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**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

OFFICE
OF THE
SECRETARY

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 FIFTH SUPPLEMENTAL RESPONSE TO
STATE'S FIRST REQUESTS FOR DISCOVERY**

Applicant Private Fuel Storage L.L.C. ("Applicant" or "PFS") files this Fifth 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.

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

Template = SECY-035

SECY-02

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 Contention L – Geotechnical²

<u>Name and Address:</u>	John Clark Bay Geophysical Associates 868 Robinwood Ct. Traverse City Michigan 49686
<u>Profession:</u>	Geophysical Consultant
<u>Employer:</u>	Bay Geophysical Associates, Inc.
<u>Professional Expertise:</u>	See attached resume.
<u>Educational, Scientific Experience, and Professional Qualifications:</u>	See attached resume.
<u>Publications in the last ten years:</u>	See attached resume.
<u>Testifying experience as expert in last four years:</u>	Lithos v. Savoy; Michigan Oil and Gas Advisory Board, Fall of 1996.
<u>Subject Matter of Testimony:</u>	Mr. Clark will testify regarding all aspects of the seismic reflection data collected and analyzed by Bay Geophysical Associates for the PFS Facility.

² On August 7, 2000, in a telephone call discussing upcoming discovery matters, counsel for Applicant advised counsel for the State that PFS would most likely be naming John Clark, President of Bay Geophysical, to address issues concerning the seismic reflection data for the PFSF site raised by the State's witness Lee Allison, former Director of the Utah Geological Survey. On Tuesday, September 5, 2000, counsel for Applicant advised counsel for the State that Applicant would be identifying John Clark and Marc Sterling as its witnesses to address seismic reflection data issues. Counsel for Applicant also advised State counsel at that time that it would be identifying Robert Youngs of Geomatrix to testify to portions of the Geomatrix Report (for which Kevin Coppersmith had been previously identified as the sole witness).

Documents reviewed and/or
relied upon:

The documents and materials reviewed and relied upon by Mr. Clark will include the seismic reflection data, the Bay Geophysical Associates report regarding the seismic reflection data, the Geomatrix Final Report – Fault Evaluation Study and Seismic Hazard Assessment for the PFS Facility, and associated materials developed for the PFS Facility, including the License Application, Safety Analysis Report, and responses to RAIs. In addition, Mr. Clark may review and rely upon documents produced by the State and the NRC Staff, as well as any new information that may come into PFS's possession, including responses to discovery requests.

Name and Address:

Dr. Robert Youngs
Geomatrix Consultants, Inc.
2101 Webster Street, Suite 1200
Oakland, California 94612-3066

Profession:

Geotechnical Consultant

Employer:

Geomatrix Consultants, Inc.

Professional Expertise:

See attached resume.

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:

Dr. Youngs will testify concerning ground motion issues raised by the State in Basis 2 of Utah L.

Documents reviewed and/or
relied upon:

The documents reviewed and relied upon by Dr. Youngs will include the Geomatrix Consultants Inc., Fault Evaluation Study and Seismic Hazard Assessment. Private Fuel Storage Facility, February 1999; Geomatrix Consultants Inc., Development of Design Ground Motions for the Private Fuel Storage Facility, March 1999; Geomatrix Report, Update of Deterministic Ground Motion Assessments, April 1999; documents and data referenced therein; and associated materials developed for PFSF, including the License

Application, Safety Analysis Report, and responses to RAIs. In addition, Dr. Youngs may review and rely upon other documents produced by the State and the NRC Staff, as well as any new information that may come into the possession of PFS.

Name and Address: Marc Sterling
Sterling Seismic Services
8122 Southpark Lawn, Suite 207
Littleton
Colorado 80129

Profession: Seismic Data Processing

Employer: Sterling Seismic Services, Ltd.

Professional Expertise: See attached resume.

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: Mr. Sterling will testify regarding the processing of seismic reflection data collected by Bay Geophysical Associates for the PFS Facility.

Documents reviewed and/or relied upon: The documents and materials reviewed and relied upon by Mr. Sterling will include the seismic reflection data, the processing flow for the data, the Bay Geophysical Report and associated materials developed for the PFS Facility. In addition, Mr. Sterling may review and rely upon documents produced by the NRC Staff and the State as well as any new information that may come into the possession of PFS.

