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PAUL A. GAUKLER
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December 10, 1999

Secretary of the Commission
U.S. Nuclear Regulatory Commission
16 H23 O-16 C1
Attn: Rulemakings and Adjudications Staff
Washington, D.C. 20555-0001

Re: Private Fuel Storage L.L.C.,
Docket No. 72-22, ASLBP No. 97-732

Dear Sir or Madam:

Enclosed please find the signed originals (plus two copies each) to replace facsimile signature pages of the declarations of John Parkyn and Jeffrey Johns verifying Applicant's Responses to the State's Fourth Request for Discovery and Applicant's Supplemental Response to State's Third Request for Discovery, filed December 6, 1999, and the declaration of John D. Parkyn, filed pursuant to 10 C.F.R. § 2.790, certifying the proprietary nature of the material in Applicant's Responses to the State's Fourth Request for Discovery and Applicant's Supplemental Response to State's Third Request for Discovery.

Please call me at 202-663-8304 if you have any questions.

Sincerely,

Paul Gaukler

Paul Gaukler

Enclosures

cc: G. Paul Bollwerk, Esq. (without enclosures)
Dr. Jerry R. Kline (without enclosures)
Dr. Peter S. Lam (without enclosures)
Sherwin E. Turk, Esq. (without enclosures)
Susan F. Shankman (without enclosures)
John Paul Kennedy, Sr. (without enclosures)
Denise Chancellor, Esq. (without enclosures)
Diane Curran, Esq. (without enclosures)

Richard E. Condit, Esq. (without enclosures)
Joro Walker, Esq. (without enclosures)
Danny Quintana, Esq. (without enclosures)

Document #: 866980 v.1

December 10, 1999

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

APPLICANT'S THIRD SUPPLEMENTAL RESPONSE TO STATE'S FIRST REQUESTS FOR DISCOVERY

Applicant Private Fuel Storage L.L.C. ("Applicant" or "PFS") files this Third Supplemental Response to "State of Utah's First Set of Discovery Requests Directed to the Applicant ("State's First Discovery Requests"). The Applicant files this Supplemental Response pursuant to 10 C.F.R. § 2.740(e), to name additional witnesses it expects to call at hearing. The Applicant's original response to the State's First Discovery Requests noted that it would file such supplemental responses as it identified additional witnesses.[1]

I. GENERAL DISCOVERY REQUESTS

A. GENERAL INTERROGATORIES

GENERAL INTERROGATORY NO. 3. For each admitted Utah contention, give the name, address, profession, employer, area of professional expertise, and educational and scientific experience of each person whom PFS expects to call as a witness at the hearing. For purposes of answering this interrogatory, the educational and scientific experience of expected witnesses may be provided by a resume of the person attached to the response.

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[1] Applicant's Objections and Non-Proprietary Responses to State's First Requests for Discovery, dated April 21, 1999, at 17.

APPLICANT'S RESPONSE: The Applicant supplements its response to the State's First Discovery Requests by identifying the following additional persons whom the Applicant expects to call as witnesses at the hearing with respect to the State's admitted contentions. The Applicant is still in the process of identifying witnesses that it expects to call at the hearings and will supplement this response in accordance with 10 C.F.R. § 2.740(e).

Utah E – Financial Assurance

Name and Address:	Joseph. F. Gase Stone and Webster 7677 East Berry Avenue Englewood, CO 80111
Profession:	Manager, Project Controls & Resource Staffing
Employer:	Stone and Webster Engineering Corporation
Professional Expertise:	Construction Cost Estimation
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	None
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Construction cost estimates for the PFSF. Mr. Gase will testify concerning the costs of constructing the PFSF.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Mr. Gase will include the PFS License Application and Safety Analysis Report, PFS budget estimates, RAI responses pertaining to financial assurances, and documents pertaining to the cost of

	constructing the PFSF. In addition, Mr. Gase may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.
Name and Address:	Jon K. Kapitz
Profession:	Project Manager, Dry Cask Storage
Employer:	Northern States Power Company
Professional Expertise:	Operation and Maintenance of Independent Spent Fuel Storage Facilities.
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	To be provided later.
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Cost estimates for operating and maintaining the PFSF. Mr. Kapitz will testify concerning the costs of operating and maintaining the PFSF.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Mr. Kapitz will include the PFS License Application and Safety Analysis Report, PFS budget estimates, RAI responses pertaining to financial assurances, and documents pertaining to the cost of operating and maintaining the PFSF. In addition, Mr. Kapitz may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.

Utah H – Inadequate Thermal Design

Name and Address:	Dr. Indresh Rampall Holtec International 555 Lincoln Drive West Marlton, NJ 08053
Profession:	Chemical Engineer
Employer:	Holtec International
Professional Expertise:	Process Design and Evaluation
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Thermal analysis of the HI-STORM storage cask for PFS site. Dr. Rampall will testify to the methods and results of the thermal analysis of the HI-STORM storage cask to account for second order thermal effects, such as solar insolation of the concrete pads and radiant heating by adjacent casks.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Dr. Rampall will include the PFS Safety Analysis Report, RAI responses concerning the thermal analysis, and Holtec's analyses of second order thermal effects. In addition, Dr. Rampall may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.
Name and Address:	Stephen Vigeant 245 Summer Street Boston, MA 02210
Profession:	Meteorologist

Employer:	Stone and Webster Engineering Corporation
Professional Expertise:	Meteorology
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience as expert in last four years:	See Attached Resume
Subject matter of testimony:	Skull Valley expected temperatures. Mr. Vigeant will testify concerning the expected temperatures in the Skull Valley as they relate to the design basis temperatures for the cask storage systems to be used at the PFSF.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Mr. Vigeant will include the PFS Safety Analysis Report, Environmental Report and temperature records relevant to Skull Valley. In addition, Mr. Vigeant may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.

Utah K – Credible Accidents

Name and Address:	George F. A. Wagner c/o Burdeshaw Associates, Ltd. 4701 Sangamore Road Bethesda, MD 20816
Profession:	Rear Admiral, USN (Ret.)
Employer:	Burdeshaw Associates
Professional Expertise:	Cruise Missile Weapon Systems
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume

Publications in the last ten years:	None
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Cruise missile operations. Adm. Wagner will testify concerning testing, operations and reliability of cruise missiles as such relates to the PFSF.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Adm. Wagner will include the Safety Analysis Report, PFS RAI responses concerning cruise missiles, and documents obtained from the U. S. Armed Forces concerning cruise missiles. In addition, Adm. Wagner may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.

Utah L - Geotechnical

Name and Address:	Dr. C. Allin Cornell 110 Coquito Way Portola Valley CA 94028
Profession:	Professor (Research)
Employer:	Stanford University
Professional Expertise:	Probabilistic Methods
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience as expert in last four years:	Testimony before California Earthquake Authority, July 1997.

Subject matter of testimony:	Probabilistic Seismic Hazards Analysis. Dr. Cornell will testify concerning the appropriateness of the probabilistic methods used by PFS to develop its seismic analysis.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Dr. Cornell will include the PFS Safety Analysis, seismic RAI responses, studies performed by PFS's consultants, including the probabilistic seismic hazards analysis, and standard handbooks (including his own) on probabilistic methods. In addition, Dr. Cornell may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.
Name and Address:	Paul Trudeau Stone & Webster 245 Summer Street Boston, MA 02210
Profession:	Geotechnical Engineer
Employer:	Stone and Webster Engineering Corporation
Professional Expertise:	Soils and Geotechnical Engineering
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience in last four years:	None
Subject matter of testimony:	Soils and geotechnical issues. Mr. Trudeau will testify to the soil and geotechnical conditions at the PFS facility, as they relate to the design of foundations and structures at the PFSF, and the methods used to determine the soil and geotechnical conditions at the PFSF site.

Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Mr. Trudeau will include the PFS Safety Analysis Report, Environmental Report, RAI responses pertaining to geotechnical and soils issues, geotechnical and soils analyses performed, and related reports prepared, by Stone & Webster and other PFS consultants. In addition, Mr. Trudeau may review and rely upon documents produced by the State, including as well as any new information that may come into PFS's possession, including responses to discovery requests.
Name and Address:	Dr. Thomas Chang Stone & Webster 245 Summer Street Boston, MA 02210
Profession:	Geotechnical Engineer
Employer:	Stone and Webster Engineering Corporation
Professional Expertise:	Soils and Foundation Engineering
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Soils and related geotechnical issues. Dr. Chang will testify to the soil and geotechnical conditions at the PFS facility, as they relate to the design of foundations and structures at the PFSF, and the methods used to determine the soil and geotechnical conditions at the PFS site.
Documents reviewed	

and/or relied upon:	The documents reviewed and relied upon by Dr. Chang will include the PFS Safety Analysis Report, Environmental Report, RAI responses pertaining to geotechnical and soils issues, geotechnical and soils analyses performed, and related reports prepared, by Stone & Webster and other PFS consultants. In addition, Dr. Chang may review and rely upon documents produced by the State, as well as any new information that may come into PFS's possession, including responses to discovery requests.

Utah R – Emergency Plan

Name and Address:	Kenneth W. Dungan Risk Technologies, LLC 1310 Centerpoint Boulevard Knoxville, TN 37932
Profession:	Risk Management Engineer
Employer:	Risk Technologies, LLC
Professional Expertise:	Risk Management, Fire Protection and Emergency Preparedness, including fire-fighting capability.
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Fire protection at the PFSF. Mr. Dungan will testify concerning potential fires at the PFSF, PFS's fire protection practices and procedures, and PFS's fire-fighting capability.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Mr. Dungan will include the PFS Safety

	Evaluation Report, RAI responses prepared by PFS, and standard industry handbooks on fire protection. In addition, Mr. Dungan may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.

Utah S - Decommissioning

Name and Address:	Thomas LaGuardia TLG Services 148 New Milford Road East Bridgewater, CT 06752
Profession:	Consultant
Employer:	TLG Services
Professional Expertise:	Decommissioning Cost Estimation
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume (to be updated later)
Publications in the last ten years:	See Attached Resume (to be updated later)
Testifying experience in last four years:	See Attached Resume (to be updated later)
Subject matter of testimony:	Decommissioning cost estimates for the PFSF. Mr. LaGuardia will testify concerning the costs of decommissioning the PFSF.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Mr. LaGuardia will include the License Application and Safety Analysis Report, NRC regulations and regulatory guides and documents relating to the cost of decommissioning the PFSF. In addition, Mr. LaGuardia may review and rely upon documents produced by the State as well as

any new information that may come into PFS's possession.

Utah GG – Cask-Pad Stability

Name and Address:	Dr. Alan Soler Holtec International 555 Lincoln Drive West Marlton, NJ 08053
Profession:	Mechanical Engineer
Employer:	Holtec International
Professional Expertise:	Mechanical design and dynamics of spent fuel casks and fuel racks.
Educational, Scientific Experience, and Professional Qualifications:	See Attached Resume
Publications in the last ten years:	See Attached Resume
Testifying experience as expert in last four years:	None
Subject matter of testimony:	Coefficient of Friction used in Analysis of TranStor Cask Stability. Dr. Soler will testify concerning the coefficient of friction used in analyzing the stability of the TranStor storage case during seismic events.
Documents reviewed and/or relied upon:	The documents reviewed and relied upon by Dr. Soler will include the Safety Analysis Report, the PFSF Site Specific Cask Stability Analysis for the TranStor Storage Cask (and documents referenced therein), previous cask stability analysis of the TranStor and Hi-Storm casks, and information supplied by PFS on model input values. In addition, Dr. Soler may review and rely upon documents produced by the State as well as any new information that may come into PFS's possession.

GENERAL INTERROGATORY NO. 4. For each admitted Utah contention, identify the qualifications of each expert witness whom PFS expects to call at the hearing, including but not limited to a list of all publications authored by the witness within the preceding ten years and a listing of any other cases in which the witness has testified as an expert at a trial, hearing or by deposition within the preceding four years.

APPLICANT'S RESPONSE: See Response to General Interrogatory 3 above. The Applicant is still in the process of identifying expert witnesses that it expects to call at the hearings and will supplement this response in accordance with 10 C.F.R. § 2.740(e).

GENERAL INTERROGATORY NO. 5. For each admitted Utah contention, describe the subject matter on which each of the witnesses is expected to testify at the hearing, describe the facts and opinions to which each witness is expected to testify, including a summary of the grounds for each opinion, and identify the documents (including all pertinent pages or parts thereof), data or other information which each witness has reviewed and considered, or is expected to consider or to rely on for his or her testimony.

APPLICANT'S RESPONSE. See Applicant's Response to General Interrogatory No. 3 above. Pursuant to subsequent discussion and agreement with counsel for the State of Utah, Applicant will identify and/or provide copies of documents relied upon, or expected to be relied upon, by Applicant's experts.

Respectfully submitted,

Jay E. Silberg
Ernest L. Blake, Jr.
Paul A. Gaukler
SHAW PITTMAN
2300 N Street, N.W.
Washington, DC 20037
(202) 663-8000
Counsel for Private Fuel Storage L.L.C.

Dated: December 10, 1999

December 10, 1999

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

DECLARATION OF PAUL A. GAUKLER

Paul A. Gaukler states as follows under penalties of perjury:

1. I am with Shaw Pittman in Washington, D.C.

2. I am duly authorized to verify Applicant's Third Supplemental Response to State's First Requests for Discovery; specifically, those supplemental responses to General Interrogatory Nos. 3-5.

3. I certify that the statements in such responses are true and correct to the best of my personal knowledge and belief.

I declare under penalty and perjury that the foregoing is true and correct.

Executed on December 10, 1999.

Paul Gaukler

Paul A. Gaukler

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of Applicant's Third Supplemental Response to State's First Requests for Discovery, Declaration of Paul Gaukler, and the attached resumes were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. mail, first class, postage prepaid, this 10th day of December 1999, except for the resumes of RADM George F. A. Wagner, USN (Ret.) and Kenneth W,. Dungan, P.E., which have been served by facsimile with conforming copies sent by first class U.S. mail.[2]

G. Paul Bollwerk III, Esq., Chairman
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: GPB@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: JRK2@nrc.gov; kjerry@erols.com

[2] The resumes of RADM George F. A. Wagner, USN (Ret.) and Kenneth W. Dungan, P.E. have not been sent by facsimile to counsel for OGD and the Skull Valley Band pursuant to previous requests not to have materials sent to them by facsimile.

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: PSL@nrc.gov

* Susan F. Shankman
Deputy Director, Licensing & Inspection
Directorate, Spent Fuel Project Office
Office of Nuclear Material Safety &
Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications
Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

* Adjudicatory File
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
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160 East 300 South, 5th Floor
P.O. Box 140873
Salt Lake City, Utah 84114-0873
e-mail: dchancel@state.UT.US

John Paul Kennedy, Sr., Esq.
Confederated Tribes of the Goshute
Reservation and David Pete
1385 Yale Avenue
Salt Lake City, Utah 84105
e-mail: john@kennedys.org

Joro Walker, Esq.
Land and Water Fund of the Rockies
2056 East 3300 South, Suite 1
Salt Lake City, UT 84109
e-mail: joro61@inconnect.com

Diane Curran, Esq.
Harmon, Curran, Spielberg &
Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
e-mail:DCurran.HCSE@zzapp.org

Danny Quintana, Esq.
Skull Valley Band of Goshute Indians
Danny Quintana & Associates, P.C.
68 South Main Street, Suite 600
Salt Lake City, Utah 84101
e-mail: quintana@xmission.com

Richard E. Condit, Esq.
Land and Water Fund of the Rockies
2260 Baseline Road, Suite 200
Boulder, CO 80302

* By U.S. mail only

Paul A. Gaukler

Resume of

Joseph F. Gase

November 1999

JOSEPH F. GASE

MANAGER
PROJECT CONTROLS & RESOURCE STAFFING

EDUCATION

Indiana Institute of Technology - BS in Civil Engineering, 1971

LICENSES AND REGISTRATIONS

Engineer-in-Training - Indiana

EXPERIENCE SUMMARY

Mr. Gase is currently Manager of Project Controls and Resource Staffing for Stone & Webster's Denver Office. In this capacity, he is responsible for enhancing project performance by providing business and financial support, cost and schedule control and construction estimating services. He is also responsible for Denver Office resource planning and allocation. Mr. Gase has over 28 years of diversified experience in business and financial management, cost and scheduling, construction cost estimating, expenditure forecasting and field construction experience including craft supervision.

Currently, with a cadre of uniquely qualified and experienced professionals under his direction, Mr. Gase provides a wide variety of project support services including:

- Proposal strategies and commercial proposal preparation for both private sector clients and government agencies where knowledge and experience in government regulations, innovative pricing and various incentive arrangements have proved to be a critical success factor.
- Enhancing the financial performance of Denver Office projects by assisting project managers with improved project control techniques, effective contract change control, critical variance analyses and providing qualified business and contract support.
- Construction capital cost estimating services for both proposals and project specific tasks.
- Project cost control and planning and scheduling services.

JOSEPH F. GASE

DETAILED EXPERIENCE

STONE & WEBSTER APRIL 1971 to PRESENT

Stone & Webster - Denver, Colorado (February 1980 to present)

Resource Manager – June 1999

Division Manager, Project Controls - May 1991

Project Controls Supervisor – October 1989

Principal Cost & Estimating Engineer – July 1988
Assignments include:

- San Diego Gas & Electric Company
- R. L. Ferguson and Associates
- Department of Energy
- Wyoming Water Development Commission
- Garb Oil Corporation
- Western Fuels-Utah, Inc.
- Sunedco Coal Company
- Northern States Power Company
- Alaska Power Authority
- Northern States Power Company

Stone & Webster – Construction Department (April 1971 – January 1980)

City of Colorado Springs Department of Public Utilities,
Unit No. 1 R.D. Nixon Station (November 1977 – January 1980)
Colorado Springs, CO - 200 MW Fossil Plant
Senior Construction Engineer

Power Authority of the State of New York, (February 1975 - October 1977)
Consolidated Edison Central Station Unit No. 6
Astoria, New York - 900 MW Fossil Plant
Senior Planning Engineer -

Construction Department, Boston Office (May 1974 - Jan 1975)
Construction Planning Engineer

Virginia Electric and Power Company (April 1971 – April 1974)
Unit No. 3, Mt. Storm, West Virginia - 560 MW Fossil Plant.
Construction Planning Engineer

RESUME OF

JON KAPITZ

Jon K. Kapitz
Project Manager
Prairie Island Dry Cask Storage

EDUCATION

B.S. Nuclear Engineering, University of Wisconsin - 1980
M.S. Nuclear Engineering, University of Wisconsin - 1981

PROFESSIONAL EXPERIENCE

Project Manager, Prairie Island Dry Cask Storage
1992 to present

Responsible for overall project management of the Prairie Island Independent Spent Fuel Storage Installation. Work includes managing the licensing, fabrication/construction, training, startup, and operation of the Prairie Island Independent Spent Fuel Storage Installation, as well as preparing and managing the project's budget. Managed the successful startup and operation of the project in compliance with NRC (Part 72), State and local permits and regulations.

The Prairie Island ISFSI is a $44 million project.

Major Accomplishments

- Licensing the Prairie Island ISFSI with the NRC, the State of Minnesota Public Utilities Commission, and the Minnesota Legislature.
- Managing construction of the Prairie Island ISFSI.
- Developing procedures for cask loading and unloading.
- Training all site personnel involved in cask operations.
- Managing the startup and operation of the Prairie Island ISFSI .

Project Engineer, Northern States Power
1990-1992

Responsible for the oversight of all engineering and licensing activities for the TN-40 cask project. Also gave technical support to the cask designer in cask design and NRC application submittal.

Major Accomplishments

- Developed request for proposal for dry spent fuel storage technology.
- Worked with Transnuclear and Stone & Webster to prepare and submit a license application to the NRC for the Prairie Island ISFSI.

Nuclear Engineer, Prairie Island Nuclear Generating Plant
1987-1990

Responsibilities included the following: system engineer for spent fuel pool cooling, reactor engineer for Unit 1 reactor, and responsible engineer for fuel consolidation and dry cask storage projects. As system engineer for the spent fuel pool cooling system, responsible for coordinating all system operations and maintenance. As responsible engineer for fuel rod consolidation project, managed the operation of the fuel rod consolidation and waste reduction demonstration.

Major Accomplishments

- Managed the operation of the fuel rod consolidation and waste reduction project, which is the largest commercial fuel-rod consolidation demonstration in U.S.
- Responsible for replacement of spent fuel pool bridge crane with single failure proof system ($700,000 project).
- Obtained NRC Senior Reactor Operator License. 560 hours control room experience.

Nuclear Engineer, Nuclear Safety Analysis Dept. -Northern States Power
1983-1987

Responsible for reactor thermal hydraulic and transient calculations for the Prairie Island Nuclear Generating Plant.

Major Accomplishments

- Developed computational methods for thermal hydraulic analyses for the Prairie Island Nuclear Generating Plant.

Nuclear Engineer, Nuclear Core Analysis Dept. -Northern States Power
1981-1983

Responsible for core design and reactor physics calculations for the Prairie Island

Major Accomplishments

- Designed Prairie Island Unit 1 core
- Prepared Prairie Island Unit 2 Cycle 7 Startup and Operations Report

LICENSES

Registered Professional Engineer - Minnesota
Senior Reactor Operator License - Prairie Island (Inactivated-1991)

PROFESSIONAL MEMBERSHIPS/ACTIVITIES

American Nuclear Society
EPRI Fuel Reliability, Storage, and Disposal Steering Committee
NEI Dry Cask Storage Issues Task Force
American Nuclear Society

CONTINUEING EDUCATION

Minnesota Management Institute – University of Minnesota Carlson School of Management, Executive Development Center - 1999

Resume of

Indresh Rampall, Ph.D.

