plant radioactive wastes; preparation of sections pertaining to the processing systems for a PSAR of an Italian nuclear power plant; and modeling the CSS for redesign using eductors for pH control instead of injection pumps.
- 1972 - 1976 Computational Methods Specialist, Process Engineering Specialty Group, Nuclear Industries Division, Stone and Webster Engineering Corporation. Supervised the Computer Section of the Process Engineering Group. Responsible for modeling the complete radioactive waste system for BWRs (i.e. reactor core to drums); modeling and refining the existing computer program for the boron recovery systems in PWRs, and modeling other chemical process systems for nuclear power plants (e.g. waste evaporators and demineralizers). Further responsibilities included recruitment, managing the engineer-in-training program for the group, and teaching refresher courses in math for the Professional Engineers Exam.



Licenses

E.I.T. portion of professional engineer

Societies

American Institute of Chemical Engineers - Full Member

Publications

Schreurs, S.; "Overview of the High-Level and Transuranic Waste Branch Modeling Effort," U.S. Nuclear Regulatory Commission, 1978

Contributing author to "Technical Writing Style Guide," NUREG-0650, U.S. Nuclear Regulatory Commission, November 1979.



FARZIN RAMEZANBEIGI
Civil/Structural Engineer

Education

B.S. Structural Engineering, San Francisco State University

Summary of Experience

1982 - Present Civil Engineer, TERA Corporation. Responsibilities include usage and interpretation of structural computer codes such as SAP IV, SAP V, and ADLPIPE.

1982 Teaching Assistant, San Francisco State University. Responsible for assisting advisor in use of computerized systems for engineering applications.

1981 - 1982 Assistant, Billman Construction Corporation. Assisted owner of this small business in determining technical engineering requirements for residential buildings. Also performed a wide range of general construction duties.



CHRISTIAN C. NELSON
SENIOR REACTOR OPERATIONS ENGINEER

EDUCATION

B.S. Naval Engineering, U.S. Naval Academy

SUMMARY OF EXPERIENCE

Mr. Nelson has over twelve years of experience in the nuclear energy field. At the NRC he was responsible for maintaining an effective program for the inspection of operating nuclear power plants. He has managed numerous safety and environmental evaluations associated with operating nuclear power plants. He directed a multidisciplinary engineering team in reviewing implementation of TMI Lessons Learned at operating reactors. He has also been lead engineer in resolving several generic safety issues.

1983 - Present Senior Reactor Operations Engineer - TERA Corporation.

1975 - 1983 Operating Reactors Project Manager, Office of Nuclear Reactor Regulation, NRC. Responsible for directing and performing evaluations of licensing issues for numerous operating power plants. In particular coordinated safety evaluations for power upgrades, seismic design reviews and increases in spent fuel storage capacity. Responsible for resolution of various technical issues including PWR moderator dilution, station blackout procedures and natural circulation cooldown.

Senior Reactor Operations Engineer, Office of Inspection and Enforcement, NRC. Responsible for managing the operating reactor inspection program to assure proper emphasis on the priority among inspections, balance inspection requirements with manpower resources and integrate the inspection program with other NRC activities.

Team Leader, Lessons Learned Implementation Review, NRC. Directed review of TMI Category A Lessons Learned implementation at all Combustion Engineering and early Westinghouse designed power reactors.

1970 - 1975 Officer, U.S. Navy. Served as engineering officer during four deterrent patrols and shipyard overhaul aboard a nuclear powered submarine. Qualified in submarines.

AWARDS

NRC Special Achievement Award for managing evaluation of GETR seismic issues and representing NRC evaluation at public hearing.



TERA CORPORATION

LOUIS L. FUSCO, JR.
Senior Associate Engineer

Education

B.S. Ocean Engineering, U.S. Naval Academy

Summary of Experience

Mr. Fusco has had over eight years of nuclear engineering experience, with emphasis on equipment qualification, systems engineering, licensing and project management.

Present Senior Associate Engineer, TERA Corporation.

1981 - Present Senior Engineer, Western OMTEC Corporation. Responsible for the preparation of field change instructions to operations and instruction sites.