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.

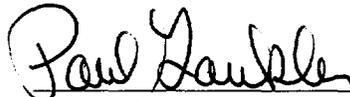
The Applicant is still in the process of identifying expert witnesses that it expects to call at the hearings and will supplement this response in accordance with 10 C.F.R.

§ 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 previous 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
D. Sean Barnett
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Dated: September 19, 2000

Counsel for Private Fuel Storage L.L.C.

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

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

CERTIFICATE OF SERVICE

I hereby certify that copies of Applicant's Fifth Supplemental Response to State's First Requests for Discovery, the attached resumes and declaration of Paul Gaukler 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 19th day of September 2000.

G. Paul Bollwerk III, Esq., Chairman
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* 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
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Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

* Adjudicatory File
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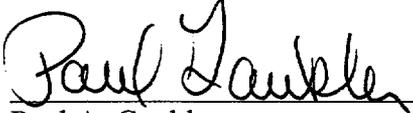
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Skull Valley Band of Goshute Indians
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Paul A. Gaukler

September 19, 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

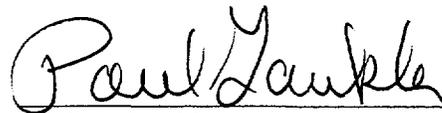
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)	
(Private Fuel Storage Facility))	ASLBP No. 97-732-02-ISFSI

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 Fifth Supplemental Response to State's First Requests for Discovery; specifically, the supplemental response 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.
4. I declare under penalty and perjure that the foregoing is true and correct.

Executed on September 19, 2000.


Paul A. Gaukler

JOHN C. CLARK
PRESIDENT
BAY GEOPHYSICAL ASSOCIATES, INC.

Mr. Clark has over 24 years of experience in geophysical interpretation and engineering in the areas of engineering, environmental, coal, and petroleum geophysics. He has designed, conducted, and interpreted all types of geophysical surveys throughout the United States, Europe, Central and South America, and the Far East. He is currently serving as a board member of the Environmental and Engineering Geophysical society.

EDUCATION

B.Sc., 1976, Geophysical Engineering, Colorado School of Mines

EXPERIENCE AND BACKGROUND

1986 to Present - President, Bay Geophysical Associates, Inc./Apex Geophysical Corporation. Apex Geophysical Corporation was formed in 1986; in 1991 Bay Geophysical Associates, Inc. was formed and purchased Apex Geophysical Corporation.

Since founding Apex/Bay Geophysical, Mr. Clark has been involved in a variety of projects, some of which are at the leading edge of current technology. These include: Development of proprietary shallow void detection methods for use on sewers, roads, and other extremely shallow structures. Development of patented high frequency electromechanical vibrator. Development of proprietary seismic trace decomposition technique for enhanced identification of fractured carbonate reservoirs. Consultation to major and independent oil companies to solve difficult acoustic imaging problems in the Michigan, Illinois, Appalachian, Williston, and Anadarko basins. Developing the high resolution shear wave seismic reflection technique to assess shallow groundwater as part of research conducted for Argonne National Laboratory. Development of high definition seismic data acquisition methods. Frequencies up to 150 Hz have been recovered from depths of up to 12,000 ft. Design and interpretation of 3-D surveys in Michigan, Illinois, Texas, and Kansas. Design, acquisition, and interpretation of high resolution 2-D, 3-D, single, and multi component surveys at existing and proposed nuclear facilities including Savannah River, Hanford, proposed low level North Carolina facility, and Skull Valley UT proposed Spent Fuel facility. The design and interpretation of highly redundant refraction profiling using many recording channels. This method of refraction profiling enhances the interpretability and reliability of the data while reducing the cost. This method was recently adapted to Vibroseis sources for greatly enhanced noise rejection. The design and interpretation of high resolution P- and S- wave seismic reflection surveys to locate karsts, abandoned mine workings, delineate shallow stratigraphy and contaminant pathways and traps, and to locate faults. The design and interpretation of seismic reflection surveys to delineate subsurface faulting to assess reservoir leakage risk in underground injection control projects. The design of a microseismic monitoring station to monitor induced seismicity in an underground injection control project. The implementation of seismic processing and attribute analysis techniques to digital ground penetrating radar data to enhance various subsurface imaging problems. The supervision of data acquisition, processing, and interpretation of over 6,000 miles of deep seismic reflection data in