RESUME

INDRESH RAMPALL, Ph.D.

PRINCIPAL ENGINEER
HOLTEC INTERNATIONAL

EDUCATION

Ph.D. in Chemical Engineering
University of Notre Dame (1992), GPA 3.97/4.0

M.S. in Chemical Engineering
University of Notre Dame (1989), GPA 4.0/4.0

B. Tech in Chemical Engineering
Indian Institute of Technology (1978), Grade A2

PROFESSIONAL EXPERIENCE

HOLTEC INTERNATIONAL

April 1993 - Present — Principal Engineer

Heat exchange, steam generation and fuel pool cooling system design, licensing and consulting.

CLARKSON UNIVERSITY
Potsdam, NY

September 1992 - April 1993 — Research Associate

ENGINEERS INDIA LIMITED (EIL)
New Delhi, India

1978 - 1987 — Senior Engineer, Research and Development Department

A major consultancy and project engineering company in the refineries, petrochemicals and on- and off-shore exploration.

EXPERIENCE SUMMARY

- Process Design and Development Experience

  1. Process design work including Heat and Material Balance Calculations, preparation of Process Flow and P&I Diagrams, Specifications for Process Instruments, Pumps and Equipment (Pressure Vessels, Heat Exchangers, etc.). Also prepared Operations Manuals for start-up, operations, shutdown, emergency procedures and plant safety.

2. Developed process models for design of two-phase flow high pressure pipelines from off-shore platforms.

3. Developed steady state and dynamic process design models of heterogeneous fixed bed catalytic reactors used in refineries and petrochemical plants. The models were used to analyze industrial and pilot-plant data for the o-xylene and ethylene oxidation reactors to develop a complete reactor simulation model.

4. Development of a process design and simulation model for the zeolites based ZSM-5 catalyst used in the xylenes isomerization reactor for a large petrochemical complex. Appointed as the lead process engineer for planning of bench scale experiments at plant site as well as analysis of data to obtain a detailed kinetic model of the process.

Chemical Process Plant Experience

1. Appointed as the *lead process engineer* for development of the Ethylene epoxidation technology. Completed the process design, construction supervision and operation of a highly automated, full-scale, single tube, medium pressure, pilot plant for the catalytic oxidation of ethylene to ethylene oxide. Highly experienced with hands-on work involving process instrumentation, continuous on-line analyzers as well as process gas chromatographs. Developed process models from statistical analysis of pilot-plant data to evaluate catalyst/reactor performance.

2. Commissioning of a 25 million lbs/yr industrial plant for the production of phthalic anhydride by oxidation of o-xylene. Worked in pre-commissioning activities, preparation for start-up, establishing stable and safe operating conditions and guarantee test runs to meet all process specifications for yield and purity of products.

PhD Thesis Title and Summary of Research

Shear induced structure and migration in non-colloidal suspensions

1. *Experimental determination of the pair distribution function for a suspension of spheres in simple shear flow*

   A new direct flow visualization technique, employing a thin sheet of laser light, is developed for imaging the interior of suspensions. This is combined with a novel pattern recognition algorithm to simultaneously locate the position and size of particles in a dynamic cross-section of a suspension of 3 mm acrylic spheres sheared in a flow visualization apparatus. Fundamental information on the nature of particle interactions and the suspension micro-structure is obtained. In addition to direct applications in predicting rheological properties of the suspension such as the bulk viscosity, we also gain insight into the more complex phenomena such as normal stress differences, anisotropy, particle migration, etc.

2. *The influence of shear induced migration on turbulent resuspension*

   A new model is proposed to predict the condition when particles are first ejected from the viscous sub-layer of a fluid flowing over a settled layer of particles into the

turbulent core of the fluid. The resuspension process is modelled in terms of a set of non-linear integro-differential convection-diffusion equations with moving singular boundaries. The equations are discretized and solved as a large set of *dense* differential and algebraic equations using the DASSL solver on the Convex mini-supercomputer.

Important Applications of PhD Research

- Knowledge of the micro-structure (i.e., the local arrangement and orientation of particles) has important applications in the area of Rheology of Suspensions and mechanical properties of Filled Polymer Composites. The bulk properties of the suspension such as effective viscosity, thermal and electrical conductivities are strongly influenced by this local distribution of particles.

- In the area of Multi-Phase Flow, the resuspension and transport of an initially settled bed of particles due to turbulent flow of fluid is solved. This work has applications in viscous systems such as flow of coal-oil slurry or drilling muds.

- Solved the mass transfer due to turbulent eddies near a wall in sedimenting systems. The model is applicable for the analysis of the improved performance of cross-flow microfiltration of suspended particles as well as in ultrafiltration of large molecular species. Increased mass fluxes can be obtained due to an induced secondary eddy flow in the near wall region.

Computational Experience

Developed programs in Fortran and C for solving complex engineering problems using advanced numerical techniques on a variety of hardwares - IBM, Vax, Convex, and Sun workstations - and operating systems - DOS, VAX/VMS, Unix, etc.

Supercomputer Training

Undertaken special training programs to take advantage of the Convex vectorization support in Fortran. Familiar with programming techniques on the massively parallel Connection Machine.

Patent

An improved process scheme for production of phthalic anhydride by oxidation of o-xylene in multistage reaction systems, by I. Rampall, A. Datta and P.K. Mukhopadhayay, Patent application in India (submitted).

PUBLICATIONS

1. *Measurement of the shear-induced microstructure of concentrated suspensions of non-colloidal spheres*, by D.T. Leighton and I. Rampall, Review paper in "Particulate Two-Phase Flow", M. Roco (editor), Butterworths, (1993).

2. *The influence of shear induced migration on turbulent resuspension*, by I. Rampall and D.T. Leighton, Submitted to the Int. J. of Multiphase Flow, (1992).

3. *The influence of surface roughness on the pair-particle distribution function in dilute suspensions of non-colloidal spheres in simple shear flow*, by I. Rampall, J.R. Smart, D.T. Leighton, Submitted to the Journal of Fluid Mechanics, (1992).

4. *Studies in reactor configuration for phthalic anhydride production*, by I. Rampall, A. Datta and P.K. Mukhopadhayay, "Frontiers in Chemical Reaction Engineering", vol. II, L.K. Doraiswamy and R.A. Mashelksar (Editors), 241-258, John Wiley and Sons, (1984).

5. *Parameter estimation and simulation of multi-tubular ethylene oxide reactor*, by R. Aggarwal, I. Rampall and A. Datta, "Recent Trends in Chemical Reaction Engineering", vol. II, B.D. Kulkarni, R.A. Mashelkar and M.M. Sharma (Editors), 360-374, Wiley Eastern, (1987).

PRESENTATIONS

1. *Flow driven by oscillatory gravitational fields in a vertical channel wall effects*, by I. Rampall and R. Shankar Subramanian, First international workshop on g-jitter, Clarkson University, Potsdam, NY (June 13-18, 1993).

2. *A direct flow visualization method to study the shear-induced microstructure of non-colloidal suspensions*, by I. Rampall, Invited seminar talk at Clarkson University, Potsdam, NY (1993).

3. *Particle dynamics near a solid wall in concentrated suspensions of non-colloidal spheres*, by G. Krishnan, I. Rampall and D.T. Leighton, Presented at the AIChE Annual meeting in Miami, FL (1992).

4. *The influence of shear induced migration on turbulent resuspension*, by I. Rampall and D.T. Leighton, Presented at the AIChE Annual meeting in Los Angeles, CA (1991).

5. *On the pair-particle distribution function in dilute suspensions of non-colloidal spheres in simple shear flow*, by I. Rampall, J.R. Smart and D.T. Leighton, Paper presented at the AIChE Annual meeting in Chicago (1990).

Resume of

Stephen A. Vigeant

Stephen A. Vigeant

Air Quality Meteorologist

Years Experience (as of October 1999)

At Stone & Webster: 23 With other Firms: 2

Division/Department/Location

Government/Environmental Sciences & Engineering - 042/Boston

Professional History

Stone & Webster Engineering Corporation, Boston, Massachusetts - 1976 to Present
The Pennsylvania State University, University Park, Pennsylvania - 1975 to 1976
The Center for the Environment and Man, Hartford, Connecticut - 1973 to 1973

Major Accomplishments

Author of a chapter on dispersion modeling for hazardous chemical consequence assessments (Chemical Plume Dispersion Analysis) of a Stone & Webster book entitled "Risk Assessment and Risk Management for the Chemical Process Industry."

Areas of Expertise

- Air Quality Permitting, Dispersion Analyses, and Clean Air Act Consulting.
- Meteorological/Climatological Consulting.
- Hazardous Chemical Consequence Assessments.
- Nuclear Power Plant Licensing and Emergency Planning Activities.
- Cooling Tower Environmental Impact Studies.

Division/Department Assignments

Environmental Sciences & Engineering (May 1989 to May 1991)

Dispersion Modeler

Experience Summary

Mr. Vigeant has 23 years of experience in environmental impact assessment and licensing, specifically in the fields of atmospheric dispersion analyses, climatological/field studies, air quality permitting and studies, hazardous chemical consequence assessments, cooling tower impact studies, and nuclear power plant licensing.

As a Lead Environmental Scientist, he has provided the regulatory interface, performed impact analyses, and prepared air permit applications for utility, cogeneration, pulp and paper, municipal, and industrial clients. Included in this work has been the interpretation of state (SIP) and federal (Clean Air Act) regulations, interaction with state and federal regulatory agencies to define requirements, assessment of pollution control technologies (BACT/MACT), performance of dispersion modeling analyses and impact assessments using a variety of EPA-approved models and preparation of applications for state, PSD, and Title V operating permits. Also included has been the preparation of air quality impact assessment sections for environmental impact reports and statements (EIR/EIS), project feasibility studies, and independent review studies as well as the performance of air quality audits at various facilities, "due diligence" reviews, and general air quality (Clean Air Act) consulting (non-attainment review, acid rain, air toxics, permitting).

Mr. Vigeant has provided consulting services in the area of climatological analyses, design basis meteorological investigations (design snow/wind load, tornado/severe weather probabilities, probable maximum precipitation, wind roses, fastest mile wind determinations) meteorological monitoring, and meteorological field studies.

Other work has included assessments of the consequences of postulated accidental releases of toxic and/or explosive chemicals on plant personnel and structures as well as on the public for a variety of petrochemical and industrial clients. These assessments have involved defining the chemical release rate from a hypothesized accident scenario, determining the evolution rate of toxic/explosive vapors, analyzing the dispersion of the chemical plume using appropriate computer models that handle dense gas and/or neutrally buoyant gases (e.g., DEGADIS, SLAB, INPUFF2) and comparing dispersion results with appropriate health and/or explosive concentration criteria (TLV/STEL/IDLH/UEL/LEL).

Mr. Vigeant has also coordinated activities related to the preparation of radiological dispersion analyses, cooling tower environmental impact assessments, site hazard evaluations, design basis meteorological parameters, and climatological description sections for nuclear power plant projects. Included in these activities have been the preparation of climatological summaries for a given site, performance of radiological dispersion analyses using in-house computer programs for licensing and semi-annual report preparation, preparation of control room habitability studies, and modeling of cooling tower drift and visible plume impacts. Also included are the coordination of field studies in complex terrain to define dispersion patterns for emergency planning purposes, development of manual techniques to estimate dispersion of elevated releases, and participation as a controller in emergency planning drills and NRC-graded exercises.

Education

M.S. in Meteorology - The Pennsylvania State University, University Park, Pennsylvania - 1978
B.S. in Meteorology - Lowell Technological Institute, Lowell, Massachusetts - 1974

Publications

Carl A. Mazzola, Stephen A. Vigeant, and Don McCamy, "Application of ARCON96 Atmospheric Dispersion Model to Browns Ferry Nuclear (BFN) CREVS Intake X/Q Calculations". Presented at the Sixth Nuclear Utility Meteorological Data User Group (NUMUG) Meeting, Syracuse, NY, May 12-14, 1999.

Vigeant, S. and C. Wedig, "Biological Systems to Control Stack Gas Emissions". Presented at Bioeast 95: A Forum to Examine Non-Pharmaceutical Biotechnology, Washington, D.C., January 12, 1995.

Dunn, R., W. Frazier, and S.A. Vigeant, "NO_x Compliance Planning Considerations for Utilities Affected by Titles I and IV of the CAAA of 1990. Proceedings of the Electric Utility Congress '93, Boston, Massachusetts, June 15-16, 1993.

Vigeant, S. A., "Is Your Plant Ready to Comply With the Clean Air Act?". Presented at the 21st New England Plant Engineers Conference and Show, Newport, Rhode Island, May 6-8, 1992.

Vigeant, S.A., H.R. Greenberg, and J.J. Cramer; Chapter 10 "Chemical Plume Dispersion Analysis" of a book entitled "Risk Assessment and Risk Management for the Chemical Process Industry," Van Rostrand Reinhold, New York, New York, 1991.

Vigeant, S.A., J.J. Cramer, C.A. Mazzola, and K. Rao, "Atmospheric Impacts of Natural Draft Cooling Tower Emissions," American Power Conference, Chicago, Illinois, 1980.

Vigeant, S.A., C.A. Mazzola, T.J. Burda, and W.S. Novak, "An Emergency Preparedness Assessment Technique Considering Complex Valley Meteorology," American Nuclear Society, San Francisco, California, 1983

Vigeant, S.A. and C.A. Mazzola, "A Manual Overlay Dose Assessment Technique for Elevated Radioactive Releases," American Nuclear Society, San Francisco, California, 1985.

Vigeant, S.A. and A. Kasprak, "Determining the Impact of an Accidental Hazardous Chemical Release," Fifth Joint Conference on Applications of Air Pollution Meteorology, Chapel Hill, North Carolina, 1986.

Vigeant, S.A., and C.A. Mazzola, "Modeling the Impact of an Accidental Hazardous Chemical Release," Proceeding for the International Conference on Vapor Cloud Modeling, Sponsored by the Center for Chemical Process Safety, AIChE, Cambridge Massachusetts, 1987.

Vigeant, S.A. and S. Wiedenbaum, "Assessing the Consequences of Postulated Hazardous Chemical Accidents at an Ethylene Plant: A Case Study," AIChE Summer National Meeting, Denver, Colorado, 1988.

Security Clearances

Department of Energy (DOE), Savannah River Site, L-Clearance - 1986, Inactive

Computer Hardware/Software Capabilities

Mr. Vigeant has comprehensive knowledge of: IBM Mainframe, IBM-compatible PC, JCL, FORTRAN, MS-DOS, Windows 95, MS-Word, Excel Spreadsheet

Training

Making Effective Presentations, Stone & Webster - 1981
Time Management Workshop, Stone & Webster - 1982
Project Management Workshop, Stone & Webster - 1990

Licenses, Registrations, and Certifications

American Meteorological Society, Certified Consulting Meteorologist (CCM) - 1985, Active

Professional Affiliations

American Meteorological Society, Member
Air and Waste Management Association, Member
The Scientific Research Society of America (Sigma Xi), Associate Member

Experience History

STONE & WEBSTER ENGINEERING CORPORATION, BOSTON, MASSACHUSETTS - 1976 TO PRESENT

Environmental Assessments/Due Diligence Reviews (January 1997 to Present)
Electric Utility Clients
Lead Air Quality/Environmental Scientist

Title V Operating Permit Application Preparation (Jan 1998 to present)
Westchester County Department of Public Works - Grasslands Reservation
Lead Air Quality Scientist

Permitting for Wastewater Pumping Station Diesel Generator (June 1997 to April 1999)
Massachusetts Water Resources Authority, Intermediate Pump Station
Lead Air Quality Scientist

Permitting for Central Heating Plant Upgrade (November 1996 to present)
University of Connecticut, Storrs Campus
Lead Air Quality Scientist

Consequence Analysis - Thermoelectric Station (Aug 1996 to Oct 1996)
Companhia Siderurgica Nacional

Boston Extension Ramps Feasibility Study (Feb 1996 to Apr 1997)
Massachusetts Turnpike Authority
Lead Air Quality Scientist

Emissions Inventory for Title V Applicability (Aug 1995 to Dec 1995)
New Hampshire Army National Guard

Title V Operating Permit Assistance Work (Feb 1995 to Dec 1995)
Elrama, Cheswick, Brunot Island, and Phillips Plants - Duquesne Light Company
Task Manager

Title V Operating Permit Assistance Work (Apr 1994 to Aug 1994)
MacIntosh and Larsen Plants - Lakeland Electric & Water Utilities
Task Manager

Independent Reviews of Wind Energy Assessments (Feb 1995 to Sep 1995)
U.S. and European Wind Energy Parks - Confidential Clients

Mobile Source Air Quality Impact Assessment for DEIR/FEIR (Apr 1994 to Jan 1995)
Union Station Intermodal Transportation Center - Worcester Redevelopment Authority
Lead Air Quality Scientist

Air Quality Permitting Plan for Replacement Steam Station (Apr 1994 to Aug 1994)
Minot Street Station - Trigen-Boston Energy Corporation
Lead Air Quality Scientist

NO_x Compliance Planning (June 1994 to Nov 1994)
Elrama, Cheswick, Brunot Island, and Phillips Plants - Duquesne Light Company
Lead Air Quality Scientist

NO_x Compliance Planning (June 1994 to Nov 1994)
Cape Fear, Mayo, Roxboro, and Robinson Generating Stations - Carolina Power & Light
Lead Air Quality Scientist

NO_x RACT Emission Control Plan (June 1994 to Nov 1994)
Amherst Campus - University of Massachusetts
Lead Air Quality Scientist

NO_x RACT Compliance Plan (May 1994 to Aug 1994)
Fairfield Hills Hospital - Connecticut Department of Mental Health
Lead Air Quality Scientist

FGD Scrubber Retrofit Project Permitting (June 1991 to Nov 1991)
Petersburg Generating Station - Indianapolis Power & Light
Lead Air Quality Scientist

Verification Inspection (June 1991)
Paducah Gaseous Diffusion Plant - U.S. Department of Energy
Lead Air Quality Scientist

Defense Waste Processing Facility (DWPF) Clean Air Act Amendments Compliance Appraisal (Dec 1990 to May 1991)
Savannah River Site - U.S. Department of Energy
Lead Air Quality Scientist

Complex Terrain Field Study (Dec 1982 to Dec 1983)
Zimmer Nuclear Power Station - Cincinnati Gas & Electric Company
Lead Meteorologist

Public Hearings on the Greene County Nuclear Power Plant and 700 MW Fossil Fueled Unit (Oct 1977 to Feb 1980)
Greene County Nuclear Power Station & 700 MW Fossil Fuel Fired Power Plant (Arthur Kill) - Power Authority of the State of New York
Meteorologist

Cooling Tower Drift and Plume Model Development (Aug 1976 to Dec 1977)
Greene County Nuclear Power Station & 700 MW Fossil Fuel Fired Power Plant (Arthur Kill) - Power Authority of the State of New York
Meteorologist

Specialized Assignments or Functions for Multiple Clients:
Control Room Habitability Studies

Assignments include:

- Lead Environmental Scientist (March 1999)
  Millstone Nuclear Power Station
  Northeast Utilities Service Company

- Lead Environmental Scientist (May 1997)
  Shearon Harris Nuclear Power Plant
  Carolina Power & Light Company

- Lead Environmental Scientist (Nov 1994 to Feb 1995)
  James A. FitzPatrick Nuclear Power Station
  New York Power Authority

- Lead Environmental Scientist (Nov 1991 to Jan 1992)
  Salem and Hope Creek Nuclear Generating Stations
  Public Service Electric and Gas Company

- Lead Environmental Scientist (June 1987 to Jan 1989)
  Comanche Peak Nuclear Generating Station
  Texas Utilities Electric

- Lead Environmental Scientist (Mar 1986 to June 1986)
  Oyster Creek Nuclear Generating Station
  GPU Nuclear

- Lead Environmental Scientist (Oct 1984 to June 1986)
  Indian Point 3
  New York Power Authority

- Lead Environmental Scientist (Jan 1986 to Mar 1986)
  James A. Fitzpatrick Nuclear Generating Station
  New York Power Authority

- Lead Environmental Scientist (Feb 1985 to Apr 1985)
  Nine Mile Point Unit 2
  Niagara Mohawk Power Corporation

- Lead Environmental Scientist (Mar 1981 to Dec 1981)
  Beaver Valley Power Station
  Duquesne Light Company

- Lead Environmental Scientist (Jan 1983 to Dec 1983)
  Shoreham Nuclear Power Station
  Long Island Lighting Company

Air Quality (Clean Air Act) Permitting
Assignment include:

- Lead Air Quality Scientist (June 1997 to Present)
  Braintree-Weymouth Intermediate Pump Station - Plan Approval Application
  Massachusetts Water Resources Authority

- Lead Air Quality Scientist (Aug 1995 to Present)
  Delaware City Compressor Station - State Permitting/FERC Filing
  Eastern Shore Natural Gas Company

- Lead Air Quality Scientist (Jan 1997 to Present)
  University of Connecticut Storrs Campus – Central Heating Plant Modeling
  University of Connecticut

- Lead Air Quality Scientist (Jul 1995 to Nov 1995)
  UCB Chemicals Corporation Radcure Unit (N. Augusta, SC) - Modeling
  UCB Chemicals Corporation

- Lead Air Quality Scientist (Jul 1994 to Present)
  Wells, Maine LNG Facility - State Permitting/Modeling/FERC Filing/Testimony
  Granite State Gas Transmission, Inc.

- Lead Air Quality Scientist (Feb 1993 Aug 1993)
  VPS Fiber Recycle Facility (Auburn, ME) - State Permitting/Modeling
  Auburn VPS Partnership, Ltd.