1981 Staff Engineer, NUS Corporation. Assigned as on-site technical consultant to the Sacramento Municipal Utility District, in responding to the environmental qualification of Class 1E electrical equipment at Rancho Seco Nuclear Power Plant. Responsible for equipment inspection, record and test reviews, and vendor/client interface. Also responsible for nuclear engineering studies and evaluations in areas such as nuclear process system design and operation, seismic qualification, radioactive waste, shielding and licensing.

1980 - 1981 Senior Engineer, EDS Nuclear, Inc. Nuclear systems engineering and licensing lead responsible for the direction and supervision of up to eight engineers on three major projects. Review and preparation of FSAR chapters on electrical and control systems. Responsible for nuclear system piping rupture postulation with interaction analysis and protection of unacceptable scenarios. Responsible for NUREG-0660 reviews for nuclear utility clients.

1975 - 1980 Lieutenant, U.S. Navy. Qualified as engineer officer, officer of the deck and engineering officer of the watch on a nuclear-powered fast attack submarine. Major division officer assignments included: Main Propulsion Assistant, Damage Control Assistant, Reactor Controls Officer, Chemistry and Radiological Controls Officer, and Sonar Officer.



TERA CORPORATION

STANLEY W. KAUT
Associate Electrical Engineer

Education

B.S. Electrical Engineering, Rochester Institute of Technology

Summary of Experience

Mr. Kaut has had 20 years of diversified engineering experience with emphasis in design review, construction, testing, operation, licensing and quality assurance of electrical power, instrumentation and control systems and equipment. He has made continuous contributions to the nuclear power industry since his involvement with the BWR turnkey program. His experience with electrical power includes the installation, testing, and servicing of substations, motor control centers, switchgear, power transformers, motors, generators, D.C. battery systems, bus duct, cabling and related metering, and relaying. His experience with instrumentation and control includes the installation, testing, design, calibration, and maintenance of process systems and equipment that measure such variables as level, flow, pressure, temperature, and vibration; and of nuclear systems such as neutron monitoring, area and process radiation monitoring, and rod control. Mr. Kaut has also had significant experience with design review, plant procedures and Quality Assurance (QA). He has directed a technical group responsible for providing design review services to nuclear utilities. The services have been directed toward providing an independent assessment of plant safety, operability, maintainability, inspectability, and availability features. Mr. Kaut has developed procedure programs for several BWR and PWR power plants providing for the administrative control of plant personnel during startup testing, operation, maintenance or on-line surveillance testing. Mr. Kaut's involvement with quality (QA/QC) includes first-hand experience performing QC activities in manufacturing shops, electrical equipment installation sites and at nuclear power plant construction sites. He has been involved in the development and review of quality programs and procedures (including training) for AE's utilities, and manufacturing organizations. He has participated in many audits and is certified as a lead auditor.

Present	Associate Electrical Engineer, TERA Corporation.
1975 - Present	Manager, Systems Engineering, NUTECH.
1970 - 1975	Manager of Projects, Nuclear Services Corporation.
1963 - 1970	Field Engineer, General Electric Company.

Registration

Electrical Engineer, State of California
Nuclear Engineer, State of California
Control System Engineer, State of California



TERA CORPORATION

JAMES I. OWENS
Principal Associate Engineer

Education

B.S.E.E. Iowa State University
Advanced Engineering Program, General Electric Company

Summary of Experience

Mr. Owens has had over 30 years of experience in the design and construction of power plants - fossil and nuclear. He was General Manager Production Engineering and Construction for a major utility with responsibility for generation planning, as well as design and construction of all production facilities. In this capacity he functioned as a member of the utility executive staff and worked with AEs, suppliers, NRC, other regulatory bodies and interfaced with the public. He has had major responsibility for cost and schedule performance.

1982 - Present Principal Associate Engineer, TERA Corporation.

1979 - 1982 General Manager, Production Engineering and Construction, Delmarva Power & Light Company. Responsible for the design and construction of a 500MWe coal fired power plant and the conversion of a two unit oil fired plant to coal, as well as additions and improvements to the existing system.

1978 - 1979 Manager, Production Engineering & Construction, Delmarva Power & Light Company. Responsible for planning new facilities and all preliminary engineering and licensing work on a 500MWe coal fired power plant.

1976 - 1978 Manager, Power Plant Design, Delmarva Power & Light Company. Responsible for the specification, bidding, and evaluation of twin unit Nuclear Steam Supply Systems and preliminary design of BOP.