Michigan, Ohio, Pennsylvania, Illinois, and Mississippi. The design, processing, and interpretation of electrical and electromagnetic surveys to delineate brine spills and effluent plumes. The design, implementation, processing, and interpretation of a simultaneous shear wave and compressional wave seismic reflection survey for the U.S. Air Force. The purpose of this survey was to determine the engineering properties of rock at depth. Investigation of the usage of high resolution gravity data to compensate for seismic static problems caused by in-homogeneities in glacial till for a group of oil companies.

1982 to 1986 - Chief Geophysicist, Miller Oil Corporation. Mr. Clark was responsible for the acquisition, processing, and interpretation of over 2,500 miles of seismic reflection data. He was instrumental in the development and application of high resolution seismic techniques to deeper horizons. Using these techniques, 100 + Hz reflections were obtained from depths exceeding 5,000 feet. He was involved in the development and interpretation of multi offset Vertical Seismic Profiles (VSPs) in conjunction with Schlumberger. During this period Mr. Clark developed borehole-surface seismic tomography on behalf of Miller Brothers. Mr. Clark was involved in the development of approximately 160 prospects while at Miller Brothers.

1977 to 1982 - Senior Project Geophysicist, D'Appolonia Consulting Engineers. Mr. Clark performed the following projects while with D'Appolonia: He performed microseismic surveys in Honduras and in Spain for the evaluation of a dam site and a nuclear power site. He designed, conducted, and interpreted electrical surveys at various sites in order to determine relative water quality, to map waste effluents, and to prepare environmental impact statements. He served as a well log analyst on the U.S. Strategic Petroleum Reserve project. He conducted and interpreted seismic guided (seam) wave experiments in Pennsylvania for the purpose of locating coal seam discontinuities. He conducted borehole shear wave surveys for nuclear power plant foundation studies in Georgia, Michigan, and Brazil. He conducted guided seismic wave tests on cast in place piles at a nuclear power plant foundation in Brazil. He supervised the geophysical investigation of the Hot Dry Rock Geothermal investigation program on the Delmarva Peninsula, Virginia. On this project, he developed a digital thermal logging system using micro-computers and digital test equipment.

1976 to 1977 - Geophysicist, Exploration Data Consultants. Mr. Clark managed the acquisition and data reduction of gravity crews in North Dakota and Nevada. He maintained the electronics of a well logging truck and interpreted well logs.

AFFILIATIONS:

Society of Exploration Geophysicists Interpretation Subcommittee 1995-1998; American Society of Testing and Materials; National Water Well Association; Association of Ground Water Scientists and Engineers; Environmental and Engineering Geophysical Society, Founding Member.

PUBLICATIONS:

The High Resolution Shear Wave Seismic Reflection Technique, report for Contract No. 02112405, Argonne National Laboratory. Johnson, W.J. and Clark, J.C., 1991, High Resolution Shear Wave Seismic Reflection Surveying for Hydrogeological Investigations, report for