- Lead Air Quality Scientist (Aug 1992 to Nov 1992)
  Texas Cogeneration Project (Texas, MD) - PSD Permitting/Modeling
  United American Energy

- Lead Air Quality Scientist (Apr 1990 to Dec 1991)
  Fort Edward Cogeneration Project (Fort Edward, NY) - Permitting/Modeling
  United American Energy

- Lead Air Quality Scientist (Nov 1990 to Nov 1991)
  Vineland Cogeneration Project (Gas Turbine) - Modeling
  Cogeneration Partners of America

- Lead Air Quality Scientist (Oct 1989 to Jan 1992)
  Windsor Energy Improvement Project (Standby Diesel Generators) - Permitting/Modeling
  Aetna Life Insurance Company

- Lead Air Quality Scientist (Apr 1988 to Aug 1991)
  Wastewater Sludge Incinerator Retrofit Project - Permitting/Modeling
  Greater Lawrence Sanitary District

- Lead Air Quality Scientist (May 1991 to June 1991)
  Central Steam Facility Boiler Replacement (Oil-Fired Boilers) - Modeling
  Brookhaven National Laboratory

- Lead Air Quality Scientist (Mar 1989 to May 1989)
  Beckley Cogeneration Project (CFB Boiler) - Permitting/Modeling
  Beckley Cogeneration Company

- Lead Air Quality Scientist (Dec 1989 to Jan 1990)
  Cogeneration Facility Project (Gas Turbine) - Modeling
  City of Dover, Delaware

- Lead Air Quality Scientist (Dec 1987 to July 1988)
  RDX Expansion Project (Ammunition Facility) - Modeling
  U.S. Army

- Lead Air Quality Scientist (Oct 1988 to Nov 1988)
  Port Jefferson Power Station - GEP Stack Height Calc
  Long Island Lighting Company

- Lead Air Quality Scientist (Feb 1987 to Mar 1987)
  Piscataway Cogeneration Facility (Gas Turbine)
  Union Carbide

- Lead Air Quality Scientist (May 1986 to Jan 1988)
  Groton Cogeneration Project (Gas Turbine) - Permitting/Modeling
  Stone & Webster Development Corporation

- Lead Air Quality Scientist (Jan 1988 to Apr 1988)
  Dedado Unit 1 Gas Turbine - Permitting
  Guam Power Authority

- Lead Air Quality Scientist (May 1987 to May 1988)
  Boiler Oil Cap Relaxation - Modeling
  Eastern Fine Paper

- Lead Air Quality Scientist (Mar 1985 to Aug 1985)
  Boiler Coal Conversion Project - Complex Terrain Modeling
  Hammermill Paper Company

- Lead Air Quality Scientist (Mar 1982 to May 1982)
  Boiler Coal Conversion - Complex Terrain Modeling
  Eastern Fine Paper

- Lead Air Quality Scientist (Jan 1978 to Aug 1982)
  700 MW Coal/RDF Fired Power Plant - PSD Permit Modeling
  Power Authority of the State of New York

- Lead Air Quality Scientist (Jan 1980 to Apr 1980)
  Getty Methanol Plant
  Getty Oil Company

Air Quality (Clean Air Act) Impact Assessments for EIRs/EISs and Studies
Assignment include:

- Lead Air Quality Scientist (Apr 1999 to May 1999)
  Connecticut Light & Power - Environmental Regulatory Compliance Assessment
  Northeast Generation Company

- Lead Air Quality Scientist (Sep 1998 to October 1998)
  MidAmercan Energy - Air Quality Regulatory Compliance Assessment
  CalEnergy Company, Inc.

- Lead Air Quality Scientist (Aug 1998 to September 1998)
  Waukegan and Crawford Stations – Environmental Regulatory Compliance Assessment
  Commonwealth Edison

- Lead Air Quality Scientist (April 1998 to August 1998)
  Industrial Facility - Air Quality Regulatory Compliance Analysis
  Confidential Client

- Lead Air Quality Scientist (May 1997 to June 1997)
  Picatinny Arsenal Environmental Assessment - Air Quality Impact Assessment
  U. S. Army

- Lead Air Quality Scientist (Dec 1995 to Feb 1996)
  Belchatow Power Plant (Belchatow, Poland) - Dispersion Modeling (Stack Height) Study
  Community Energy Alternatives

- Regulatory Specialist (Nov 1995 to Dec 1995)
  Technical Background Document: NO_x/VOC Initiative 305 - NO_x Emissions Regulatory Programs
  Environment Canada

- Lead Air Quality Scientist (Apr 1994 to Jan 1995)
  Union Station Intermodal Transportation Center (Worcester, MA) - DEIR/FEIR Sections
  Worcester Redevelopment Authority

- Lead Environmental Scientist (June 1995 to June 1995)
  Solvay Paperboard Facility (Solvay, NY) - Dryer Fogging Assessment
  Solvay Paperboard Company

- Lead Air Quality Scientist (Feb 1995 to March 1995)
  Northside Generating Station (Jacksonville, FL) - HAP Emissions Study for Orimulsion
  Jacksonville Electric Authority

- Cooling Tower Impact Specialist (June 1992 to July 1992)
  Patriot Coal Fired Generating Station - PSD Application Cooling Tower Impacts
  Indianapolis Power & Light

- Lead Air Quality Scientist (June 1991 to Oct 1991)
  Aliveri 600 MW Power Plant - Environmental Assessment
  Public Power Corporation - Greece

- Lead Air Quality Scientist (June 1990 to June 1991)
  Combustion Turbine Siting Study - 20 Sites
  Allegheny Power System

- Lead Air Quality Scientist (Nov 1990 to May 1991)
  El-Kureimat Environmental Assessment - 600 MW Power Plant
  Egyptian Electricity Authority

- Lead Air Quality Scientist (July 1988 to Nov 1988)
  Gas Turbine Siting Study - 3 Sites
  Eastern Utilities Associates

- Lead Air Quality Scientist (May 1987 to July 1988)
  Deer Island Wastewater Treatment Plant Facilities Planning Report and EIS Section
  Massachusetts Water Resources Authority

- Lead Air Quality Scientist (June 1990 to Jan 1991)
  Fort Meade Energy Plant Environmental Assessment
  National Security Agency

- Lead Air Quality Scientist (Oct 1991 to Nov 1991)
  Cogeneration Feasibility Study
  TIMCO, Inc.

- Lead Air Quality Scientist (Feb 1990 to Jan 1992)
  Columbus Park Pumping Station - Permitting Consulting
  Boston Water & Sewer

- Lead Air Quality Scientist (Sept 1990 to Apr 1991)
  Gas Pipeline Compressor Station - Permitting Consulting
  Tennessee Gas Pipeline

- Lead Air Quality Scientist (May 1990)
  NSPS Consulting
  Puerto Rico Power Authority

- Lead Air Quality Scientist (Nov 1989)
  Commuter Rail Extension Feasibility Study - Air Quality Impacts
  Massachusetts Bay Transportation Authority

- Lead Air Quality Scientist (May 1988 to Dec 1988)
  Ohio-Ontario Clean Fuels Project - EIS
  Ohio-Ontario Clean Fuels

- Lead Air Quality Scientist (Sept 1988)
  GEP Stack Height Calculation
  United Illuminating

- Lead Air Quality Scientist (Jan 1988)
  Air Intake Design Consulting - Cavity Analysis
  Colombia University

- Lead Air Quality Scientist (Sept 1982 to Dec 1982)
  800 MW Fossil Fueled Unit - Environmental Report Section
  ARAMCO/SCECO

- Lead Air Quality Scientist (Sept 1982 to Oct 1982)
  Mystic Station Coal Conversion Project - EIS Section on Acid Rain
  Boston Edison Company

- Lead Air Quality Scientist (Sept 1979 to Dec 1979)
  Mason Station Coal Conversion - Complex Terrain Modeling
  Central Maine Power

- Lead Air Quality Scientist (June 1979)
  Edgar Station Coal Conversion - Coal Pile Fugitive Dust Calculation
  Boston Edison Company

Hazardous Chemical Consequence Assessments
Assignments include:

- Lead Environmental Scientist (Aug 1996 to Oct 1996)
  Consequence Analysis for Coke Oven Gases- Thermoelectric Station
  Companhia Siderurgica Nacional

- Lead Environmental Scientist (Oct 1992 to Feb 1993)
  Ammonia and NO_x Emissions Hazard Assessment - Idaho Chemical Processing Plant
  Idaho National Engineering Laboratory

- Lead Environmental Scientist (May 1991)
  Propane Tank Explosion Analysis
  Brookhaven National Laboratory

- Lead Environmental Scientist (Jan 1990 to Apr 1990)
  Anhydrous Ammonia Storage Tank Design Study - Lakeview Generating Station
  Ontario-Hydro

- Lead Environmental Scientist (May 1989 to Oct 1989)
  Chemical Plant Toxic Impact Assessment
  Sybron, Inc.

- Lead Environmental Scientist (Aug 1988 to Sept 1988)
  Chemical Plant Toxic Consequence Assessment
  CIBA-GEIGY

- Lead Environmental Scientist (July 1986 to Aug 1986)
  Ammonia Storage Tank Consequence Assessment
  Sigma Instruments

- Lead Environmental Scientist (Aug 1988 to Sept 1988)
  Chemical Plant Toxic Consequence Assessment
  Hercules, Inc.

- Lead Environmental Scientist (Mar 1987 to Apr 1987)
  Fort McMurray Plant Toxic/Explosive Consequence Assessment
  Syncrude Canada, Ltd.

- Lead Environmental Scientist (Dec 1985 to Apr 1986)
  Maharashtra Gas Cracker Complex Explosion Analysis
  Indian Petrochemical Corporation, Ltd.

- Lead Environmental Scientist (May 1985 to July 1985)
  Marcus Hook Facility Explosion Analysis
  Sun Oil Company

- Lead Environmental Scientist (Nov 1986 to Dec 1986)
  Marcus Hook Facility Explosion Analysis
  BP Oil Company

Nuclear Power Plant Licensing Activities
Assignment include:

- Lead Meteorologist (April 1998 to July 1999)
  Millstone Nuclear Power Station - Control Room and Site Boundary X/Q Calculations
  Northeast Utilities

- Lead Meteorologist (April 1998 to July 1998)
  Brown's Ferry Nuclear Power Station - Control Room and Site Boundary X/Q Calculations
  Tennessee Valley Authority

- Lead Meteorologist (Sep 1996 to Present)
  Private Fuel Storage Facility - ER/SAR Meteorology and Air Quality Sections
  Private Fuel Storage, LLC

- Lead Meteorologist (Jan 1996 to March, 1996)
  Goodhue County Independent Spent Fuel Storage Installation- ER Meteorology Section
  Northern States Power

- Lead Meteorologist (Nov 1987 to Jan 1992)
  River Bend Nuclear Power Station - Semi-Annual Report
  Gulf States Utilities

- Lead Meteorologist (Feb 1987 to Mar 1987)
  Pilgrim Nuclear Station - Semi-annual Report
  Boston Edison Company

- Lead Meteorologist (May 1977 to Aug 1987)
  Beaver Valley Power Station - Licensing
  Duquesne Light Company

- Lead Meteorologist (Jan 1981 to Aug 1984)
  Nine Mile Point Unit 2 - Licensing
  Niagara Mohawk Power Corporation

- Lead Meteorologist (Aug 1976 to Oct 1977)
  Greene County Nuclear Power Plant - Cooling Tower Impacts
  New York Power Authority

- Lead Meteorologist (Sept 1984 to Sept 1987)
  Peach Bottom Atomic Power Station - Emergency Planning Drill Controller (6)
  Philadelphia Electric Company

- Lead Meteorologist (Mar 1987 to Dec 1989)
  Savannah River Site - Emergency Planning Drill Controller (3)
  U.S. Department of Energy

- Lead Meteorologist (Nov 1985 to Dec 1990)
  Shoreham Nuclear Power Station - Emergency Planning Drill Controller (20)
  Long Island Lighting Company

Testimony Experience

Construction Permit Application Public Hearing, Delaware City Compressor Station
New Castle, Delaware (May 9, 1996)
Eastern Shore Natural Gas Company

Maine Board of Environmental Protection Public Hearing, Wells, Maine LNG Facility
Wells, Maine (March 6, 1996)
Granite State Gas Transmission, Inc.

Resume of

RADM George F.A. Wagner, USN (Ret.)

RADM George F. A. Wagner, USN (Ret.)

Rear Admiral George Wagner retired from active duty in 1998 after 38 years of service in the Navy as a Surface Warfare Officer and acquisition professional. He served at sea up through command of a SPRUANCE class ASW destroyer and ashore in several major acquisition program positions during eighteen years of duty in Washington, DC.

His specialties are C^4, ISR, cruise missiles, unmanned aerial vehicles, and command and control systems at the tactical and strategic levels.

Admiral Wagner's last assignment from 1995 to 1998 was as Commander of the Space and Naval Warfare Systems Command (SPAWAR), an organization of 7,000 people with an annual budget of about $3.0B. In this position, he was responsible for the design, development, procurement, installation and support of the Navy's command, control and communications systems, the information technology infrastructure, space based systems, undersea surveillance systems, and force level systems engineering. He also successfully relocated the 1,000 person SPAWAR Headquarters from Washington, DC to San Diego, CA. as part of Base Realignment and Closure (BRAC-95) during this tour of duty.

From 1991 to 1995, he was Program Executive Officer for the Cruise Missile programs and Joint Unmanned Aerial Vehicles programs. As PEO (CU), he was responsible for ten major programs, including the TOMAHAWK cruise missile, Harpoon anti-ship cruise missile, Standoff Land Attack Missile (SLAM), Tri-Service Standoff Attack Missile (TSSAM), the mission planning systems for these cruise missiles, all Navy Aerial Target programs, and the design, development, procurement and fielding of all DoD Unmanned Aerial Vehicle (UAV) systems.

From 1990 to 1991, Admiral Wagner was the Force Warfare Systems Engineer for the Navy, responsible for developing force and theater level technical and interface standards to ensure interoperability of Navy, joint and allied systems. This followed a brief assignment as a Manager and Director of the Navy's Acquisition Professional Personnel program.

From 1987 to 1989, he served as the Assistant Chief of Naval Research with management responsibilities for the Navy's 6.1 and 6.2 Tech Base programs.

Admiral Wagner was the Ship Launched TOMAHAWK Program Manager from 1983 to 1987 during the crucial development, test and fielding period for this then new system. As Program Manager he fielded the first Navy nuclear weapon system in twenty years, TOMAHAWK Land Attack Missile, Nuclear (TLAM/N), the anti-ship version of TOMAHAWK with a radar seeker, and the conventional TLAM which has been used several times this decade in Iraq.

Earlier tours of duty included engineering officer afloat, and maintenance, repair and overhaul coordinator for a Type Commander, with additional responsibility for all new ship construction and conversion programs.

Education: B.Sc., U.S. Naval Academy
M.S., Naval Architecture/Marine Engineering, Massachusetts Institute of Technology

Resume of

C. Allin Cornell

C. ALLIN CORNELL

EDUCATION:

Stanford University, Architecture	AB	1960
Stanford University, Civil Engineering (Structures)	MS	1961
Stanford University, Civil Engineering (Structures)	PhD	1964
Doctoral Thesis: "Stochastic Process Models in Structural Engineering"		

PROFESSIONAL EMPLOYMENT:

Stanford University :	Acting Assistant Professor	1963-1964
Universidad Nacional Autonoma de Mexico :	Visiting Professor	Summer 1966
University of California, Berkeley :	Visiting Associate Professor	1970-1971
Basler and Hofmann, Zurich:	Research Engineer	Summer 1972
Laboratorio Nacional de Engenharia Civil, Lisbon:	Visiting Research Investigator	1974-1975
Massachusetts Institute of Technology:	Assistant Professor and Ford Post-Doctoral Fellow	1964-1966
	Assistant Professor	1966-1968
	Associate Professor	1968-1974
	Holder of Gilbert Winslow Career Development Chair	1971-1974
	Professor	1974-1983
Stanford University :	Visiting Professor	1981-1983
	Professor - Half-Time	1983-present
	Co-Director, Reliability of Marine Structures Program	1988-present
	Fellow, SU-USGS Institute on Earthquake Engineering and Seismology	1988-present
Consulting Practice:	Part-Time	1965-1981
	Half-Time	1981-present
Cygna, Inc., San Francisco	Senior Vice President	1984-1985
C. Allin Cornell, Co.	President	1981-present

PROFESSIONAL ORGANIZATIONS AND COMMITTEES (Current and Former):

American Iron and Steel Institute:
- Advisory Committee on Load-Factor Building Design

American National Standards Institute:
- Building Loads Code Committee A58

American Society of Civil Engineers:
- Committee on Structural Safety
- Committee on Nuclear Power Plant Safety
- Committee on Bridge Safety
- Committee on Offshore Structure Safety

Earthquake Engineering Research Institute:
Editorial Board: Earthquake Spectra, 1991-1993
Seismic Risk Committee

Joint European Committee on Structural Safety

National Academy of Engineering (Elected 1981)

Phi Beta Kappa

Seismological Society of America:	Board of Directors,	1984-1987
	Vice-president	1985-1986
	President	1986-1987

Sigma Xi

Society of Risk Analysis:
Senior Advisory Board, 1991 P.S.A.M. Conference

JOURNAL EDITORIAL BOARDS:

Structural Safety; Risk Abstracts; Probabilistic Engineering Mechanics; Engineering Structures; Earthquake Spectra

GOVERNMENT COMMITTEES AND SERVICE:

NBS, Consultant	1967-1975
USGS, Advisory Committee to Seismicity and Risk Analysis Branch	1974
UNESCO, Working Group on Definition of Seismicity and Ground Motion	1974
USGS, Workshop on Earthquake Prediction and Engineering Hazards	1977
NAE/NRC-Marine Board	
Committee on Offshore Technology	1979-1981
Committee on Marine Structures,	
Loads Advisory Group	1986-1987
Parent Committee	1987-1989
NAS Committee on Seismology	1981-1984
Panel on Science of Earthquakes	1996-1998
NAS-Water Board	
Committee on Techniques for Estimating Probabilities of Extreme Floods	1986-1988
NAE/NRC-Geotechnical Board - Comm. for Workshop on Reliability Methods for Risk Mitigation in Geotechnical Engineering	1992-1994
NRC Seismic PRA Seminar Technical Coordinator	1982

OECD-CSNI Specialist Meetings: Probabilistic Methods in SRA for NPP's
Chairman 1980
Technical Organizing Committee 1983

NATO, Advanced Study Institute,
Reliability of Structures and Soils, Lecturer, (Seismic Safety of NPP's) 1982

AWARDS RECEIVED:

Huber Research Prize, American Society of Civil Engineers 1971

Guggenheim Fellowship 1974-1975

Fulbright-Hayes Advanced Research Grant 1974-1975

Moisseiff Award, American Society of Civil Engineers 1977

Norman Medal, American Society of Civil Engineers 1983

(First) ICASP Award, Committee of Inter. Conference on Applications of Statistics and Probability in Soils and Structures 1987

Fruedenthal Medal, American Society of Civil Engineers 1988

Offshore Technology Research Center Honors Lecture, OTC 1995

EERC Distinguished Lecturer 1999

SOME REPRESENTATIVE RECENT SPONSORED UNIVERSITY RESEARCH CONTRACTS:

SPONSOR:

NSF Stochastic Models of Structural Loads.
Spatial and Temporal Memory in Earthquake Recurrence and Hazard.
Nonlinear Seismic Assessment Procedures for Buildings
Probabilistic Prediction of Near-Source Strong Ground Motion and Nonlinear Structural Response

ONR Reliability Analysis of Moored Marine Structures.

EPRI Multi-site Wind Record Analysis for Transmission Lines Structural Loads.
Effectiveness of Strong Ground Motions.

MMS Probability-Based Design Procedures for Offshore Structures

NRC Hazard-Consistent Nonlinear Analysis of Structures and Soils

JOINT INDUSTRY PROJECT
(36 company consortium, managed by Amoco Production Company)
Structural Systems Reliability Analysis for Offshore Structures.

INDUSTRIAL AFFILIATES PROGRAM 1986-present
Reliability of Marine Structures.