1973 - 1976 Project Manager, Summit Nuclear Power Plant, Delmarva Power & Light Company. Staffed the Project Organization, negotiated contracts for the NSSS, Turbine Generator, and most major auxiliaries. Directed Preliminary Design and Licensing through the Construction Permit for twin HTGRs. Responsible for nuclear engineering for the station.

1950 - 1972 General Electric Company, Gibbs and Hill and General Atomic Company. Engineering and managerial assignments included development of control systems for Peach Bottom & Dresden Nuclear Power Plants and the Sea Wolf nuclear submarine, and preparation of PSARs for sixteen research and test reactors.

Professional Affiliations

Registered Professional Engineer, New York
Member, American Nuclear Society
Member, IEEE
Member, EPRI Nuclear Divisional Committee



TERA CORPORATION

EDWARD M. BECK
Principal Associate Engineer, Nondestructive Testing

Education

B.C.E. Auburn University

Summary of Experience

Mr. Beck has over 15 years experience in the area of nondestructive testing. He has been responsible for the direction and management of several major projects. He has distinguished himself by serving as Section Chairman and Director of the AWS and ASNT.

Present	Principal Associate Engineer, Nondestructive Testing
1978 - Present	Assistant Vice President, Corporate Consultant/Metals, Radiation Safety Officer for Carolinas. Responsible for the development of new techniques and services. Responsible to the Director of Engineering for the approval of all NDE procedures established in the Engineering Procedures Manual. Responsible to the Director of Engineering for approval of all NDE Level III candidates.
1976 - 1978	Manager of NDE Services - Charlotte Branch, Law Engineering Testing Company. Managed nondestructive testing services for the District. Responsible for Virginia and Carolinas.
1972 - 1975	Project Manager, Law Engineering Testing Company. Administered and controlled radiographic, magnetic particle, and dye penetrant investigations for the Brunswick Steam and Electric Plant. Responsible for the supervision of up to 25 engineering technicians.
1968 - 1972	Manager of the Nondestructive Testing Department, Georgia Division, Law Engineering Testing Company. Administered and controlled all work which included radiography, ultrasonic, and magnetic particle investigation, dye penetrant tests and in general, all metal inspection in building and construction.
1964 - 1967	Assistant to Chief of Operations, United States Public Service Commission.

Certifications/Registrations

Professional Engineer, North Carolina and New York
Level III ASNT certification in ultrasonic, radiographic, liquid penetrant and magnetic particle testing.

Professional Associations

American Welding Society - past Section Chairman and Director
American Society for Nondestructive Testing - past Section Director
American Society of Mechanical Engineers
American Institute of Steel Construction
American Society for Metals
Numerous technical committees and task forces



TERA CORPORATION

ROBERT A. RENEAU
Associate Engineer, Nondestructive Testing

Education

B.C.E. Georgia Tech

Summary of Experience

Mr. Reneau has ten years experience in the areas of nondestructive examination and material testing. He has been responsible for the direction and supervision of engineers and technicians performing radiographic, magnetic particle, liquid penetrant, and ultrasonic evaluations on several major industry and nuclear projects.

Present	Associate Engineer, Nondestructive Testing, TERA Corporation.
1980 - Present	Engineer, Law Engineering Testing Company. Technical responsibility for metals services of Charlotte, North Carolina branch.
1975 - 1980	Service Engineer, Westinghouse Electric Corporation. Provided technical assistance during disassembly, reassembly, and operation of power generation equipment including steam turbines and generators for utility and industrial customers in U.S. and abroad. In addition to technical responsibilities, duties included supervision, scheduling and cost accounting.
1974 - 1975	Project Manager, Law Engineering Testing Company. Responsible for supervision of engineering technicians performing radiographic, magnetic particle, and dye penetrant evaluations during construction of Brunswick Steam Electric Plant.
1973 - 1974	Branch Engineer, Law Engineering Testing Company. Technical responsibilities for soil and foundation engineering activities including the test pile programs and foundation investigations for the LMFBR.

Certifications/Registrations

Professional Engineer, North Carolina
Level II ASNT certification in radiographic, magnetic particle, liquid penetrant and ultrasonic testing.

Professional Associations

American Welding Society
American Society for Metals
The American Institute of Plant Engineers



TERA CORPORATION