Contract No. 02112405, Argonne National Laboratory. Johnson, W.J. and Clark, J.C., 1992, High Resolution S- Wave Reflection Surveying for Groundwater Characterization, presented at National R & D Conference on the Control of Hazardous Materials, February 4-6, 1992, San Francisco, California. Clark, J.C. and Johnson, W. J., 1992, Improving Subsurface Resolution with the Seismic Reflection Technique: Use S- Waves, presented at the Sixth National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring and Geophysical Methods, May 9-13, 1992, Las Vegas, Nevada. Clark, J.C. and Miller, W.A., 1993, High Resolution Seismic Surveying for Near Surface Imaging: The Promise of Higher Definition with Mini-Vibrators, Oyocon Geophysical Imaging and Technology Conference, May 21 and 22, 1993, Denver, Colorado. Clark, J.C. and Miller, W.A., 1993, Concerns and Pitfalls in Swept Source Data Acquisition, accepted for presentation at the Oyocon Geophysical Imaging and Technology Conference, May 21 and 22, 1993, Denver, Colorado. Clark, J.C., Miller, W.A., and Johnson, W.J., 1994, The Application of High Resolution Shear Wave Seismic Reflection Surveying to Hydrogeological and Geotechnical Investigations, presented at the Symposium on the Application of Geophysics to Engineering and Environmental Problems, March 27 - 31, 1994, Narbutovskih. Susan M., Michelsen, Finn B., and Clark, John C., 1995, High Resolution Seismic Reflection Test at the DOE Hanford Site, presented at the Symposium on the Hydrogeology of Washington State, August 28-30, 1995, Olympia, Washington. Clark, J.C. and VanHollebeke, P. V., 1998, Characterization of Bedrock Topography at Argonne National Laboratory's Raymond Site, Proceedings of the First International Symposium on Integrated Technical Approaches to Site Characterization (ITASC), Argonne National Laboratory, Argonne, Illinois. Waddell, M.G., Domoracki, W.J., Clark, J.C., and Carr, R., 1999, The Use of Shear-Wave Reflection Data in Expedited Site Characterization: An Example from Ceresco, Nebraska: in LaFreniere, L.M. ed., Proceedings of the Second International Symposium on Integrated Technical Approaches to Site Characterization (ITASC), Argonne National Laboratory, Argonne, Illinois. Clark, J.C., Kurtzweil, L.R., and Vanhollebeke, P.A., 1999, Simultaneous High Resolution Shear Wave Reflection and Refraction Data Acquisition for the Delineation of Karsts at an Epa Site: in LaFreniere, L.M. ed., Proceedings of the Second International Symposium on Integrated Technical Approaches to Site Characterization (ITASC), Argonne National Laboratory, Argonne, Illinois. Clark, John C., 1999, The Applications of High-Resolution Shear Wave Seismics to the Identification of Extremely Shallow Features: Stratigraphy, Channels, Fractures, and Voids", presented at the 1999 GSA annual meeting, Denver, Colorado.

ROBERT R. YOUNGS
PRINCIPAL ENGINEER

EDUCATION

University of California: Ph.D.,
Geotechnical Engineering,
1982

University of California: M.S.,
Geotechnical Engineering,
1973

California State Polytechnical
University, Pomona: B.S.,
Civil Engineering, 1969

REGISTRATION

Geotechnical Engineer,
California No. 924, 1987
Civil Engineer, California
No. 22519, 1973

AFFILIATIONS

American Society of Civil
Engineers
American Geophysical Union
Earthquake Engineering
Research Institute
Seismological Society of
America
Society for Risk Assessment

SKILLS AND EXPERIENCE

Dr. Youngs has 24 years of consulting experience, with primary emphasis in hazard analysis. He has pioneered approaches for incorporating earth sciences data, and their associated uncertainties, into probabilistic hazard analyses; The work has focused on developing quantitative evaluations of hazard by combining statistical data and expert judgment. Within Geomatrix's Decision Analysis (DA) operating unit, Dr. Youngs has helped develop capabilities that integrate the fields of earth sciences, hazard analysis, and risk assessment. Representative project experience includes:

Regional Seismic Hazard Mapping/Microzonation Studies: Ech Cheliff Region, Algeria; San Juan Province, Argentina, PG&E; Mendoza Province, Argentina; Seismic Design Mapping Project, State of Oregon, Oregon Department of Transportation

Seismic Source/Ground Motion Characterization for Hazard Analysis: Diablo Canyon Power Plant, PG&E; WNP-2 Hanford Power Plant, WPPSS; Hanford Reservation, Westinghouse Hanford Co.; Palo Verde Nuclear Generating Station, Arizona Power; Yucca Mountain Nuclear Waste Repository Site, U.S. Department of Energy

Development of Hazard Methodologies/Uncertainty Treatment: Seismic Hazard in the Eastern United States, Electric Power Research Institute (EPRI); Maximum Earthquakes in Eastern United States, EPRI; Expert Elicitation Methodology Demonstration for Yucca Mountain Performance Assessment, EPRI; Characterization of seismic hazard in Southern Ontario, Atomic Energy Control Board, Canada

Hazard Analyses for Performance Assessment of Built Structures: seismic hazard at San Francisco-Bay Area bridges, California Department of Transportation (CDOT); seismic hazard at Humboldt Bay bridges, CDOT ; seismic hazard and site response studies for K-reactor, Westinghouse Savannah River Co.; seismic hazard analysis for operating nuclear power plants in Spain, Westinghouse Energy Systems Europe; seismic hazard analysis and development of earthquake ground motions for Blue River Dam, Oregon, USACOE.