REPRESENTATIVE CONSULTING PROJECTS

1996 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
USGS/DOE (Review of U.S. Hazard Maps)
DOE/Woodward-Clyde (Yucca Mountain PSHA Peer Review)
DOE/Geomatrix (Yucca Mountain Volcano Hazard Analysis)
NRC/REI (Ground Motions Procedures Peer Review Panel)
NRC/Waterways Exper.Sta. (Probabilistic Liquefaction Analysis)
Warburg Pincus (Seismic Insurance Risk Methods)
Aon Insurance Services (Seismic Insurance Risk Analysis)
Seattle Seahawks (King Dome Seismic Review)
B.C. Hydro (Keenleyside Dam Seismic Risk, Peer Review Panel)
Offshore Platform Structures/Marine Reliabiity
Chevron (Hurricanes)
Amoco (Offshore Reliability)
REI/JIP (Riser Reliability)
Shell/PMB (Maui A and B Seismic Reliability)
ABS (Risk-Based Ship Criteria)

1995 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
DOE/Woodward-Clyde (Yucca Mountain PSHA Peer Review)
DOE/Geomatrix (Yucca Mountain Volcano Hazard Analysis)
DOE/BNL (Short-term Seismic Exposure)
MMS/LLNL (Santa Barbara Channel PSHA)
B.C. Hydro (Seismic Risk Methods)
NRC/LLNL (Seismic Source Characterization)
EQE (Review of Cal. Eq. Auth. Analysis)
USGS/ATC (Paper/Workshops on PSHA)
Offshore Structures Reliability
Exxon Pro.Res. (Seismic Hazard and Response: Caspian Sea/Sakalin Island)
Mobil (Seismic Hazard and Response: Holly Platform)
PMB/JIP (Hurricane Andrew Bayesian Update of Structural Loads and Capacities II)

1994 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
DOE/LLNL (Senior Hazard Advisory Committee; site hazard revisions)
DOE/BNL (Tanks Seismic Expert Panel; site reviews)
NRC/LLNL (Appendix B Revision; expert committee)
DOE/High-Level Waste Review Board
Commonwealth Edison Co. (Short-Term Criteria)
Woodward-Clyde (Hazard Methodology Update)
SRI/EDF (France) (SPRA Methodology)

Westinghouse Hanford (Safety Class Definition)
REI/DOE (SHA review)
Guy Carpenter Inc. (Loss estimation review)
ISEC/Golden Gate Bridge Retrofit
Offshore Structures Reliability:
PMB/JIP (Hurricane Andrew Bayesian Update of Foundation Capabilities)
PMB/JIP (Hurricane Andrew Bayesian Update of Structural Loads and Capacities II)
REI/JIP (Reliability Software Development Advice)
Chevron (Hurricane Statistics)
Exxon Production Research (Response Analysis)
Statoil (Failure Probability Bases}

1993 *Seismic Studies (Seismic Hazard Analysis;*
Seismic Probability Risk Assessment;
Seismic Margins; Criteria Development;
Policy Advising, etc.):
DOE/LLNL (Senior Seismic Hazard Advisory Committee; site reviews)
DOE/BNL (Tanks Seismic Expert Panel)
Woodward-Clyde (SHA)
San Diego Gas & Electric (SHA Review)
EPRI (Max. Magnitude Project)
NRC/CNWRA (HLW Seismic Criteria)
ISEC/Golden Gate
REI/NRC(Seismic Motions/PRA)
EPRI (Max. Magnitude Project)
Ofshore Structures Reliability:
PMB/JIP (Hurricane Andrew Bayesian Update of Structural Loads and Capacities)
Unocal (Seismic safety review; SHA reviews)
Chevron (Extreme Wave Reliability-Methodology)
Statoil (Norway) (North Sea SHA review)
PMB/JIP (Dynamic Capacity)

1992 *Seismic Studies (Seismic Hazard Analysis;*
Seismic Probability Risk Assessment;
Seismic Margins; Criteria Development;
Policy Advising, etc.):
DOE/LLNL (NPR Senior Advisory Committee; Interim Criteria, site reviews)
DOE/BNL (TSEP; site SHA reviews)
NRC/LLNL (Appendix B Revision, expert panel)
EPRI (Maximum Magnitude Project)
Geomatrix (CalTrans SHA reviews)
Woodward-Clyde (CalTrans SHA reviews)
Portland General Electric (Senior Seismic Panel)
ISEC/Golden Gate
REI/NRC (Seismic Motions/PRA)
ESA (Aqueduct Analysis)
REI/NSF (Loma Prieta Motions Analysis)

Offshore Structures Reliability:
Unocal (SHA review; SHA and criteria)
REI (TLP-LRFD JIP)
PMB/USN
PMB/JIP (Dynamic Capacity)
PMB/JIP (Andrew Bayesian Update)
Chevron (Reliability Methodology)
API (Seismic Requalification Criteria)

1991 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
DOE/LLNL (Natural Hazards; NPR Senior Advisory Committee; Interim Criteria, site reviews)
BC Hydro (Seismic Hazard Committee)
Portland General Electric (Senior Seismic Panel)
EPRI (Maximum Magnitude Project)
NRC
REI/CGMG (Seismic Motion Analysis)
REI/NRC (Seismic Motions/PRA)
Offshore Structures Reliability:
PMB/USN (Underwater Array Reliability)
EPR (Seismic Review)
API (Seismic Requalification Criteria)
Other:
Paul, Hastings, Janofsky and Wal (Fiber Pipe Reliability)

1990 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
DOE/LLNL/BNL (NPR Senior Advisory Committee; Interim Criteria; Site Reviews; High-Level Waste Tanks)
EPRI/NUMARC/IPEEE
Exxon Production Research (Reliability)
USGS/NEPEC (Bay Area Seismic Hazard)
NRC/ACNW
Portland General Electric
Woodward-Clyde Consultants
Offshore Structures Reliability:
Exxon Production Research (EPR) (reliability software)
PMB/NCEL
ELF Aquitaine (France)/LRFD Development
Other:
NASA/Veritas Research (Structural Reliability)

1989 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
DOE/LLNL (Senior Review Group: External Events Assessment and Criteria; NPR Criteria)
Pacific Gas and Electric
Portland General Electric
Electric Power Research Institute (Severe Accident Policy, Seismic Hazard, High Frequency Ground Motion Effects)
Nuclear Regulatory Commission/ANL
Woodward Clyde Consultants
Risk Engineering, Inc.
Geomatrix
Offshore Structures Reliability:
Joint Industry Project (12 sponsors); Full-scope Reliability ("MCAPS"); Amoco Production Co., Manager.
ELF Aquitaine (France)
Exxon Production Research
Statoil (Norway)

1988 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
Pacific Gas and Electric Co. (Diablo Canyon Long-Term Seismic Program, Advisory Board and Consultant)
Electric Power Research Institute (Senior Advisory Group: Eastern U.S. Seismic Hazards Project)
Risk Engineering, Inc.
U.S. Nuclear Regulatory Commission/ANL
Portland General Electric (Senior Seismic Panel)
Bechtel Corporation
Canada Oil and Gas Administration
Statoil (Norway)
Offshore Structures Reliability:
Joint Industry Project (36 sponsors); Structural Systems Reliability; Amoco Production Co., Manager
Joint Industry Project (12 sponsors): Full-Scope Systems Reliability ("MCAPS"); Amoco Production Co., Manager
ELF Aquitaine (France)
Amoco Production Co.
Exxon Production Research
Bridge Loadings:
NCHRP (Jointly with Imbsen and Associates, Inc.)

1987 *Seismic Studies (Seismic Hazard Analysis;*
Seismic Probability Risk Assessment;
Seismic Margins; Criteria Development;
Policy Advising, etc.):
Pacific Gas and Electric Co. (Diablo Canyon Long-Term Seismic Program, Advisory Board and Consultant)
Electric Power Research Institute (Senior Advisory Group: Eastern U.S. Seismic Hazards Project)
(Non-Poissonian Earthquake Recurrence Analysis Project)
U.S. Nuclear Regulatory Commission
Geomatrix
Offshore Structural Reliability:
Joint Industry Project (36 sponsors); Systems Reliability; Amoco Production Co., Manager
Joint Industry Project (12 sponsors): Full-Scope Systems Reliability ("MCAPS"); Amoco Production Co, Manager
ELF Aquitaine (France)
Site-Specific Bridge Loads:
NCHRP (Jointly with Imbsen and Associates, Inc.)

1986 *Seismic Studies (Seismic Hazard Analysis;*
Seismic Probability Risk Assessment;
Seismic Margins; Criteria Development;
Policy Advising, etc.):
Pacific Gas and Electric Co. (Diablo Canyon Long-Term Seismic Program, Advisory Board and Consultant)
Electric Power Research Institute (Senior Advisory Group: Eastern U.S. Seismic Hazards Project)
Woodward-Clyde
Impell
Bechtel Corp.
Yankee Atomic Electric Co.
U.S. Nuclear Regulatory Commission
Offshore Structures Reliability:
Joint Industry Project (36 sponsors); Systems Reliability; Amoco Production Co., Manager
Joint Industry Project (12 sponsors): Full-Scope Systems Reliability ("MCAPS"); Amoco Production Co., Manager
ELF Aquitaine (France)
Amoco Production Co.

1985 *Seismic Studies (Seismic Hazard Analysis;*
Seismic Probability Risk Assessment;
Seismic Margins; Criteria Development;
Policy Advising, etc.):
Pacific Gas and Electric Co. (Diablo Canyon Long-Term Seismic Program, Advisory Board and Consultant)
Electric Power Research Institute (Senior Advisory Group: Eastern U.S. Seismic Hazards Project)
(Non-Poissonian Earthquake Recurrence Analysis Project)
Maine Yankee Power Co.

Yankee Atomic Electric Co.
U.S. Nuclear Regulatory Commission (Design Margins and SPRA Validation Senior Advisory Committees)
Bechtel Corp.
Sandia (Long-Term Nuclear Waste Disposal)
Electricite de France

Structural Systems Reliability:
G.A. Technologies (through DOE) (HTGR Probability-Based Design Criteria Advisory Board)

Offshore Structures Reliability:
ELF Aquitaine (France)
Joint Industry Project (36 sponsors); Structural Systems Reliability; Amoco Production Co., Manager
Joint Industry Project (12 sponsors): Full-Scope Systems Reliability ("MCAPS"); Amoco Production Co., Manager

Statistical Analysis of Construction Quality Sampling:
Anolik et al (Shelter Ridge Condominiums)
Fairfield et al (Hunters Point Housing Project)

1984 *Seismic Studies (Seismic Hazard Analysis; Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
Maine Yankee Power Co. (Maine Yankee)
Lawrence Livermore National Laboratory
Pacific Gas and Electric Co. (Diablo Canyon)
Yankee Atomic Electric Co. (Yankee Rowe, et al)
Niagara Power (through Dames and Moore)
NRC (Design Margins and SPRA Validation Senior Advisory Committees)
Dames and Moore (Millstone)
Electric Power Research Institute (Senior Advisory Group: Eastern U.S. Seismic Hazards Project)

Probabilistic Extreme Precipitation and Flood Analysis:
Yankee Atomic Electric Co.

Risk Analysis Tutorials, Short Courses, etc.:
Woodward-Clyde Consultants
ACTA, Inc.

Offshore Structures Design Criteria:
PMB Systems (SOHIO, Shell)

1983 *Seismic Studies (Seismic Hazard Analysis: Seismic Probability Risk Assessment; Seismic Margins; Criteria Development; Policy Advising, etc.):*
Maine Yankee Power Co. (Maine Yankee)
Lawrence Livermore National Laboratory
NRC, (ACRS)
Yankee Atomic Electric Company
Cygna, Inc.
Boston Edison (through Yankee Atomic Electric Co.)
Pickard, Lowe & Garrick, Inc. (Seabrooke)

Niagara Power (through MPR, and Dames and Moore)
Electric Power Research Institute (Research through Yankee Atomic Electric Co.)
Electric Power Research Institute (Eastern Seismic
Hazard Project Senior Advisory Committee)
Law Engineering and Testing Co. (Duke Power Co.)
Office of Naval Research
A. Anolik (Westborough Housing Study)

Structural Code Development:
Electric Power Research Institute/Col. State Univ. (Transmission Lines)
ACTA, Inc.

Probabilistic Extreme Precipitation and Flood Analysis:
Yankee Atomic Electric Co.

Risk Analysis Tutorials, Short Courses, etc.:
Woodward-Clyde Consultants (Probabilistic Methods)
ACTA, Inc. (Extreme Events)

Offshore Structures Design Criteria (Waves, Ice, System Reliability, etc.):
PMB Systems (SOHIO, Shell)

1982 *Seismic Studies (NPP Sites)*:
Pickard, Lowe and Garrick (Zion, Indian Point, Seabrooke)
Yankee Atomic Electric Co. (Yankee Rowe)
Maine Yankee Power Co. (Maine Yankee)
Woodward-Clyde Consultants
Stone and Webster Corp. (Millstone)
Dames and Moore (Millstone)
Electric Power Research Institute (through Yankee
Atomic Electric Co.: Development of Historic SHA)
NRC, Lawrence Livermore National Laboratory

Pile Foundation System Reliability:
NUCLEN, (Brazil)

Structural Code Development:
Electric Power Research Institute/Colorado State Univ.
ACTA, Inc.

Load Combination Analysis:
Lawrence Livermore National Laboratory

Risk Analysis Tutorials, Short Courses, etc.:
NRC (through Sandia National Laboratory)
Woodward-Clyde Consultants

1980-81 *Seismic Studies*:
Pickard, Lowe and Garrick
Yankee Atomic Electric Power Co.
Lawrence Livermore National Laboratory

Pile Foundation System Safety:
NUCLEN, (Brazil)

Load Combination Analysis:
Lawrence Livermore National Labortory

1979-80 *Seismic Studies*:
Pickard, Lowe and Garrick
Weston Geophysical Research

Woodward-Clyde Consultants
Lawrence Livermore National Laboratory/NRC
Yankee Atomic Electric Co.

Air Pollution Hazard Study:
Pickard, Lowe and Garrick

Structural Safety Short Course:
Raytheon Co.

Load Combination Analysis:
G.E. Mark II Reactor Owners Group (through N.M. Newmark)

1978-79 *Seismic Studies*:
T.V.A.
Weston Geophysical Research
Southern California Edison Co.
Woodward-Clyde Consultants
Lawrence Livermore National Labortory/NRC

Load Combination Studies:
G.E. Mark II Reactor Owners Group (through N.M. Newmark)

1977-78 *Seismic Risk Analysis and Ground Motion Predictions*:
T.V.A.
Pacific Gas and Electric Co.
Woodward-Clyde Consultants

Seismic Reliability Studies of Nuclear Power Plant Systems:
Southern California Edison Co. Pacific Gas and Electric Co.
Pickard, Lowe and Garrick
Technical Chairman; one-week seminar for German Government (BAM)
Nuclear Regulatory Commission and Lawrence Livermore National Laboratory;
Senior Advisory Group: Seismic Safety Margins Research Project

1976-77 *Seismic Risk Analysis and Ground Motion Consultation*
Bell Laboratories
Pacific Gas and Electric Co.
Law Engineering
U.S. Army Corps of Engineers
Boston Edison Co.
Weston Geophysical Research, Inc.

Statistical Analysis of Fires:
NFPA

1975-76 *Probabilistic Systems Analysis; Dutch Oosterschelde Closure Project*:
T. W. Lambe and Associates

Seismic Risk Analysis and Ground Motion Consultation:
Nuclear Fuel Services
Dames and Moore
Weston Geophysical Research, Inc.
Boston Edison Co.
Basler and Hofmann

Advisory Committee on NFPA Project on Probabilistic Fire Safety Analysis

1974-75 *Seismic Risk Analysis Consultation*:
Dames and Moore
Weston Geophysical Research, Inc.
Aircraft Crash Risk Consultation:
Pickard and Lowe

1973-74 *Aircraft Crash Risk Studies for Nuclear Power Plants*
for PEPCO and Stone and Webster through Weston Geopysical Research, Inc. and others
Seismic Risk Analyses and Artificial Design Motions
for Several Engineering Projects
Assorted Hazard Study Reviews
for Pickard and Lowe
Refinement and Documentation of Seismic Risk Analysis Programs
for J. A. Blume and Associates
Wind-Loading Studies on Boston's John Hancock Building
for Hansen, Holley and Biggs
National Bureau of Standards Building Live Loads Survey
Report Preparation; and (through J. H. Wiggins and Company)
Survey Implementation Review

1972-73 *Through Weston Geophysical Research, Inc., American Electric Power; Stone and Webster; et al.*:
Design Response Spectra and Probabilistic Artificial Motions for Several
Nuclear Power Plant Projects
For Pickard and Lowe:
Wind-Induced Wave Risks on Great Lakes
Review of Seismic Risk Analysis for Dames and Moore
Consultation to NBS on Live Load Survey Implementation
Aircraft Crash Risk Analysis for Nuclear Power Plants
for Oregon Nuclear and Thermal Energy Council

1971-72 *Design of a Building Live Loads Survey*
for National Bureau of Standards
Through Weston Geophysical Research, Inc.:
a) Response Spectra and Seismic Design Criteria for Several Nuclear Power Plants
b) Development of Seismic Risk Map for American Electric Power
Retained as Seismic Consultant to Environmental Research, Inc., Las Vegas, Nevada
Through Hansen, Holley and Biggs:
Seismic Design Levels and Response Spectra for Drydock Sites on West Coast
for Crandall Drydocks, Inc.
Wind Dispersion Analysis
for Pickard and Lowe
Advisor to University of Mexico Earthquake Engineering Project
for UNESCO

1970-71 *Review of Fire Loads Survey Analysis for CEACM, Paris*
Through Weston Geophysical Research, Inc.: Seismic Design Criteria
for several Nuclear Power Plants
Aircraft Crash Risk Analysis for Pickard and Lowe

PUBLICATIONS

Book:

Benjamin, J. R. and Cornell, C. A., *Probability, Statistics, and Decision for Civil Engineers*, McGraw-Hill Book Company, 1970.

Papers in Refereed Journals:

Torres, G. G. B., Brotchie, J. R., and Cornell, C. A., "A Program for the Optimum Design of Prestressed Concrete Highway Bridges", *Journal of the Prestressed Concrete Institute*, Vol. 11, No. 3, June, 1966.

Reinschmidt, K. F., Cornell, C. A., and Brotchie, J. R., "Iterative Design and Structural Optimization", *Journal of the Structural Division*, ASCE, Vol. 92, No. ST6, December, 1966, pp. 281-318.

Sturman, G. M., Albertson, L. C., Cornell, C. A., and Roesset, J. M., "A Computer-Aided Bridge Design System", *Journal of the Structural Division*, ASCE, Vol. 92, No. ST6, December, 1966, pp. 141-165.

Cornell, C. A., "Bounds on the Reliability of Structural Systems", *Journal of the Structural Division*, ASCE, Vol. 93, No. ST1, February, 1967, pp. 171-200.

Ayer, F. and Cornell, C. A., "Grid Moment Maximization by Mathematical Programming", *Journal of the Structural Division*, ASCE, Vol. 94, No. ST2, February, 1968, pp. 529-549.

Cornell, C. A. and Vanmarcke, E. H., "Some Practical Implications of Elementary Safety Analysis", *Journal of the Boston Society of Civil Engineers*, Vol. 55, No. 3, July, 1968.

Cornell, C. A., "Engineering Seismic Risk Analysis", *Bulletin of the Seismological Society of America*, Vol. 58, No. 5, October, 1968, pp. 1583-1606.

Cornell, C. A., "A Probability-Based Structural Code", *Journal of the American Concrete Institute*, No. 12, Proc. Vol 66 December, 1969, pp. 974-985.

Corotis, R. B., Vanmarcke, E. H., and Cornell, C. A., "First Passage of Non-Stationary Random Processes", *Journal of the Engineering Mechanics Division*, ASCE, No. EM2, April, 1972, pp. 401-414.

Peir, J. C. and Cornell, C. A., "Spatial and Temporal Variability of Live Loads", *Journal of the Structural Division*, ASCE, Vol. 99, No. ST5, May, 1973, pp. 923-943.

McGuire, R. K. and Cornell, C. A., "Creep of Concrete Under Stochastic Live Load", *Journal of the Structural Division*, ASCE, Vol. 99, No. ST5, May, 1973, pp. 923-943.

Merz, H. A. and Cornell, C. A., "Seismic Risk Analysis Based on a Quadradic Magnitude-Frequency Law", *Bulletin of Seismological Society of America*, Vol. 63, No. 6, December, 1973, pp. 1999-2006.

McGuire, R. K. and Cornell, C. A., "Live Load Effects in Office Buildings", *Journal of the Structural Division*, ASCE, Vol. 100, No. ST7, July, 1974, pp. 1351-1366.

Ang, A. H. S. and Cornell, C. A., "Reliability Bases of Structural Safety Design", *Journal of the Structural Division*, ASCE, Vol. 100, No. ST9, September, 1974, pp. 1755-1770.

Whitman, R. V., et al., "Seismic Design Decision Analysis", *Journal of the Structural Division*, ASCE, Vol. 101, No. ST5, May, 1975, pp. 1067-1084.

Garson, R. C., Morla-Catalan, J., and Cornell, C. A., "Tornado Design Winds Based on Risk", *Journal of the Structural Division*, ASCE, Vol. 101, No. ST9, September, 1975, pp. 1883-1897.

Cornell, C. A. and Merz, H. A., "Seismic Risk Analysis of Boston", *Journal of the Structural Division*, ASCE, Vol. 101, No. ST10, October, 1975, pp. 2027-2034.

Morla-Catalan, J. and Cornell, C. A., "Earth Slope Reliability by a Level-Crossing Method", *Journal of the Geotechnical Division*, ASCE, Vol. 102, No. GT3, June, 1976.

Veneziano, D., Grigoriu, M., and Cornell, C. A., "Vector-Process Models for System Reliability", *Journal of the Engineering Mechanic Division*, ASCE, Vol. 103, No. EM3, Proc. paper 12981, June, 1977, pp. 441-460.

Ravindra, M. K., Cornell, C. A., and Galambos, T. V., "Wind and Snow Load Factors for Use in LRFD", *Journal of the Structural Division*, ASCE, Vol. 104, No. ST9, Proc. Paper 14006, September, 1978, pp. 1443-1457.

Fardis, M. N. and Cornell, C. A., "Containment Liner Seismic Reliability Under Statistical Uncertainty", *Nuclear Engineering and Design*, Vol. 49, No. 3, September, 1978, pp. 279-294.

Fardis, M. N. and Cornell, C. A., "Seismic Soil-Containment Interaction: Pipe Safety", *Journal of the Engineering Mechanics Division*, ASCE, Vol. 104, No. EM6, Proc. Paper 14218, December, 1978, pp. 1353-1370.

Fardis, M. N., Cornell, C. A., and Meyer, J. E., "Accident and Seismic Containment Reliability", *Journal of the Structural Division*, ASCE, Vol. 105, No. ST1, Proc. Paper 14305, January, 1979, pp. 67-83.

Larrabee, R.D. and Cornell, C.A., "Upcrossing Rate Solution for Load Combinations", *Journal of the Structural Division*, ASCE, Vol. 105, No. ST1, Proc. Paper 14329, January, 1979, pp. 125-132.

Cornell, C. A., Shakal, A., and Banon, H., "Seismic Motion and Response Prediction Alternatives", *Earthquake Engineering and Structural Dynamics*, Vol. 7, 1979, pp. 295-315.

Millman, R., Kilcup, R., and Cornell, C. A., "Design Temperature for Structural Elements", *Journal of the Structural Division*, ASCE, Vol. 106, No. ST4, Proc. Paper 15364, April, 1980, pp. 877-895.

Kennedy, R. P., Cornell, C.A., Campbell, R.D., Kaplan, S. and Perla H.F., "Probabilistic Seismic Safety Study of an Existing Nuclear Power Plant", *Nuclear Engineering and Design*, Vol. 59, No. 2, August, 1980, pp. 315-338.

Cornell, C. A., "Some Thoughts on Systems and Structural Reliability", *Nuclear Engineering and Design*, Vol. 60, No. 1, September, 1980, pp. 115-116.

Cornell, C. A., "Utilization of Present Knowledge of Probabilistic Structural Reliability in Analyses of Nuclear Power Plants", *Nuclear Engineering and Design*, Vol. 60, No. 1, September, 1980, pp. 33-36.

Larrabee, R. D. and Cornell, C. A., "Combination of Various Load Processes", *Journal of the Structural Division*, Vol. 107, No. STl, January, 1981, pp. 223-239.

Fardis, M. N. and Cornell, C. A., "Analysis of Coherent Multistate Systems", *IEEE Transactions on Reliability*, Vol. R-30, No. 2, June, 1981, pp. 117-122.

Galambos, T.V., Ellingwood, B., MacGregor, J.G. and Cornell, C.A., "Probability-Based Load Criteria: Assessment of Current Design Practice", *Journal of the Structural Division*, ASCE, Vol. 108, No. ST5, May, 1982, pp. 959-977.

Galambos, T,V., Ellingwood, B., McGregor, J.G. and Cornell, C.A., "Probability-Based Load Criteria: Load Factors and Load Combinations", *Journal of the Structural Division*, ASCE, V. 108, No. ST5, May, 1982, pp. 978-997.

Winterstein, S. R. and Cornell, C. A. "Load Combinations and Clustering Effects", *Journal of the Structural Division*, ASCE, Vol. 110, No. 11, November, 1984, pp. 2690-2708.

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Cornell, C. A., "Reliability-Based Earthquake-Resistant Design; The Future", *Proc. Eleventh World Conf. on Earthquake Design"*, Acapulco, Mexico, June, 1996.

Cornell, C.A., and Bandyopadhyay, K. K., "Should We Relax Seismic Criteria for Shorter System Exposure Times?", *ASME Proc. Press. Vessels and Piping Conf.*, Montreal, July, 1996.

Winterstein, S. R., Ude, T.C., Bazzurro, P., and Cornell, C. A ., "Ocean Environment Contours For Structural Response Analysis and Experiment Design", *ASCE Probabilistic Methods Speciality Conference"*, Worcester, MA., August, 1996.

Bazzurro, P., Winterstein, S.R., Ude, T.C., and Cornell C.A., "Magnitude-Distance Contours for Probabilistic Seismic Hazard Analysis", *ASCE Probabilistic Methods Speciality Conference"*, Worcester, MA., August, 1996.

Schmucker, D. G., and Cornell, C. A., "Reliabiity of Jackets: Beyond-Static-Capacity", *7th ASCE EMD/STD Joint Speciality Conference on Probabilistic Mechanics and Structural Reliability*, Worcester, MA., August, 1996.

Budnitz, R.J. (Chairman), Apostolakis, G., Boore, D.M., Cluff, L.S., Coppersmith, K.J., Cornell, C.A., and Morris, P.A. "Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts", Author: SSHAC (Senior Seismic Hazard Analysis Committee), Report No. NUREG/CR-6372 prepared for *US Nuclear Regulatory Commission, U.S. Department of Energy and the Electrical Power Research Institute*, April, 1997.

Bazzurro, P. and Cornell, C.A., "Spatial Disaggregation of Seismic Hazard", *Proc. 6th U.S. National Conference on Earthquake Engineering*, Seattle, Washington, June, 1998.

Luco, N. and Cornell, C.A., "Effects of Random Connection Fractures on the Demands and Reliability for a 3-Story Pre-Northridge SMRF Structure", *Proc. 6th U.S. National Conference on Earthquake Engineering*, Seattle, Washington, June, 1998.

Shome, N. and Cornell, C.A., "Normalization and Scaling Accelerograms for Nonlinear Structural Analysis", *Proc. 6th U.S. National Conference on Earthquake Engineering*, Seattle, Washington, June, 1998.

Carballo, J.E. and Cornell, C.A., "Input to Nonlinear Analysis: Modification of Available Accelerograms for Different Source and Site Characteristics", *Proc. 6th U.S. National Conference on Earthquake Engineering*, Seattle, Washington, June, 1998.

Stahl, Bernard, Gebara, Joseph M., Aune, Stig and Cornell, C. Allin, "Acceptance Criteria for Offshore Platforms", *Proc. 17th International Conference on Offshore Mechanics and Arctic Engineering – OMAE98-1463;* July 5-9, 1998, Lisbon, Portugal.

Luco, N., and Cornell, C.A., "Seismic Draft Demands for Two SMRF Structures with Brittle Connections", *Proc. Structural Engineers World Congress,* San Francisco, July, 1998.

Bazzuro, Paolo, Winterstein, Steven R. and Cornell, C. Allin, "Seismic Contours: A New Characterization of Seismic Hazard", *Proc. 11th European Conference on Earthquake Engineering,* Paris, France, September 6-11, 1998.

Amin, M., Budnitz, R., Cornell, C.A., Kennedy, R. P., Olson, D. E., and Tang, H.T., "Reduced Seismic Loads for Temporary Conditions", *Proceedings, 7th Inter. Symp. On Current Issues Related to Nuclear Power Plant Structures, Equipment and Piping,* N.C. State Univ., Raleigh, N.C., December, 1998.

Plus Technical Research Reports, Progress Reports, and Discussions in Professional Journals.

[resumes\Basic large pcs.\all publications] (updated 05/12/99)

Resume of

Thomas Y. Chang

Thomas Y. Chang

Senior Lead Engineer

Years Experience (as of June 1999)

At Stone & Webster: 23 With other Firms: 12

Department/Division/Location

Department 52/Environmental & Infrastructure/Boston

Professional History

Stone & Webster Engineering Corporation, Boston, Massachusetts - 1976 to Present
D'Appolonia Consulting Engineers, Inc., Pittsburgh, Pennsylvania - 1974 to 1976
Soil Mechanics Research Laboratory, The Ohio State University, Columbus, Ohio - 1970 to 1974
Department of Civil Engineering, The Ohio State University, Columbus Ohio - 1969 to 1970
Department of Ocean Engineering, University of Rhode Island, Kingston, Rhode Island - 1969
Soil Mechanics Research Laboratory, University of Rhode Island, Kingston, Rhode Island - 1967 to 1969
Retired Servicemen Engineering Agency, Taipei, Taiwan - 1964 to 1967

Languages

Chinese

Experience Summary

Dr. Chang a Senior Lead Engineer with over 35 years of experience in civil engineering; for the last 31 he has specialized in soil and foundation engineering. He has worked on various sized industrial, commercial, and utility buildings and structures as well as civil works including highways, sewer and water treatment facilities, waste disposal facilities, dams, and waterfront structures. He has evaluated excavation and backfilling operations, piling and drilled pier installations, in-situ densification, and preload placement related to foundation design. His experience includes supervising geotechnical engineers and geologists in performing site investigations, laboratory testing, specification preparation, and serving as field liaison during construction.

For highway and transit infrastructures, Dr. Chang has been responsible for site investigations, bridge pier and abutment foundations evaluations, embankment settlement and stability analyses, long term stability of cut slopes as well as various retaining structures including conventional and mechanically stabilized wall systems, soil nail retaining walls. He has performed technical and economic evaluation of using piling, drilled shafts and load bearing elements to support the bridges and viaduct piers for Central Artery facilities in Boston. He has also performed design review and provided critical comment to enhance integrity and operation safety for the underpinning of subway station to facilitate large highway tunnel construction underneath , the construction of large immersed highway tunnels within five feet clearance above the old unreinforced concrete subway tunnels in dredged channel and tunnel jacking construction of full size highway box beneath the active railroad yards.

For coal-fired power plants, Dr. Chang has been responsible for site investigations, foundation design and coal storage, leachate runoff pond, and ash waste disposal area design parameters. As a Lead Geotechnical Engineer for wastewater treatment system for oil-fired power plants, he has been responsible for the design of the hazardous waste impoundment facilities, including groundwater investigations and groundwater impact analysis, liner selection and testing, leachate collection system, and groundwater monitoring system design. For the conversion or reconversion to coal-firing of the current oil-firing power plants, Dr. Chang has been responsible for the subsurface and groundwater investigations, hydrogeological analyses, and site characterization for the preparation of the Draft Environmental Impact Statement (DEIS) and Solid Waste Management Facilities Reports for environmental licensing application of the coal conversion project. Dr. Chang also has been providing expert testimony in the public hearings conducted for licensing of the solid waste management facility.

Dr. Chang's expertise also includes earthquake engineering and the application of numerical modeling to various geotechnical and groundwater engineering problems. He has performed seismic risk analyses and established seismic design criteria and response spectra for several nuclear power plants. He has developed a finite element computer program for nonlinear elastic load deformation analysis of soils. He has employed finite element methods with nonlinear material properties to compute stress and displacement patterns within the dam and to study arching behaviors between zones and stress transfer near foundation irregularities for various dam protective designs. His experience in geotechnical analyses includes the hydrogeological modeling of groundwater and seepage problems. Dr. Chang was responsible for seepage and groundwater analyses for three cooling pond dikes that required remedial work to control seepage and enhance safety. Dr. Chang was also responsible for groundwater modeling of the oil waste land treatment facilities for pollutant migration and contamination monitoring study. Dr. Chang has also performed static and dynamic soil-interaction structure analyses, foundation study and design, and slope stabilities for nuclear and fossil power plant facilities.

As Division Testing Specialist, Dr. Chang is responsible for the overall technical capability and performance of the Geotechnical Testing Laboratory. He has extensive experience in determination of various soil and rock properties for engineering purposes. This experience includes establishing the relationship between laboratory test data to field performance evaluation of soil-structure interaction problems. He also has been responsible for testing various mining and industrial solid waste materials such as coal refuse, tailing sands, gypsum wastes from mining operations, paper sludges, silica fumes, steel slags, and fly ash.

Prior to joining SWEC, Dr. Chang was Director of Testing and Research for E. D'Appolonia Consulting Engineers, Inc., Pittsburgh, Pennsylvania. He managed its geotechnical laboratory, staffed with 12 testing engineers and technicians, and was responsible for scheduling and directing testing programs for numerous large geotechnical engineering projects. Specific responsibilities at D'Appolonia included evaluation of soil and rock-testing programs, interpretation of test results, consultation, and research on special geotechnical problems. These projects included nuclear power plants, dams, and embankments; heavy industrial plants and iron ore yards; as well as tailings and solid waste disposal facilities for mining operations, heavy industry, and fossil power plants.

Education

Ph.D, Geotechnical Engineering, Ohio State University - 1974
M.S., Geotechnical Engineering, University of Rhode Island - 1969
B.S., Civil Engineering, National Taiwan University - 1963

Licenses, Registrations, and Certifications

Professional Engineer - Taiwan; Rhode Island

Publications

Hunt, D.D., Christian, J.T., Chang, T.Y.H., and Cadena, P.A. "Determining Design Response Spectra for a Site of Low Seismicity on the Basis of Historical Records," Proceedings of the Third U.S. National Conference on Earthquake Engineering, Charleston, South Carolina, August 1986.

Cregger, D.M., Majeski, P.J., and Chang, T.Y., "Geotechnical Characterization of Ohio Valley Soils," Special Publication on Geological Environmental and Soil Properties, ASCE National Convention, Houston, Texas, October 1983

Chang, T.Y.H. and Christian, J.T., "Finite Element Analysis of Permanent Settlements Due to Storm Loadings on Offshore Structures," Proceedings of the International Conference on Finite Element Methods, Shanghai, China, August 1982.

Christian, J.T., Marr, W.A., Chang, T.Y., and Boehmer, J.W., "Permanent Displacement Analysis for Oosterschelde" Symposium on Soil Mechanics in the Marine Environment Part 1. Case Studies of Soil Dynamics in Marine Environment, ASCE National Convention and Exposition, Boston, April 1979.

Wang, Mian-Chang, and Chang, T.Y.H., "Vibration Shear Modulus of Sedimented Silt," Journal of Materials, JMLSA, Vol. 7, No. 3, pp.435-439, September 1972.

Experience History

STONE & WEBSTER ENGINEERING CORPORATION, BOSTON, MASSACHUSETTS - 1976 TO PRESENT

Division Testing Specialist (Aug 1976 to Dec 1982 and Jan 1985 to Present)

MBTA I-90/I-93 Coordination Services (Nov 1991 to Present)
Massachusetts Bay Transit Authority (MBTA)
Lead Geotechnical Engineer

Mystic Station Betterment Project (Mar 1999 to Present)
Sithe Mystic Development L.L.C.
Geotechnical Consultant

The Independent Spent Fuel Storage Installation (Jan 1999 to Present)
Maine Yankee Atomic Power Company
Geotechnical Consultant

Private Fuel Storage Facility – Skull Valley, UT (Apr 1998 to Present)
Private Fuel Storage, L.L.C.
Geotechnical Consultant

Rail Spur – Big Brown Steam Electric Station (Mar 1997 to Present)
TXU Electric
Geotechnical Consutlant

Bayamon Alignment Section 1 (Nov 1996 to Present)
Tren Urbano, Puerto Rico Highway and Transportation Authority
Lead Geotechnical Engineer

Woburn Regional Transportation Center (Oct 1997 to Nov 1998)
Massachusetts Port Authority
Lead Geotechical Engineer

Building 99 Fuel Oil Storage Facility – GE Lynn Riverbank Plant (Dec 1997 to Apr 1998)
General Electric Corporation
Lead Geotechnical Engineer

Logan 2000, International Gateway Project (Nov 1997)
Massachusetts Port Authority
Value engineering team member

East Cut Drainage Project, New Haven (Jun 1997 to Sept 1997)
Connecticut Department of Transportation
Geotechnical Consultant

Orange Footprint Bridge Rehabilitation and Restoration (Nov 1996 to Apr 1997)
Massachusetts Highway Department
Lead Geotechnical Engineer

Central Artery/Third Harbor Tunnel Project, I-93/I-90 Interchange, I-93 Southbound (Oct 1993 to Oct 1996)
Massachusetts Highway Department
Lead Geotechnical Engineer

South Boston/Pier Fort Point Channel Underground Transitway (Nov 1991 to Aug 1995)
Massachusetts Bay Transportation Authority (MBTA)
Geotechnical Consultant

Virgin Pulp Substitute Project (Feb 1993 to Nov 1994)
Stone & Webster Business Development Corporation
Lead Geotechnical Engineer

Maintenance Engineering Services (Feb 1992 to Sept 1992)
Sequoyah Nuclear Plant, Tennessee Valley Authority
Lead Geotechnical Engineer

Yeochun Naphtha Cracking Center Project (Apr 1992 to May 1992)
Han Yang Chemical Corporation
Geotechnical Consultant

Flue Gas Desulfurization Project (Oct 1991 to Feb 1992)
Petersburg Generating Station, Indianapolis Power and Light Company
Geotechnical Consultant

LoPresti Park Reconstruction Project (Aug 1990 to Nov 1991)
Boston Public Facilities Department
Lead Geotechnical Engineer

Crestone Circle Project (May 1991 to Sept 1991)
City of Chattanooga
Geotechnical Consultant

Deer Island Facilities project Design Manual (Mar 1991)
Massachusetts Water Resources Authority
Value engineering team member

1989 West Point Paper Mill Expansion (Feb 1990 to Oct 1991)
Chesapeake Corporation
Lead Geotechnical Engineer

Central Artery/Third Harbor Tunnel Project; Area 05 Geotechnical Consulting Services (June 1990 to June 1991)
Massachusetts Department of Public Works
Geotechnical Consultant

New Production Reactors (Oct 1990 to Aug 1992)
Idaho National Engineering Laboratory, U.S Department of Energy
Geotechnical engineer

Weldon Dam - Mattaceunk Project (July 1990 to Mar 1992)
Georgia Pacific Corporation
Lead Geotechnical Engineer

Pelham Bay Landfill (Nov 1990 to Dec 1990)
City of New York, Department of Environmental Protection
Geotechnical Engineer

DP-4 Nut Island Headworks (Dec 1990 to Dec 1990)
Boston Harbor Project, Massachusetts Water Resources Authority
Geotechnical Engineer

Fitchburg Wood-Fired Facility (Nov 1990 to Dec 1990)
Kenetech Energy System, Inc.
Lead Geotechnical Engineer

Thousand Spring Project Unit No. 1 (July 1990)
Great Basin Energy Company
Geotechnical Engineer

Rocky Flats Plant (May 1990 to June 1990)
(USDOE), EG&G, Inc.
Geotechnical Reviewer

New York City Sludge Management Project (Aug 1989 to Aug 1990)
City of New York
Site Manager

Comprehensive Analysis of Gas Safety Program and Procedures (Oct 1989 to Aug 1990)
Kansas Power and Light Company
Task Manager and Lead Geotechnical Engineer

Market Square North Project (Sept 1989)
Potomac Electric Power Company
Geotechnical Engineer

Hudson Regional Medical Center (June 1989)
Gulf Foundation, Inc.
Geotechnical Engineer

Teberebie Goldfield Project, Ghana (Oct 1988 to May 1989)
Pioneer Group, Inc.
Lead Geotechnical Engineer

Beckley Cogeneration Project (Feb 1989 to May 1989)
Beckley Cogeneration Company
Lead Geotechnical Engineer

No. 2 Naphtha Cracker Flare Relocation Project (Dec 1988 to Jan 1989)
China Petroleum Corporation
Lead Geotechnical Engineer

440 MW Combined Cycle Plant (Oct 1988 to Dec 1988)
Seminole Electric Cooperative, Inc.
Geotechnical Engineer

Turkey Point Nuclear Power Plant (Nov 1988 to Dec 1988)
Florida Power and Light Company
Geotechnical Engineer

Watts Bar Nuclear Plant (Jan 1988 to June 1989)
Tennessee Valley Authority
Lead Geotechnical Engineer

Oceana-Mission Unit 1, San Luis Rey Hills 1 Development (Oct 1988 to Nov 1988)
Catlin Engineering, Inc.
Geotechnical Engineer

Resource Recovery Facilities (Sept 1988 to Oct 1988)
Union County, New Jersey, Ogden and Martin, Inc.
Geotechnical Engineer

Supercalender and JR Winder Project (Mar 1988 to Sept 1988)
Madison Paper Industries
Lead Geotechnical Engineer

Ludington Pump Storage Plant (Mar 1988 to July 1988)
Consumers Power Company
Lead Geotechnical Engineer

Artesia Cogeneration Plant, California (June 1988 to Sept 1988)
O'Brien Energy Systems
Geotechnical Engineer

Plattsburg Paper Mill (Mar 1988 to June 1988)
Georgia Pacific Corporation
Lead Geotechnical Engineer

Mill 2 PCB Remediation Project (Mar 1988 to June 1988)
Great Northern Paper Company
Geotechnical Engineer

Shoreham Nuclear Power Plant (Jan 1988 to Mar 1988)
Long Island Light Company
Geotechnical Engineer

Technical and Field Service Contract (TFSC) (Oct 1987 to Feb 1988)
Salt Repository Project
Department of Energy
Lead Geotechnical Engineer

Sequoyah Nuclear Plant (Aug 1987 to Jan 1988)
Tennessee Valley Authority
Geotechnical Engineer

Comanche Peak Steam Electric Station (June 1986 to Dec 1987)
Texas Utilities Electric Company
Geotechnical Engineer

Sandstone Dam and Reservoir Project (Oct 1987 to Nov 1987)
Wyoming Water Development Commission
Geotechnical Engineer

General Warehouse and Storage Facilities (Sept 1987 to Oct 1987)
Massachusetts Bay Transportation Authority (MBTA)
Lead Geotechnical Engineer

161 First Street Building, Cambridge (Aug 1987 to Sept 1987)
Gunwyn Company
Geotechnical Engineer

Permian Basin, National Waste Terminal Storage Program (Jan 1984 to Sept 1987)
Office of Nuclear Waste Isolation
Battelle Memorial Institute
Geotechnical Engineer

Water Pollution Control Plant and Low Level Pumping Station (Jan 1986 to Aug 1987)
Town of Wallingford, Connecticut
Geotechnical Engineer

MBTA Lechmere Maintenance Facility (June 1987 to July 1987)
Massachusetts Bay Transportation Authority
Lead Geotechnical Engineer

Hunt's Point Compressor Station (July 1987)
Consolidated Edison Company
Geotechnical Engineer

Moscow Embassy Building (May 1987)
Department of States
Geotechnical Engineer

Ethylene Process Plant (Feb 1987 to May 1987)
Formosa Plastic Company
Geotechnical Engineer