Hazard Analyses for Development of Design Criteria: Seismic hazard assessment for the New Production Reactor at Savannah River Site and Idaho National Engineering Laboratory (DOE); WNP-1, 2,4 Hanford and WNP-3, 5 Satsop, WPPSS; Potential High-Level Radioactive Waste Repository Site, Yucca Mountain, DOE; Waste Tank Sites at Hanford, Washington, Westinghouse Hanford Co.

Performance Assessment of Natural Systems: Demonstration of risk-based total system performance assessment, EPRI, DOE; Earthquakes/tectonics expert elicitation project, EPRI; Probabilistic volcanic hazard analysis, Yucca Mountain, TRW and DOE; Fault displacement hazard analysis for Yucca Mountain, USGS, DOE

PUBLICATIONS

"Strong ground motion attenuation relationships for subduction zone earthquakes." Youngs, R.R., Chiou, S.J., Silva, W., and Humphrey, J.: Seismological Research Letters, v. 68, n. 1. January/February 1997.

"Seismic hazard mapping for highway design in the state of Oregon." Youngs, R.R.: Proceedings, Design of Highway Bridges for Extreme Events, Federal Highway Administration, Atlanta, Georgia. December 1996.

"Regional probabilistic seismic hazard mapping with uncertainty: An example from the state of Oregon, USA." Youngs, R.R., Coppersmith, K.J., Hanson, K., DiSilvestro, L., and Wells, D.: Fifth International Conference on Seismic Zonation, Nice, France. October 17-18, 1995.

"Earthquake ground shaking hazard in Utah." Proceedings, Earthquake Engineering Research Institute Wasatch Front Seismic Risk Regional Seminar, v. 1, Salt Lake City, Utah. November 29-30, 1994.

"Magnitude dependent variance of peak ground acceleration." Youngs, R.R., Abrahamson, N., Makdisi, F., and Sadigh, K.: Bulletin, Seismological Society of America, accepted for publication. 1994.

"Computer applications in geotechnical earthquake engineering." Chang, C.-Y., and others: Geotechnical News, v. 12, n. 2, p. 36-38. June 1994.

"Specification of ground motions and response spectra for seismic evaluation of nuclear power plants." Youngs, R.R.: Proceedings, Fourth Symposium on Current Issues Related to Nuclear Power Plant Structures, Equipment, and Piping, Orlando, Florida. December 1993.

"Assessing fault rupture hazard for the proposed repository at Yucca Mountain, Nevada: Demonstration of a methodology using expert judgments." Perman, R.C., Coppersmith, K.J., Youngs, R.R., and Shaw, R.: Proceedings, Fourth Annual International Conference on High Level Radioactive Waste Management, v. 1, p. 2086-2091. 1993.

"Preliminary assessment of fault rupture hazard at the Yucca Mountain site based on expert judgment." Coppersmith, K.J., Youngs, R.R., Perman, R., and Shaw, R.: Proceedings, Fourth Annual International Conference on High Level Radioactive Waste Management, v. 1, p. 6-13. 1993.

"A comprehensive seismic hazard model for the San Francisco bay region." Youngs, R.R., Coppersmith, K.J., Taylor, C., Power, M.S., Di Silvestro, L., Angell, M., Hall, T., Wesling, J., Mualchin, L.: Proceedings, Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, California Division of Mines and Geology Special Publication 113, p. 431-441. 1992.

"A stable algorithm for regression analyses using the random effects model." Abrahamson, N.A., and Youngs, R.R.: Bulletin, Seismological Society of America, v. 82, n.1, p. 505-510. 1992.