Beaver Valley Nuclear Power Station Unit 2 (Oct 1983 to Feb 1987)
Duquesne Light Company
Geotechnical Engineer

Bradley Lake Hydroelectric Project (Feb 1986 to Oct 1986)
Alaska Power Authority
Geotechnical Engineer

Salt Cave Hydroelectric Project (Jan 1986 to Apr 1986)
City of Klamath Falls, Oregon
Geotechnical Engineer

New York Naval Station (Mar 1985 to Jan 1986)
U. S. Department of Navy
Geotechnical Engineer

Al Kuriymat Power Plant Site (Sept 1985 to Nov 1985)
Egyptian Electric Authority
Geotechnical Engineer

Unit 1 and 2 Coal Conversion, New Boston Station (Jun 1984 to Aug 1985)
Boston Edison Company
Lead Geotechnical Engineer

Pawnee Generating Station (Feb 1985)
Public Service Company of Colorado
Geotechnical Engineer

Taisee Nuclear Power Plant (Nov 1984 to Dec 1984)
Taiwan Electric Power Company
Lead Geotechnical Engineer

Oil Waste Land Treatment Facilities (Sept 1984 to Nov 1984)
Yorktown Refinery Plant, Amoco Oil Company
Geotechnical Engineer

Unit 1 and 2 Coal Conversion (Sept 1984 to Jan 1985)
New Boston Station, Flakt, Inc.
Lead Geotechnical Engineer

J. L. McCluskey Hydroelectric Plant (Apr 1984)
Arco Metals Company
Geotechnical Engineer

Unit 1 and 2 Coal Conversion (May 1984 to June 1984)
New Boston Station, Babcock & Wilcox Company
Lead Geotechnical Engineer

Units 4, 5 and 6 Coal Conversion (Sept 1982 to June 1984)
Mystic Station, Boston Edison Company
Lead Geotechnical Engineer

Units 1 and 2 Coal Conversion (Sept 1982 to June 1984)
New Boston Station, Boston Edison Company
Lead Geotechnical Engineer

Coal Conversion (July 1982 to Jan 1984)
Danskammer Point Generating Plant
Central Hudson Gas and Electric Corporation, New York
Lead Geotechnical Engineer

Millstone Nuclear Power Station - Unit 3 (June 1983 to Oct 1983)
Northeast Utilities Service Company
Geotechnical Engineer

River Bend Nuclear Power Station (July 1983 to Nov 1983)
Gulf States Utilities Company
Geotechnical Engineer

Upper Baker and Lower Baker Dams (Aug 1983 to Sept 1983)
Puget Sound Power and Light Company
Geotechnical Engineer

Permian Basin, National Waste Terminal Storage Program (Feb 1982 to Sept 1983)
Office of Nuclear Waste Isolation
Battelle Memorial Institute
Geotechnical Engineer

Lovett Generating Station Coal Conversion (July 1981 to June 1983)
Orange and Rockland Utilities, Inc. New York
Lead Geotechnical Engineer

Wastewater Treatment System (Apr 1980 to June 1983)
Mystic Station, Boston Edison Company
Lead Geotechnical Engineer

Shoreham Nuclear Power Station (Apr 1983 to May 1983)
Long Island Light Company
Geotechnical Engineer

Martin Cooling Reservoir Dikes (May 1982 to Sept 1982)
Martin Power Station, Florida Power and Light Company
Geotechnical Engineer

Clinch River Breeder Reactor Project (Feb 1982)
Department of Energy
Geotechnical Engineer

Patriot Generating Station (Aug 1981 to Feb 1982)
Indianapolis Power and Light Company
Geotechnical Engineer

Malakoff Generating Station (Apr 1981 to Nov 1981)
Houston Power and Light Company
Geotechnical Engineer

Millstone Nuclear Power Station - Unit 3 (Nov 1981 to Dec 1981)
Northeast Utilities Service Company, Connecticut
Geotechnical Engineer

Salem Harbor Station (Sept 1981 to Oct 1981)
New England Power Company
Geotechnical Engineer

Beaver Valley Power Station - Unit 2 (Feb 1980 to July 1981)
Duquesne Light and Power Company
Geotechnical Engineer

Martin Cooling Reservoir (Jan 1980 to May 1981)
Martin Power Station, Florida Power and Light Company
Geotechnical Engineer

Sanford Cooling Reservoir (Feb 1980 to Apr 1980)
Sanford Power Station, Florida Power and Light Company
Geotechnical Engineer

Manatee Cooling Reservoir (Jan 1980 to Apr 1980)
Manatee Power Station, Florida Power and Light Company
Geotechnical Engineer

Millstone Nuclear Power Station - Unit 3 (Apr 1980 to May 1980)
Northeast Utilities Service Company
Geotechnical Engineer

Maine Yankee Nuclear Power Station (Mar 1980 to Apr 1980)
Maine Yankee Atomic Power Company
Geotechnical Engineer

Patriot Generating Station (May 1979 to Jan 1980)
Indianapolis Power and Light Company
Geotechnical Engineer

Prairie Island Nuclear Generating Plant (Jan 1980 to Feb 1980)
Northern States Power Company
Geotechnical Engineer

Verification and Documentation (June 1979 to Dec 1979)
Geotechnical Division Computer Programs
Geotechnical Engineer

North Valmy Power Station (Oct 1979 to Nov 1979)
Sierra Pacific Power Company
Geotechnical Engineer

Salina Basin, National Waste Terminal Storage Program (June 1979 to Sept 1979)
Office of Nuclear Waste Isolation, Battelle Memorial Institute
Geotechnical Engineer

Surry Nuclear Power Station - Units 1 and 2 (Mar 1979 to June 1979)
Virginia Electric and Power Company
Geotechnical Engineer

Beaver Valley Power Station - Unit 1 (Mar 1979 to June 1979)
Duquesne Light Company
Geotechnical Engineer

James A. FitzPatrick Nuclear Power Station (Mar 1979 to June 1979)
Power Authority of the State of New York
Geotechnical Engineer

Maine Yankee Nuclear Power Station (Mar 1979 to June 1979)
Maine Yankee Atomic Power Company
Geotechnical Engineer

Petersburg Generating Station (May 1979 to June 1979)
Indianapolis Power and Light Company
Geotechnical Engineer

Mystic Station (Nov 1978 to Apr 1979)
Boston Edison Company
Geotechnical Engineer

Oosterschelde Closure Project (Jan 1978 to Feb 1979)
Rijkswaterstaat Deltadienst
The Hague, Netherlands
Geotechnical Engineer

Waste Treatment Building (Aug 1978 to Oct 1978)
Mystic Station, Boston Edison Company
Geotechnical Engineer

Haven Nuclear Power Plant Site (Feb 1978 to Nov 1978)
Wisconsin Electric and Power Company
Geotechnical Engineer

Beaver Valley Power Station - Unit 1 (Feb 1978 to Nov 1978)
Duquesne Light Company
Geotechnical Engineer

North Anna Nuclear Power Station - Units 3 and 4 (Sept 1977 to June 1978)
Virginia Electric and Power Company
Geotechnical Engineer

Beaver Valley Power Station - Unit 2 (Feb 1978 to Mar 1978)
Duquesne Light Company
Geotechnical Engineer

Nine Mile Point 2 Nuclear Power Station (July 1977 to Mar 1978)
Niagara Mohawk Power Corporation
Geotechnical Engineer

River Bend Nuclear Power Station (Jan 1977 to Jan 1978)
Gulf States Utilities Company
Geotechnical Engineer

North Anna Nuclear Power Station - Units 1 and 2 (May 1977 to July 1977)
Virginia Electric and Power Company
Geotechnical Engineer

Patriot Generating Station (Aug 1976 to Apr 1977)
Indianapolis Power and Light Company
Geotechnical Engineer

Salem Harbor Station (Oct 1976 to Feb 1977)
New England Power Company
Geotechnical Engineer

Oosterschelde Closure Project (Nov 1976 to Dec 1976)
Rijkswaterstaat Deltadienst
The Hague, Netherlands
Geotechnical Engineer

D'APPOLONIA CONSULTING ENGINEERS, INC., PITTSBURGH, PENNSYLVANIA - 1974 TO 1976
Director of Testing and Research

SOIL MECHANICS RESEARCH LABORATORY, THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO - 1970 TO 1974
Research Associate

DEPARTMENT OF CIVIL ENGINEERING, THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO - 1969 TO 1970

Teaching Associate

DEPARTMENT OF OCEAN ENGINEERING, UNIVERSITY OF RHODE ISLAND, KINGSTON, RHODE ISLAND - 1969

Research Associate

SOIL MECHANICS RESEARCH LABORATORY, UNIVERSITY OF RHODE ISLAND, KINGSTON, RHODE ISLAND - 1967 TO 1969

Research Assistant

RETIRED SERVICEMEN ENGINEERING AGENCY, TAIPEI, TAIWAN - 1964 TO 1967

Junior Engineer

Resume of

Paul J. Trudeau

Paul J. Trudeau

Senior Lead Engineer

Years Experience (as of December 1998)

At Stone & Webster: 26 With other Firms: 0

Department/Division/Location

Geotechnical/Division 50/Boston

Professional History

Stone & Webster Engineering Corporation, Boston, Massachusetts - 1973 to Present
Massachusetts Institute of Technology - Cambridge, Massachusetts - 1971 to 1973
Stone & Webster Engineering Corporation, Boston, Massachusetts - 1971 to 1972
Worcester Polytechnic Institute, Worcester, Massachusetts - 1967 to 1971

Areas of Expertise

- Geotechnical Engineering And Design
- Use of Computers In Geotechnical Analyses and Designs
- Managing Geotechnical Investigations
- Geotechnical Instrumentation
- Performing Cross-Hole Shear Wave Velocity Surveys
- Regulatory Compliance, Review, and Implementation (NRC)

Awards

Desmond Fitzgerald Medal awarded by the Boston Society of Civil Engineers for "Shear Wave Velocity and Modulus of a Marine Clay," Journal of the Boston Society of Civil Engineers, January 1974.

Computer Hardware/Software Capabilities

Mr. Trudeau has considerable experience with PC and mainframe computer programs for performing geotechnical analyses. He is expert in developing spreadsheets using Microsoft Excel and Lotus for solving complex engineering calculations and also is an expert FORTRAN programmer and in programming IBM JCL. He also has considerable experience in using MicroStation for generating report-quality sketches and figures and in using InRoads for plotting contours and determining earthwork quantities.

He is adept at developing batch programs, as well as programming in dBASE, AWK, perl, and developing shell scripts in Unix. He routinely uses these techniques for automatic placement of graphics at correct locations and scales in MicroStation design files for generation of geotechnical figures, such as boring location plans, subsurface profiles, contour maps, and other figures for reports.

Department/Division Assignments

Division Computer Coordinator

Training

40 hours of instruction in Waste Site Worker Protection and 8 hours of instruction in Supervisory Training to comply with OSHA 1910.120(e)(2&3)

Experience Summary

Mr. Trudeau has over 26 years of experience in the engineering industry. Currently, as a Senior Lead Engineer in the Geotechnical Division of Stone & Webster Engineering Corporation, he is designated as the Division Computer Coordinator and as the Division Specialist in cross-hole seismic velocity surveys. As Computer Coordinator, he is responsible for the development, documentation, and maintenance of more than 80 computer programs sponsored by the Geotechnical Division and for providing consulting for Geotechnical Division computer applications. As the Division Specialist in cross-hole seismic velocity surveys, he is responsible for performing the field testing and interpreting the data for use in static and dynamic analyses.

Since joining Stone & Webster Engineering Corporation in 1973, he has served as a Lead Geotechnical Engineer on numerous fossil power plants, Independent Spent Fuel Storage Installations (ISFSI) at Private Fuel Storage Facility in Skull Valley, UT and at Maine Yankee's nuclear plant in Wiscasset, ME, the Bellefonte Nuclear Plant, the Shoreham Nuclear Power Plant, the Falcon Seaboard Gas Pipeline, the TVA Widows Creek Steam Plant, and various projects at the Hanscom Air Force Base. He has also served as a Support Engineer on several nuclear and fossil power plant projects. In these roles, he was responsible for performing geotechnical investigations, preparing geotechnical analyses, developing geotechnical design criteria for other disciplines, such as Structural, Environmental, Engineering Mechanics, and Electrical, and for preparing geotechnical sections of Preliminary and Final Safety Analyses Reports and Environmental Reports. This work was performed in accordance with quality assurance programs that satisfied the quality assurance requirements of Appendix B of 10CFR Part 50 and NQA-1.

He was also responsible for reviewing geotechnical analyses and reports prepared by others on these projects, and for preparing testimony and for testifying at public hearings. He has also completed 40 hours of instruction in Waste Site Worker Protection and 8 hours of instruction in Supervisory Training to comply with OSHA 1910.120(e)(2&3) and is certified to work on hazardous waste sites.

Mr. Trudeau's field experience includes performing cross-hole shear wave velocity tests in Maine, Connecticut, and Texas, geotechnical boring supervision at Jamesport, Shoreham, and Shoreham West on Long Island in New York and at Wards Island in New York, New York, and a compaction control investigation and intake canal revetment repair at Shoreham Unit No. 1. He has performed inspections of the haul road for transport of 300-ton steam generators at the North Anna Nuclear Power Station in Virginia, and has inspected the route proposed by Chem-Nuclear for transport of the 800-ton reactor pressure vessel from the Shoreham Nuclear Power Station to their disposal facility in Barnwell, South Carolina. In addition, he has served as Lead Scientist/Field Supervisor of environmental borings that were drilled for site assessment studies performed for New York City Department of Environmental Protection at their Jamaica, Wards Island, and 26th Ward water pollution control plants.

Mr. Trudeau's laboratory experience includes performing index property tests, consolidation tests, Hardin Oscillator tests, and static and dynamic triaxial tests. He was instrumental in selection, installation, and testing and debugging of Stone & Webster's Geotechnical laboratory data acquisition system. His educational experience encompasses many aspects of civil engineering, including soil mechanics and foundations, computer programming (FORTRAN), soil dynamics, earthquake engineering, geotextiles, and structures.

Education

Master of Science in Civil Engineering, MIT, Cambridge, Massachusetts - 1973
B.S. in Civil Engineering, Worcester Polytechnic Institute, Worcester, Massachusetts - 1971

Licenses, Registrations, and Certifications

Professional Engineer - Massachusetts - 1977

Professional Affiliations

Chi Epsilon: Member - 1969
American Society of Civil Engineers: Member 1971
Boston Society of Civil Engineers Section/ASCE: Member 1971
International Society of Soil Mechanics and Foundation Engineering: Member 1974

BSCES Director
BSCES Awards Committee - Chairman
BSCES Student Chapter Committee - Chairman
BSCES Membership Committee - Member
BSCES Task Force for Younger Members - Member
ASCE National Convention Attendance Committee - Co-Chairman
BSCES Geotechnical Engineering Practice Lecture Series Committee - Member

Publications

Trudeau, P.J., Whitman, R.V., and Christian, J.T., "Shear Wave Velocity and Modulus of a Marine Clay," Journal of the Boston Society of Civil Engineers, January 1974.

Pierce, D.S., and Trudeau, P.J., "Digital and Analog Methods for the Development of Stereoscopic Contour Maps for Geological and Geophysical Analysis," Geological Society of America Abstracts with Programs, Vol. 10, No. 7, 1978.

Experience History

STONE & WEBSTER ENGINEERING CORPORATION, BOSTON, MASSACHUSETTS - 1973 TO PRESENT

Geotechnical Division (Apr 1977 to Present)
Computer Coordinator

Independent Spent Fuel Storage Installation (Sept 1998 to Present)
Maine Yankee Atomic Power Company – Wiscasset, ME
Lead Geotechnical Engineer

VX Full Scale Plant (Mar 1998 to Present)
U.S. Army Program Manager for Chemical Demilitarization, Aberdeen, Maryland
Lead Geotechnical Engineer

Combined-Cycle Power Plant (Feb 1998 to Present)
EMI, Rumford, ME and Tiverton, RI
Lead Geotechnical Engineer

Private Fuel Storage Facility – Skull Valley, UT (Dec 1997 to Present)
Private Fuel Storage, Limited Liability Corporation
Lead Geotechnical Engineer

VX Full Scale Plant (April 1997 to Present)
U.S. Army Program Manager for Chemical Demilitarization, Newport, IN
Lead Geotechnical Engineer

Mystic, Edgar, and Medway Combined Cycle Power Plants (Mar 1998 to Dec 1998)
Sithe Energies, Inc
Geotechnical Engineer

Terminal A Area 8 (Mar 1998 to Oct 1998)
MASSPORT
Geotechnical Engineer

Tapoco Developments (Dec 1997 & July/Aug 1998)
Santeetlah Dam
Geotechnical Engineer

Tapoco Developments (Aug 1997 to Sept 1997)
Cheoah Dam

Big Brown Steam Electric Station, Fairfield, TX (July 1997 to Nov 1998)
TU Electric Company
Geotechnical Engineer

Building 99 Fuel Oil Storage Facility (June 1997 to Aug 1997)
GE River Works Plant – Lynn, MA
Geotechnical Engineer

Private Fuel Storage Facility – Skull Valley, UT (Jan 1997 to Oct 1997)
Private Fuel Storage, Limited Liability Corporation
Geotechnical Engineer

Building 66 G & L G60TX Foundation (Dec 1996 to Jan 1997)
GE River Works Plant – Lynn, MA
Geotechnical Engineer

Tapoco Developments (Nov 1996 to Feb 1997)
Calderwood Dam
Geotechnical Engineer

19th St Substation (Oct 1996 to Jan 1998)
Potomac Electric Power Co, Washington, D. C.
Geotechnical Engineer

Boston Ramps (Feb 1996 to Dec 1996)
Massachusetts Turnpike Authority
Geotechnical Engineer

Goodhue County Independent Spent Fuel Storage Installation (Dec 1995 to Sept 1996)
Northern States Power Company
Geotechnical Engineer

Central Artery/Third Harbor Tunnel Project (Feb 1994 to January 1997)
Mass. Department of Public Works
Manager of Computer Services

Bellefonte Nuclear Plant (Oct 1993 to Mar 1994)
Tennessee Valley Authority
Lead Geotechnical Engineer

Chubb & Son, Incorporated (Sept 1993 to Jan 1994)
Geotechnical Consultant

Granite State Gas Transmission Company (Nov 1993)

Petersburg Generating Station (July 1993 to Sept 1993)
Indianapolis Power and Light Company

Pease Air Force Base (Aug 1993)
United States Air Force
Geotechnical Engineer

Green Mountain Power Corporation (July 1993)
Geotechnical Engineer

E. W. Stout Generating Station (July 1993)
Indianapolis Power and Light Company
Geotechnical Engineer

Hanscom Air Force Base (Apr 1993 to July 1993)
United States Air Force
Lead Geotechnical Engineer

Portland Natural Gas Transmission System (Nov 1992 to Apr 1993)

Maine Low-Level Radioactive Waste Authority (Oct 1992 to May 1993)
Geotechnical Engineer

Afobaka Dam (Oct 1992 to Jan 1993)
Suriname Aluminum Company
Geotechnical Engineer

Widows Creek (Sept 1992 to Feb 1993)
Tennessee Valley Authority
Lead Geotechnical Engineer

General Support Services Contract, Richland Field Office (Sept 1992 to Oct 1992)
U. S. Department of Energy

Patriot Generating Station (June 1992 to Aug 1992)
Indianapolis Power and Light Company
Geotechnical Engineer

Bellefonte Nuclear Plant (Feb 1992 to July 1992)
Tennessee Valley Authority
Lead Geotechnical Engineer

Central Artery/Third Harbor Tunnel Project (Mar 1990 to Feb 1992)
Mass. Department of Public Works
Manager of Computer Services

Petersburg Generating Station (Nov 1991 to Jan 1992)
Indianapolis Power and Light Company
Geotechnical Engineer

Petersburg Generating Station (Sept 1991 to May 1992)
Indianapolis Power and Light Company
Geotechnical Engineer

New Production Reactor (Sept 1991 to Oct 1991)
US Department of Energy
Geotechnical Engineer

New Production Reactor (Feb 1991 to May 1991)
US Department of Energy
Geotechnical Engineer

Widows Creek Steam Plant - Unit 8 (Feb 1991 to June 1991)
Tennessee Valley Authority
Lead Geotechnical Engineer

North Anna Nuclear Power Station (Sept 1991)
Virginia Power Company
Geotechnical Engineer

EG & G Rocky Flats (Sept 1991)
US Department of Energy
Geotechnical Engineer

Hanscom Air Force Base (Jan 1991 to Feb 1991)
United States Air Force
Lead Geotechnical Engineer

Hanscom Air Force Base (Jan 1990)
United States Air Force
Lead Geotechnical Engineer

Sludge Management Project (Sept 1989 to July 1990)
New York City Department of Environmental Protection
Geotechnical Engineer / Geotechnical Field Inspector / Lead Scientist/Field Supervisor

Plattsburgh 12 In. Diameter Gas Pipeline (Feb 1989 to Apr 1990)
Falcon Seaboard Pipeline Company
Lead Geotechnical Engineer

Great Northern Paper Company (Feb 1989 to May 1989)
Geotechnical Engineer

Shoreham Nuclear Power Station - Unit No. 1 (Jan 1983 to Mar 1992)
Long Island Lighting Company
Lead Geotechnical Engineer

Office of Nuclear Waste Isolation (ONWI) of Battelle Memorial Institute (Jan 1982 to Oct 1987)
U.S. Department of Energy
Geotechnical Computer Consultant

Bradley Lake Project (Feb 1986 to Oct 1986)
Alaska Power Authority
Geotechnical Engineer

Salt Cave Hydroelectric Project (Apr 1986 to May 1986)
City of Klamath Falls, Oregon
Geotechnical Engineer

Beaver Valley Power Station - Unit 2 (Oct 1984 to Aug 1985)
Duquesne Light Company
Geotechnical Engineer

Malakoff Site (Apr 1982 to Dec 1982)
Houston Lighting & Power Company
Geotechnical Engineer

Site X (Aug 1981 to Dec 1981)
Houston Lighting & Power Company
Geotechnical Engineer

Patriot Station (May 1981 to July 1981)
Indiana Power and Light Company
Geotechnical Computer Consultant

Site X (May 1981 to July 1981)
Houston Power and Light Company
Geotechnical Computer Consultant

Site X (Mar 1981 to May 1981)
Houston Lighting & Power Company
Geotechnical Engineer

Western Fuels Association. Inc. (Dec 1980)
Geotechnical Computer Consultant

Patriot Station (Nov 1980 to Dec 1980)
Indiana Power and Light Company
Geotechnical Computer Consultant

Site X (Oct 1980)
Houston Lighting & Power Company
Geotechnical Engineer

Pumped Storage Project (Apr 1980 to July 1980)
Public Service Company of New Mexico
Geotechnical Computer Consultant

Beaver Valley Power Station - Unit No. 2 (Feb 1980 to Mar 1980)
Duquesne Light Company
Geotechnical Computer Consultant

Millstone Unit No. 3 (Feb 1980)
Northeast Utilities Service Company
Geotechnical Engineer

Martin Cooling Dike (Jan 1980)
Florida Power and Light Company
Geotechnical Engineer

Beaver Valley Power Station - Unit No. 1 (Mar 1970 to May 1979)
Duquesne Light Company
Geotechnical Computer Consultant

Haven Nuclear Power Station (Dec 1978 to Jan 1979)
Wisconsin Electric Power Company
Geotechnical Engineer

Office of Nuclear Waste Isolation (ONWI) of Battelle Memorial Institute (Sept 1978 to Nov 1979)
U.S. Department of Energy
Geotechnical Computer Consultant

Stuyvesant & New Haven Sites (Apr 1978 to Sept 1978)
New York State Electric and Gas Corp.
Geotechnical Computer Consultant

Sundesert 500 kV Transmission and Substation Project (Aug 1977 to Dec 1977)
San Diego Gas and Electric Company
Geotechnical Computer Consultant

Jamesport Nuclear Power Station (July 1976 to Apr 1977)
Long Island Lighting Company
Geotechnical Engineer

Shoreham Unit No. 1 (Feb 1976 to June 1976)
Long Island Lighting Company
Geotechnical Engineer

Jamesport Nuclear Power Station (Feb 1975 to Jan 1976)
Long Island Lighting Company
Geotechnical Engineer

Shoreham Unit No. 1 (Sept 1974 to Jan 1975)
Long Island Lighting Company
Geotechnical Engineer

Shoreham Unit No. 1 (June 1974 to Aug 1974)
Long Island Lighting Company
Geotechnical Engineer

Jamesport Nuclear Power Station (Mar 1974 to June 1974)
Long Island Lighting Company
Geotechnical Engineer

Shoreham Unit No. 1 (Oct 1973 to Apr 1974)
Long Island Lighting Company
Geotechnical Engineer

Jamesport and Shoreham West (Sept 1973)
Long Island Lighting Company
Geotechnical Engineer

Northfield Mountain Pumped Storage Project (Aug 1973 to Oct 1973)
Northeast Utilities Service Company
Geotechnical Engineer

Jamesport Nuclear Power Station (Aug 1973)
Long Island Lighting Company
Geotechnical Engineer

Geotechnical Division Computer Coordinator (Mar 1973 to Nov 1973)

North Anna Power Station (Feb 1973)
Virginia Electric and Power Company
Geotechnical Engineer

Massachusetts Institute of Technology - Cambridge, Massachusetts - 1971 to 1973
Graduate Research Assistant

Resume of

Kenneth W. Dungan, P.E.

risktek

KENNETH W. DUNGAN, P.E.
PRINCIPAL

EDUCATION

B.S., Chemical Engr. and Fire Protection Engr., University of Maryland, 1971
M.S., Engr., Environmental Engr. (Chemical Engr. minor), University of Tennessee, 1977

PROFESSIONAL AFFILIATIONS

Registered Professional Engineer, Tennessee and Pennsylvania
Society of Fire Protection Engineers, Fellow
- President (1992)
- Qualification Board (1978-1984), Past Chairman
- Board of Directors 1984-1994)
- Tennessee Valley Chapter, Past President
- Harold E. Nelson Service Award, 1996

SFPE Scientific and Educational Foundation, Board of Governors (1994-present)
National Fire Protection Association, Member (1974-present)
- Environmental Advisory Committee (1988-1998), Chair (1997-1998)
- Technical Committee on Signaling Systems, Initiating Device Task Group (1978-present)
- Technical Committee on Non-Nuclear Power Plants (1980-present), Chairman (since 1995)
- Technical Committee on Wood, Paper, and Cellulosic Dusts (1984-1999)

American Institute of Chemical Engineers, Member (1972-present)
- Health and Safety Section (1988-present)

American Association of Engineering Societies
- Executive Committee, Vice Chairman, 1994-1995, Chair-Elect 1996, Chair 1997

National Research Council, Board on Assessment of National Institute of Standards and Technology Programs (1995-1997)
Building and Fire Research Laboratory, Vice Chair 1997

PROFESSIONAL EXPERIENCE

Mr. Dungan has a broad, diversified background in safety, fire protection, and environmental engineering. He currently provides engineering services, including performing hazards and safety analyses, risk assessments, developing design criteria, reviewing engineering design, conducting and reviewing testing programs, research, investigating losses, developing and reviewing loss prevention and emergency response programs, auditing risk management programs, and presenting seminars and workshops on fire protection and safety. He has particular expertise in utilities, telecommunications, semiconductors, and chemical industries.

Prior to co-founding Risk Technologies, LLC in 1995, he founded Professional Loss Control in 1976 and served as its President for nineteen years. Mr. Dungan was the assistant director of engineering for a captive insurance company where he was responsible for establishing engineering guidelines for the safe design and operation of chemical-related facilities, and was the department head for fire protection engineering of a large chemical and nuclear production facility.

Mr. Dungan has taught college level courses on many aspects of fire protection. He has also lectured across the United States, Canada, Europe, Asia, and Africa on various subjects of loss prevention, risk control, and emergency response.

AREAS OF SPECIALIZATION

Risk Management
Process Safety Management
Emergency Preparedness
Design
Research
Fire and Explosion Investigation

PUBLICATIONS AND PRESENTATIONS

- DiNenno, Philip, J., and Dungan, Kenneth W., "An Evaluation of Prediction Methodologies for Effectiveness of Fire Barriers in LWR Facilities," Sandia Laboratories, 1979.
- DiNenno, Philip J., and Dungan, Kenneth W., "Evaluation of the Effectiveness of Detection Systems in LWR Facilities," Sandia Laboratories, 1980.
- Dungan, Kenneth W., "Fire Protection in Coal Handling Facilities-New and Retrofit," Annual SFPE Meeting Fire Protection Engineering Seminar, Dallas, Texas, 1981.
- Dungan, Kenneth W., "Finish Fire Test on Turbine Lube Oil Hazards," presented at WATTec 1980, Knoxville, Tennessee, February 1980.
- Dungan, Kenneth W., "Kracht Centrales en Brandbeveilging, Stichting Informative Preventie," No. 20, August 1980.
- Dungan, Kenneth W., "Mechanical Design Considerations for Turbine Fire Protection," ASME Meeting, Chicago, Illinois, November 1980.
- Mowrer, D.S., and Dungan, K.W., "Coal Handling Facilities-Rejuvenating Old Problems Requires New Solutions," 15th Loss Prevention Symposium of the AIChE, Detroit, Michigan, 1981.
- Dungan, Kenneth W., "Fire Protection for Air Rights Structures," NFPA Annual Meeting, Kansas City, Missouri, May 1983.
- Dungan, Kenneth W., and Lorenz, Mark S., "Fire Loss Data Update for Nuclear Power Plants," Electric Power Research Institute, Palo Alto, California, March 1983.
- Dungan, Kenneth W., "Evaluation and Control of Pulverized Fuel Systems Hazards," NFPA Annual Meeting, New Orleans, Louisiana, May 1984.
- Dungan, Kenneth W., "Practical Application of Quantitative Fire Hazards Analyses," SFPE Symposium of Techniques of Quantitative Fire Hazards Analyses, University of Maryland, College Park, Maryland, March 1985.
- Dungan, Kenneth W., "Simplified Methodology for Evaluation of Fire Resistance of Structural Steel," presented at WATTec 13, Knoxville, Tennessee, February 1986.
- Dungan, Kenneth W., "Fire Risk Assessment," presented at "Emergency Planning and Response: The Fire Aspects," SFPE, Philadelphia, Pennsylvania, November 1987.
- Dungan, Kenneth W., "Evaluating Fire Resistance Requirements of Structural Steel," presented at "Seminar on Fire Protection for Building Construction," SFPE, North Texas Chapter, Dallas, Texas, April 1989.
- Dungan, Kenneth W., "Fire Protection: Design by Objective," presented at the SFPE Engineering Seminar, NFPA Fall Meeting, Seattle, Washington, November 1989.
- Dungan, Kenneth W., "Fire and the Environment," presented at the SFPE, Arizona Chapter, Phoenix, Arizona, April 1991.
- Dungan, Kenneth W., "Design Guide for Fire Protection of Grouped Electrical Cables," Electric Power Research Institute, Research Project Number RP2969-4, Palo Alto, California, 1991.

- Dungan, Kenneth W., "The Benefit (and Costs) of Change," presented at Conference on Fire Safety Design in the 21st Century, Worcester, Massachusetts, May 1991.

- Dungan, Kenneth W., "Chemical Process Safety in the USA," KISCO Safety Conference, Seoul, Korea, July 1994.

- Dungan, Kenneth W., "Fire Protection Performance-Based Design," presented Ontario Chapter SFPE, Toronto, Canada, October 1994.

- Dungan, Kenneth W., "Using Fire Models for Design and Operation," EEI Fire Protection Committee, Richland, Virginia, April 1995.

- Dungan, Kenneth W., "Risk-Based, Reliability-Centered Maintenance Applied to Fire Protection Systems," Second International Conference on Fire Research and Engineering, Gaithersburg, MD, 3-8 August 1997.

- Dungan, Kenneth W., Principal Engineer and co-author Military Handbook, MIL-HDBK 1117 "Inspection, Test and Maintenance of Fire Protection Systems", USDoD, April 1999.

SPECIFIC EXPERIENCE

For the past 21 years, Mr. Dungan has been supporting industrial clients around the world to understand and manage their risks from fire, explosion, and toxic releases. He has helped plants develop responses to regulations for nuclear facilities, such asUSNRC's BTP 9.5-1 Appendix A and 10 CFR 50.48 Appendix R, and USDOE Orders. He has also helped plants comply with regulations such as OSHA 1910-119, Process Safety Management and USEPA Risk Management Planning.He has conducted numerous engineering evaluations to assess the performance of fire protection/safe shutdown strategies and emergency preparedness. He has also audited many fire protection programs.

Mr. Dungan has helped to advance the application of engineering analysis to fire safety issues for numerous plants. He developed a simplified methodology for evaluation of fire resistance for structural steel and won acceptance of the methodology by the USNRC. He developed the test program and developed the topical report for conduit internal fire stopping criteria for 22 electric utilities and won acceptance of the USNRC. He has supported EPRI on a variety of projects including a design guide for fire protection of grouped electrical cables, the development of the Fire Induced Vulnerability Evaluation (FIVE) methodology and thermolag resolution testing. He also helped develop the Fire Safety Evaluation Methodology for the Atomic Energy Control Board in Canada.

Throughout his career, Mr. Dungan has developed a reputation with regulatory agencies for the credible application of engineering to fire safety issues.

Resume of

Thomas S. LaGuardia, P.E.

THOMAS S. LaGUARDIA, P.E.
President

SPECIAL QUALIFICATIONS:

Planning and management of decontamination and decommissioning programs; planning and development of the design of low-level waste facility projects; heat transfer and fluid flow systems analysis of nuclear and conventional power plant operation and process equipment; development, implementation and audit of quality assurance programs; organization, management and supervision of engineering personnel.

EDUCATION:

Polytechnic Institute of Brooklyn, Brooklyn, New York
B.S. Mechanical Engineering - 1962

University of Connecticut, Storrs, Connecticut
M.S. Mechanical Engineering - 1968

Various short courses in computer programming, radioactive waste management, dynamic shock analysis and program management.

PROFESSIONAL CERTIFICATION:

Registered PE - Connecticut 10393, New York 059389
Certified Cost Engineer, AACE

EXPERIENCE:

TLG Services, Inc.
President
1982 to Present

Responsible for the operation of this consulting engineering company whose principal objective is to provide planning and management of decontamination and decommissioning projects, and to support nuclear power plant utilities in estimating and funding the costs of decommissioning. Thoroughly familiar with approaches, methodologies and regulatory requirements associated with handling, packaging and storage of radwaste, and has been responsible for the preparation of decommissioning feasibility and cost studies for over 60 nuclear and fossil plants. Provided expert testimony in over 60 rate hearings.

Directed the preparation of the Pathfinder reactor Decommissioning Plan, and the structural analysis of the Pathfinder reactor vessel to secure an NRC license for transport as its own container. Supervised the evaluation of decommissioning alternatives and costs for decommissioning the Rancho Seco Nuclear Power Plant. Supervised the cost estimate for decommissioning the Shoreham Nuclear Power Station, and the preparation of draft Decommissioning Plan. Participated in the LILCO Nuclear D&D Safeguards Committee. Directed the preparation of the Cintichem Research Reactor DP and cost estimate. Participated in the Cintichem Nuclear Safeguards Committee. Prepared a verification review of the Fort St. Vrain decommissioning cost estimate to support a letter of credit for decommissioning funding.

Supervised the preparation of decommissioning cost estimates for the U.S. Department of Energy's Gaseous Diffusion Plants located in Oakridge, Tennessee, Paducah, Kentucky, and Portsmouth, Ohio.

Prepared a detailed study for the AIF National Environmental Studies Project to develop guidelines for producing decommissioning cost estimates on a consistent basis in a standard format. Prepared a cost benefit study for the NRC on techniques to facilitate decommissioning by reducing exposure and radioactive wastes.

Provided planning and cost estimating support for the decommissioning of the Gentilly Unit 1 reactor in Canada, and managed the removal of piping and components during the decommissioning of the Shippingport Atomic Power Station.

Nuclear Energy Services, Inc.
1974 - 1982

General Manager, Waste Management Services (1979 – 1982)

Group Manager, Engineering Support Services (1977 – 1979)

Quality Assurance Manager (1975 – 1977)

Manager of Plant Systems Engineering (1973-1975)

Gulf United Nuclear
Sr. Mechanical Engineer, Power Plant Engineering
1968-1973

Combustion Engineering, Inc.
Thermal Performance Group Leader, Marine Department
1962-1968

COMMITTEES:

ANS 15.10 - Decommissioning of Research Reactors
ANS 11.18 - Decommissioning
ANS E10.03.06 - Decommissioning
AIF NESP Subcommittee on Decommissioning

PUBLICATIONS: See attached listing.

EXPERT TESTIMONY: See attached listing

LaGuardia, T.S., et al.:

"Identification and Evaluation of Facilitation Techniques for Decommissioning Light Water Power Reactors", USNRC, NUREG/CR-3587, June 1987

"Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986

"TMI Accident: 1981 Perspective, Technical Problems and/or Opportunities," presented at the Southeastern Electric Exchange, Ashville NC, September 1981

"Decommissioning Handbook," prepared for US Department of Energy, DOE/EV/10128-1, November 1980

"Reactor Decommissioning Information Pertinent to Planning," presented at ANS meeting, Washington DC, November 1978

"An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives," AIF/NESP-009, November 1976

"Decommissioning of First-Generation Nuclear Power Plants in the United States," presented at the International Conference on Nuclear Power Performance and Safety, Vienna, Austria, October 1, 1987

"Removal of Shippingport Station Primary System Components and Piping," presented at the 1987 International Decommissioning Symposium, Pittsburgh, PA, October 5, 1987

LaGuardia, T.S.:

"Recovery of Nuclear Power Plant Decommissioning Costs," presented at the Regulatory Conference at Iowa State University, May 1977

"Nuclear Power Reactor Decommissioning," Nuclear Safety, Volume 20, No. 1, January 1979

"Decommissioning Methods and Equipment," presented at the ANS Meeting on Decontamination and Decommissioning of Nuclear Facilities, Sun Valley, Idaho, September 1979

"Concrete Decontamination and Demolition Methods," presented at the Concrete Decontamination Workshop, CONF-800542, PNL-SA-8855, May 1980

"Cost Benefit Analysis for Shippingport "Decontamination," presented at the ANS Winter Meeting, San Francisco, November 29, 1981

"State-of-the-Art Technology in Nuclear Decommissioning," presented to the ASME/ANS Nuclear Engineering Conference, Portland, OR, July 25, 1982

"Decommissioning Funding: A Primer for the Health Physicist," presented at the Health Physics Symposium on Decontamination and Decommissioning, in Knoxville, TN, February 1986

"Decommissioning Cost Estimating and Contingency Application," presented at the 1987 International Symposium, Pittsburgh, PA, October 8, 1987

"Environmental Report of the Current Decommissioning Status of Dresden 1," prepared for Commonwealth Edison Company, Docket No. 50-10, February 1988

T.S. LaGuardia
Summary of Testimony Experience on Electric Utility Dismantling/Decommissioning
Listing Current as of November 3, 1995

Index	Station	Utility	Date of Estimate	Jurisdiction
10	Beaver Valley Unit 1	Pennsylvania Power Co.	1984	Pennsylvania PUC
20	Big Rock Point	Consumers Power Co.	1990	Michigan PSC
25	Brunner Island 1-3	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
30	Brunswick Units 1 & 2	Carolina P&L Co.	1979	North Carolina PUC
40		Carolina P&L Co.	1979	South Carolina PSC
50		Carolina P&L Co.	1987	North Carolina PUC
60		Carolina P&L Co.	1987	South Carolina PSC
70		Carolina P&L Co.	1987	Federal Energy Regulatory Commission
80		Carolina P&L Co.	1989	North Carolina Utilities Commission
90	Comanche Peak 1&2	Texas Utilities Electric Company	1988	Public Utility Commission of Texas
100	Units 1 & 2	Texas Utilities Electric Company	1992	Public Utility Commission of Texas
110	Catawba Units 1&2	Duke Power Company	1989	North Carolina Utilities Commission
120	Callaway	Union Electric Company	1983	Missouri PSC
130		Union Electric Company	1983	Illinois Commerce Commission
140		Union Electric Company	1983	Iowa State Utilities Board
150		Union Electric Company	1983	Federal Energy Regulatory Commission
160	Cooper Nuclear Station	Iowa Power	1988	Iowa Utilities Board
170	Crystal River Unit 3	Florida Power Corp.	1985	Florida Public Service Commission
180		Florida Power Corp.	1991	Florida Public Service Commission
190	Humboldt Bay	Pacific G&E Co.	1985	California PUC
200	Diablo Canyon 1 & 2	Pacific G&E Co.	1985	California PUC
210	Duane Arnold	Iowa Electric Co	1985	Iowa State Utilities Board
220			1989	Iowa State Utilities Board
230	R.E. Ginna	Rochester G&E Co.	1982	New York PSC
240		Rochester G&E Co.	1989	New York PSC
250	Harris	Carolina P&L Co.	1987	Federal Energy Regulatory Commission

Index	Station	Utility	Date of Estimate	Jurisdiction
255	Harrison 1-3	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
260		Carolina P&L Co.	1987	North Carolina Utilities Commission
270		Carolina P&L Co.	1987	South Carolina PSC
280	Hatch Units 1& 2	Georgia Power Co.	1990	Georgia Public Service Commission
282	Hatfield 1-3	Allegheny Power Systems /West Penn Power	1994	Pennsylvania Public Utility Commission
285	Holtwood 15-17	Allegheny Power Systems/West Pennsylvania Power	1994	Pennsylvania Public Utility Commission
290	Hope Creek	Public Service E&G Co.	1990	State of NJ Board of Regulation
300	Kewaunee	Wisconsin Public Service	1984	Wisconsin PSC
310		Wisconsin Public Service	1984	Michigan PSC
320		Wisconsin Public Service	1984	Internal Revenue Service
330		Wisconsin Public Service	1984	Federal Energy Regulatory Commission
340	Maine Yankee	Maine Yankee Atomic Power	1983	Federal Energy Regulatory Commission
350		Maine Yankee Atomic Power	1987	Federal Energy Regulatory Commission
352	Ft. Martin 1-2	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
355	Martin Creek 1-4	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
360	Millstone Unit 1	Connecticut Light & Power	1987	CT Dept. of Public Utility Control
370	Millstone Unit 2	Connecticut Light & Power	1987	CT Dept. of Public Utility Control
380	Millstone Unit 3	Connecticut Light & Power	1987	CT Dept. of Public Utility Control
390	Monticello	Northern States Power	1979	Minnesota PSC
400		Northern States Power	1986	Federal Energy Regulatory Commission
410		Northern States Power	1986	Federal Energy Regulatory Commission
420		Northern States Power	1986	South Dakota Public Utilities Commission
430		Northern States Power	1986	Minnesota PSC
435	Montour 1-2	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
440	North Anna Units 1&2	Virginia Power Co.	1986	Virginia Corporation Commission
450	Nine Mile Point Unit 1	Niagara Mohawk Power Co.	1979	New York PSC
460		Niagara Mohawk Power Co.	1986	New York PSC
470	Nine Mile Point Unit 2	Niagara Mohawk Power	1986	New York PSC

Index	Station	Utility	Date of Estimate	Jurisdiction
480	Palisades	Consumers Power Co.	1990	Michigan PSC
490	Palo Verde Units 1,2,3	Arizona Public Service Co.	1986	Arizona PSC
500		Public Service NM	1986	New Mexico PSC
510		El Paso Electric Co.	1986	Texas Corporation Commission
520		El Paso Electric Co.	1986	City of El Paso - PURB
530		El Paso Electric Co.	1989	Public Utility Commission of Texas
540		Southern California Edison	1986	California PUC
550	Peach Bottom Units 2 & 3	Public Service E&G Co.	1990	State of NJ Board of Regulation
560	Pebble Springs (Canceled)	Portland General Electric	1977	Oregon Siting Board
570	Perry Unit 1	Cleveland Electric Ill. Co.	1985	Ohio PUC
580		Cleveland Electric Ill. Co.	1985	Federal Energy Regulatory Commission
585	Petersburg 1-4	Indianapolis Power & Light Co.	1995	Indiana Utility Regulatory Commission
586	Pleasants 1&2	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
590	Prairie Island Units 1&2	Northern States Power Co.	1979	Minnesota PSC
600		Northern States Power Co.	1986	Federal Energy Regulatory Commission
610		Northern States Power Co.	1986	Federal Energy Regulatory Commission
620		Northern States Power Co.	1986	South Dakota Public Utilities Commission
630		Northern States Power Co.	1986	Minnesota PSC
635	Pritchard 1-6	Indianapolis Power & Light Co.	1995	Indiana Utility Regulatory Commission
640	River Bend	Gulf States Utilities Co.	1985	Texas Corporation Commission
650	Robinson Unit 2	Carolina Power & Light Co.	1979	N. Carolina Utilities Commission
660		Carolina Power & Light Co.	1979	S. Carolina PSC
670		Carolina Power & Light Co.	1987	Federal Energy Regulatory Commission
680		Carolina Power & Light Co.	1987	N. Carolina Utilities Commission
690		Carolina Power & Light Co.	1987	S. Carolina PSC
700	Salem Units 1&2	Public Service Electric and Gas Company	1990	State of NJ Board of Regulation
710	Seabrook	New Hampshire Yankee	1987	NH Decommissioning Finance Committee
720			1991	NHDFC

Index	Station	Utility	Date of Estimate	Jurisdiction
730	St. Lucie Units 1&2	Florida Power & Light Co.	1987	Florida Public Service Commission
735	Stout 1-7	Indianapolis Power & Light Co.	1995	Indiana Utility Regulatory Commission
736	Sunbury 1-4	Allegheny Power Systems/West Penn Power	1994	Pennsylvania Public Utility Commission
740	Surry Units 1&2	Virginia Power Co.	1986	Virginia Corporation Commission
750	San Onofre Unit 1	Southern Calif. Edison Co.	1986/88	California PUC
760		Southern Calif. Edison Co.	1986/88	Federal Energy Regulatory Commission
770	San Onofre Units 2&3	Southern Calif. Edison Co.	1986/88	California PUC
780		Southern Calif. Edison Co.	1986/88	Federal Energy Regulatory Commission
790	South Texas Project	Houston Lighting & Power	1989	Public Utility Commission of Texas
800	Turkey Point Units 3&4	Florida Power & Light Co.	1987	Florida Public Service Commission
810	Vermont Yankee	Vermont Yankee Power Co.	1981	Vermont HR Energy Commission
820		Vermont Yankee Power Co.	1988	Federal Energy Regulatory Commission
830	Virgil C. Summer	S. Carolina Electric & Gas	1982	S. Carolina PSC
840		S. Carolina Electric & Gas	1990	S. Carolina PSC
850	Vogtle Units 1&2	Georgia Power Co. 1986		Georgia Public Service Commission
860			1990	Georgia Public Service Commission
870	Wolf Creek	Kansas City Power & Light	1983	Kansas Corporation Commission
880		Kansas City Power & Light	1983	Missouri PSC
890		Wolf Creek Nuclear Operating Co.	1988	Kansas Corporation Commission
900	Waterford	Louisiana Power & Light	1984	Louisiana PSC
910	Yankee Rowe	Yankee Atomic Electric Co.	1992	Federal Energy Regulatory Commission

Resume of

Alan I. Soler, Ph. D.

ALAN I. SOLER, Ph.D.

EXECUTIVE VICE PRESIDENT
HOLTEC INTERNATIONAL

EDUCATION

University of Pennsylvania
Ph.D. in Mechanical Engineering (1962)

California Institute of Technology
M.S. in Mechanical Engineering (1959)

University of Pennsylvania
B.S. in Mechanical Engineering (1958)

AREAS OF PROFESSIONAL CONCENTRATION

Dynamics of casks and fuel racks, impact, mechanical design of cask and MPCs, failure analysis of reinforced concrete structures, cask transporter design, NUREG-0612 compliance, crane design and stress analysis.

PROFESSIONAL EXPERIENCE

HOLTEC INTERNATIONAL
Marlton, New Jersey
1986 – Present — Executive Engineer

UNIVERSITY OF PENNSYLVANIA
Philadelphia, Pennsylvania
1966 - 1991 — Professor of Mechanical Engineering and Applied Mechanics

INGERSOLL-RAND RESEARCH CENTER
Princeton, New Jersey
May 1964–Sept. 1965 — Member of Technical Staff

DYNASTRUCTURES, INC., CONSULTANTS IN APPLIED MECHANICS
Philadelphia, Pennsylvania
May 1962–May 1964 — Research Specialist

ACADEMIC HONORS

Tau Beta Pi
Sigma Tau
Society of Sigma Xi

PROFESSIONAL SOCIETY MEMBERSHIPS/ACTIVITIES

Member, ASME, Fellow ASME, 1986
Treasurer, University of Pennsylvania Chapter, Sigma Xi, 1968-70.
General Arrangements Committee Member, 1969, ASME Vibrations Conference.
ASEE Local Activity Coordinator, 1968-1974.

Member, Rotordynamics Subcommittee, ASME Design Division, 1973-1974.
Local Arrangements Committee, 1971 Summer ASME Applied Mechanics Meeting.
Recording Secretary, ASME Applied Mechanics Division, Publication Committee, 1971-1972.
-Applied Mechanics Representative to ASME Power Division Subcommittee on Environmental Policy, 1974-1976.
Member, Turbine and Auxiliaries Committee, ASME Power Division, 1974-76, Papers Review
Member, Task Group on Heat Transfer Equipment, ASME, working group #1 (tubesheets), 1975-1998.
Member - Subcommittee on Pressure Vessels and Piping, Nuclear Engineering Division, ASME, 1976-1987, Chairman, 1984-1987.

TECHNICAL CONSULTING

Consultant to Solid Mechanics Group, Ingersoll-Rand Research Center, Princeton, New Jersey, September 1965 - December 1966.
Consultant to Condenser Engineering Department, Ingersoll-Rand Corporation, Phillipsburg, New Jersey, September 1965 – 1982. Consultant to Structural Mechanics Associates, November 1958 - January 1969.
Visiting Scientist, Mechanical Engineering Research Division, Livermore Laboratories, Livermore, CA, Summer 1973, 1974 (AEC "Q" Clearance).
Member of Consulting Group, Thermac Associates, 1975 - 1986.
Consultant to Joseph Oat Corp. - Manufacturers of Nuclear Heat Exchangers. Camden, New Jersey, 1975 - 1986.
Consultant to Heat Exchange Institute - Nuclear HEX, 1978-1979.
Consultant, Inc., Wilson Div., Reading, PA, 1979-1980.
Consultant, NADC, Willow Grove, PA, 1984-1986.

PATENTS

Patent #3,382,918, May 1968, Reinforcing Structure for Direct Flow Steam Dome for Condensers (with Mr. R. J. Stoker and Dr. B. Paul of Ingersoll-Rand Corporation).

DRY SPENT FUEL STORAGE TECHNOLOGY

1992-Present: Lead Analyst in Mechanical/Seismic/Structural analysis in support of Holtec=s Dry Storage submittals for dual-purpose casks (HI-STAR 100 for Storage and Transport) and for METCON casks (HI-STORM 100 for Storage).

1994: Performed cask tip-over and drop analysis to support §50.59 effort for defueling Shoreham Station using IF-300 casks.

1995: Principal Analyst for evaluating cask drop events for Connecticut Yankee.

1997: Co-developer of the dynamic formalism to predict peak cask deceleration from cask tip-over and drop event on ISFSI pads.

1996: Principal designer of HI-STAR 100 Impact Limiter.

1998: Developer of the "penetration area principle" to predict impact limiter response under cask drop events; method was verified using quarter-scale tests.

1999: Designer and principal analyst for Holtec International's autonomous "Cask Transfer Facility" (CTF).

HIGH DENSITY FUEL RACK STRESS ANALYSIS

- Principal developer of Holtec's rack dynamic analysis code DYNARACK. This code is widely recognized as the most sophisticated program for high density rack seismic analysis.
- Performed seismic analysis of high density racks for 36 Nuclear Power Plants in the period 1980 to present.
- Pioneered dynamic analysis techniques of elevated pool slabs. Qualified the elevated pool slabs of Quad City Units 1 and 2, Grand Gulf and Oyster Creek using dynamic reinforced concrete analysis (all approved by the USNRC).

LICENSING SUPPORT

- Provided licensing support on over forty high-density rack applications to the USNRC (in the past twenty years).
- Appeared as expert witness (support) for Pacific Gas & Electric in Diablo Canyon reracking license review (1987).

PUBLICATIONS/PRESENTATIONS

1. "On the Lobar and Longitudinal Vibrations of Solid Propellant Rocket Motors", (with H. B. Kingsbury and J. R. Vinson) Proceedings of the 6th Solid Propellant Rocket Conference, AIAA, Washington, D.C. (February 1965).
2. "On the Solution to Transient Coupled Thermoelastic Problems by Perturbation Techniques", (with M. A. Brull) presented at the Summer Applied Mechanics Meeting of ASME (June 1965) and published in the Journal of Applied Mechanics (June 1965).
3. "A New Perturbation Technique for Differential Equations with Small Parameters", (with M. A. Brull), Quarterly of Applied Mathematics XXIV, No. 2 (July 1966) and presented at the 5th National Congress on Applied Mechanics, Minneapolis, Minnesota (June 1966).
4. "On Rolling Contact and the Theorem of Angular Momentum", (with S. C. Batterman), Journal of Engineering Education 67, 9 (May 1967).
5. "Higher Order Effects in Thick Rectangular Beams", International Journal of Solids and Structures 4, (July 1968) pp. 723-739.
6. "On the Vibrations and Stability of Moving Bands", Journal of the Franklin Institute (October 1968).
7. "Higher Order Theories for Structural Analysis Using Legendre Polynomial Expansions", presented at ASME Winter Annual Meeting, Los Angeles, CA (November 1969), and published in Journal of Applied Mechanics (December 1969).

8. "One Dimensional Viscous Magnetofluidynamic Flow in an Annulus", (with S. Schwietzer), presented at the AIAA Fluid and Plasma Dynamics Conference, San Francisco, California (June 1969), and published in Journal of the Franklin Institute 289, No. 6 (June 1970).

9. "On the Solution of Finite Deformation Problems of Beams Using Rate Equations", (with J. Lehner), Journal of Applied Mechanics, (March 1970) pp. 207-210.

10. "Approximate Theory for Locally Loaded Plant Orthotropic Beams", (with H. Tsai), International Journal of Solids and Structures 6, (1970) pp. 1055-1068.

11. "Approximate Solution of the Finite Cylinder Problem Using Legendre Polynomials'< (with J. Fellers), AIAA Journal 8, No. 11 (November 1970) and presented at the 6th U.S. Congress on Applied Mechanics (June 1970).

12. "On Analysis of Cable Network Systems Using Galerkin's Method", (with H. Afshari), Journal of Applied Mechanics, (September 1970) pp. 606-612.

13. "On the Buckling of Rings", (with S. C. Batterman), ASCE Engineering Mechanics Journal (December 1970).

14. "Dynamic Response of Sincle Cables with Initial Sag", Journal of the Franklin Institute (October 1970).

15. "Analysis of Cable Dynamics and Optimum Towing Strategies for Tethered Submersibles", (with B. Paul), presented at the Ocean Engineering Symposium, University of Pennsylvania (November 19-20, 1970), and published in Journal of Marine Technology 6, 2 (April 1972) pp. 34-41.

16. "Circumferential Forces and Moments in Edge Loaded Conical Shell Elements", Journal of Applied Mechanics (March 1972) pp. 290-291.

17. "Pre-twisted Curved Beams of Thin-Walled Open Section", Journal of Applied Mechanics (September 1972) pp. 779-786.

18. "Thermal Stresses and Initial Deformation of Heated Condenser Tubes", Journal of Engineering for Power (April 1973) pp. 84-91.

19. "New Results on Applications of Multi-Segment Stepwise Integration to First Order Equations", (with G. J. Hutchins), Journal of Computer Methods in Applied Mechanics and Engineering (1972) pp. 307-316.

20. "Dynamics of Cables and Cable Systems", Shock and Vibration Digest 5, 3 (March 1973) pp. 1-9.

21. "Cable Network Vibrations Using Galerkin's Method of Polynomial Approximating Functions", (with H. Afshari), Journal of Applied Mechanics (June 1973) pp. 622-624.

22. "Analysis of Moderately Thick Shells of Revolution", (with G. J. Hutchins), Journal of Applied Mechanics (December 1973) pp. 955-961.

23. "Project Cyclops - A Design Study of a System for Detecting Extraterrestrial Life", contributing author, NASA Report CR114445 (October 1972).

24. "Vibration of Cable Gridworks with Small Initial Deformation", (with H. Afshari), Journal of Applied Mechanics (December 1973), and presented at Winter ASME Meeting, Detroit, Michigan (November 1973).

25. "Transverse Elastic Buckling of Plane Pipe Gridworks", (with H. Afshari, Journal of Structures, ASCE (April 1974).

26. "On Seal Forces in Removable End Closure in Very High Pressure Test Chambers", ASME Journal of Pressure Vessel Technology (February 1975).

27. "Limit Design of Condenser Hotwell Floors", ASME Journal of Engineering for Power (October 1975) pp. 628-633.

28. "Stability of Rotor-Bearing Systems with Generalized Support Flexibility and Damping and Aerodynamic Cross-Coupling", (with R. E. Warner), presented at ASME Lubrication Conference, Toronto (October 1974), and published in the ASME Journal of Lubrication Technology (July 1975) pp. 461-472.

29. "Tubesheet Design in U-Tube Heat Exchangers Including the Effect of Tube Rotational Restraint", published in Journal of Engineering for Industry 98, 4 (November 1976) pp. 1157-1160 and presented at Design Engineering Conference, Chicago, IL (April 1976).

30. "Effective Bending Properties for Stress Analysis of Rectangular Tubesheets", (with W. Hill), published in ASME Journal for Power 99, 3 (July 1977) pp. 365-370, presented at 1976 ASME Annual Meeting.

31. "Stress Analysis of a U-Tube Heat Exchanger Tubesheet with an Integral Channel and an Unperforated Rim", presented by Pressure Vessel and Piping Division, ASME Mexico City Conference (September 1976) (76-PV-58).

32. "Analysis of Beam Columns on Elastic Plastic Foundations with Application to Power Plant Condenser Support Plate Design", (with C. Shahravan), published in ASME Journal of Engineering for Power, 100 (January 1978) pp. 182-188.

33. "Analysis of Closely Spaced Double Tubesheets under Mechanical and Thermal Loading", presented at 1977 Joint Power Generation Conference, ASME, Los Angles, California (77-JPGC-NE-21).

34. "The Tubesheet Analysis Method in the New HEI Condenser Standards", (with M.D. Bernstein), presented at the 1977 Joint Power Generation Conference, ASME, Los Angeles, California, published in ASME Journal for Power 100 (April 1978) pp. 363-368.

35. "Design Curves for Stress Analysis of U-Tube Heat Exchanger Tubesheet with Integral Channel and Head", (with J. E. Soehrens) Journal of Pressure Vessel Technology 100 (May 1978) pp. 221-233.

36. "Design of Condenser Hotwell Floor for Pressure Loading", presented at ASME 1978 Annual Meeting, ASME Advances in Reliability and Stress Analysis H00119 (1979) pp. 203-215.

37. "A Preliminary Assessment of the HEI Tubesheet Design Method - Comparison with a Finite Element Solution", presented at ASME 1978 Winter Annual Meeting, ASME Advances in Reliability and Stress Analysis H00119 (1979) pp. 127-146.

38. "Analysis of Bolted Joints with Nonlinear Gasket Behavior", ASME Journal of Pressure Vessels 102 (August 1980) pp. 249-256.

39. "Stress Analysis of Rectangular Tubesheets for Condensers", Paper 80-C2/NE-14 presented at ASME Nuclear Engineering Conference, San Francisco, California (August 1980).

40. "A Finite Element Model for Thick Beams", (with D. Barrett) Computer Methods in Applied Mechanics and Engineering 25 (1981) pp. 299-313.

41. "A Design Concept for Minimizing Tubesheet Stress and Tubejoint Load in Fixed Heat Exchangers", (with K. P. Singh) 1982 ASME Pressure Vessel and Piping Conference, Orlando, Florida; Int. Journal for Pressure Vessel Technology, Trans. ASME (c. 1982).

42. "Dynamic Coupling in a Closely Spaced Two Body System Vibrating in a Liquid Medium: The Case of Fuel Racks", (with K. P. Singh) 1982 SMIRT Conference, Keswick, England (May 1982).

43. "A Finite Element Model for Thickwalled Axisymmetric Shell", (with D. J. Barrett), ASME Journal of Pressure Vessel Technology 104, (August 1982) pp. 215-222.

44. "Design Parameters Affecting Bolt Load in Ring Type Gasketed Joints", (with K. P. Singh), Journal of Pressure Vessel Technology, Trans. ASME (1984).

45. "Effect of Non-Uniform Inlet Air Flow on Air-Cooled Heat Exchanger Performance", (with K. P. Singh and T. L. Ng) presented at Joint ASME-JSME Transfer Conference, Hawaii (March 1983) and published in Conference Proceedings.

46. "A Method for Computing Maximum Water Temperature in a Fuel Pool Containing Spent Nuclear Fuel", (with K. P. Singh) presented at Fourth International Conference on Pressure Vessels and Piping, Portland, Oregon (June 1983), Nuclear Technology, ANS (c. 1984).

47. "Seismic Response of Free Standing Fuel Rack Constructions to 3-D Floor Motions", (with K. P. Singh) presented at the Fourth International Conference on Pressure Vessels and Piping, Portland, Oregon (June 1983) and published in Nuclear Engineering and Design 80, (1984) pp. 315-329.

48. "Analysis of Tube-Tubesheet Joint loading Including Thermal Loading", (with Xu Hong) published in Journal of Applied Mechanics (June 1984), and presented at 1984 Pressure Vessels and Piping Conference.

49. "Analysis and Design of Pressure Vessel Bolted Flanges with Non Linear Gasket Materials", 11th Conference on Production Research and Technology - Computer Based Factory Automation, Conference Proceedings, Carnegie Mellon University, Pittsburgh, PA (May 1984).

50. "Foundation Stresses under Support of Freestanding Equipment Subjected to External Loads", (with K. P. Singh and I. Gottesman), International Journal of Pressure Vessels and Piping, Vol. 20, No. 2 (1985) pp. 127-138.

51. "Finite Elements for Thick 3-D Shells", (with A. Khaskia), International Journal of Pressure Vessel Technology, 1985.

52. "Tube-to-Tubesheet Rolled Joints: Part I - Analysis Including Strain Hardening and Temperature Dependent Properties", (with S. Weinstock), Proceedings of ASME 1985 Pressure Vessel and Piping Conference H00329, New Orleans, LA.

53. "Tube-to-Tubesheets Rolled Joints: Part II - Experimental Analysis", (with K. Reinis), Proceedings of ASME 1985 Pressure Vessel and Piping Conference H00329, New Orleans, LA.

54. "An Elastic Plastic Analysis of the Integral Tubesheet in U-Tube Heat Exchangers - Towards an ASME Code Oriented Approach", (with K. P. Singh), Proceedings of ASME 1985 Pressure Vessel and Piping Conference H00329, New Orleans, LA.

55. "A Design Procedure for Evaluating the Tube Axial Load due to Thermal Effects in Multi-Pass Fixed Tubesheet Exchangers", (with K. P. Singh), ASME Journal of Pressure Vessel Technology (c. 1986).

56. "Tubesheet Analysis - A Proposed ASME Design Procedure" (with S. Caldwell and K. P. Singh), ASME Karl Gardner Memorial Symposium Proceedings (c. 1986). Channel and an Unperforated Rim, presented by Pressure Vessel and Piping Division, ASME.

57. "Some Results From Simultaneous Seismic Simulations of all Racks in a Fuel Pool", with K.P. Singh, INMM Spent Fuel Management Seminar X, Washington, D.C., January, 1993.

58. Application of Transient Analysis Methodology to Quantify Thermal Performance of Heat Exchangers, I. Rampall, K.P. Singh, A. Soler, and B. Scott, Heat Transfer Engineering, 1997.

59. "Seismic Response Characteristics of HI-STAR 100 Cask System on Storage Pads", with K.P. Singh and Mark G. Smith, INMM Conference, Washington, DC, January, 1998.