PUBLICATIONS (continued)

"Modeling fault rupture hazard for the proposed repository at Yucca Mountain, Nevada." Coppersmith, K.J., Youngs, R.R.: Proceedings, 1992 International High Level Radioactive Waste Management Conference, v. 1, p. 1142-1150. 1992.

"Site specific ground motion assessment for K-Reactor, Savannah River Site." Coppersmith, K.J., and others: Proceedings, Third Department of Energy Natural Phenomena Hazards Mitigation Conference, p. 184-194. 1991.

"Assessment of liquefaction potential in the San Jose, California urban area." Power, M.S., Perman, R., Wesling, J., Youngs, R.R., and Shimamoto, M.: Proceedings, Fourth International Conference on Seismic Micro Zonation, Stanford, California, v. II, p. 677-625. 1991.

"Seismic microzonation of the Ech Cheliff region, Algeria." Power, M.S., and others: Proceedings, Fourth International Conference on Seismic Micro Zonation, invited case study paper, Stanford, California, v. I, p. 539-588. 1991.

"Improved methods for seismic hazard analysis in the western United States." Coppersmith, K.J.: Proceedings, Fourth U.S. National Conference on Earthquake Engineering, v. 1, p. 723-731. 1990.

"Probabilistic seismic hazard analysis using expert opinion: An example from the Pacific Northwest." Coppersmith, K.J., and Youngs, R.R.: Geological Society of America Memoir on Neotectonics in Earthquake Evaluation: The Geological Society of America, v. 8, p. 27-46, Boulder, Colorado. 1990.

"The impact of fault segmentation on estimates of earthquake recurrence and seismic hazard." Youngs, R.R., and Coppersmith, K.J., Proceedings, Fourth International Conference on Seismicity and Seismic Risk, Bechyne Castle, Czechoslovakia, September 4-9, v. II, p. 440-446. 1989.

"Estimating maximum earthquakes for seismic sources in the central and eastern United States: A progress report." Coppersmith, K.J., Youngs, R.R., Johnston, A.C., Kanter, L., Schneider, J., and Arabasz, W.: Proceedings, Fourth International Symposium on Seismicity and Seismic Risk, Bechyne Castle, Czechoslovakia, September 4-9, v. I, p. 115-122. 1989.

"Keeping pace with science: Seismic hazard analysis in the western United States." Youngs, R.R., and Coppersmith, K.J.: Proceedings, Second Department of Energy Natural Phenomena Hazards Mitigation Conference, p. 262-270. October 1989.

"Keeping pace with science: seismic hazard analysis in the central and eastern United States." Coppersmith, K.J., and Youngs, R.R.: Proceedings, Second Department of Energy Natural Phenomena Hazards Mitigation Conference, p. 252-261. October 1989.

PUBLICATIONS (continued)

"Issues regarding earthquake source characterization and seismic hazard analysis within passive margins and stable continental interiors." Coppersmith, K.J., Youngs, R.R.: Earthquakes at North-Atlantic Passive Margins-Neotectonics and Postglacial Rebound (Gregersen, S. and Basham, P., eds.), NATO ASI Series C, v. 266, p. 601 - 631. 1989.

"Use of detailed geologic data in regional probabilistic seismic hazard analysis: An example from the Wasatch Front, Utah." Youngs, R.R., Swan, F.H., and Power, M.S.: Proceedings, Earthquake Engineering and Soil Dynamics II ASCE, Park City, Utah, p. 156-172. June 27-30.

"Nearfield ground motions for large subduction zone earthquakes." Youngs, R.R., Day, S.M., and Stevens, J.L.: Proceedings, American Society of Civil Engineers-Specialty Conference on Earthquake Engineering and Soil Dynamics II, Park City, Utah, p. 445-462. 1988.

"Probabilistic analysis of earthquake ground shaking hazard along the Wasatch Front, Utah." Youngs, R.R., Swan, F.H., Power, M.S., Schwartz, D., and Green, R.: United States Geological Survey-Professional Paper on Seismic Hazards in Utah (in press). Preprinted and Assessment of Regional Earthquake Hazards and Risk along the Wasatch Front, Utah United States Geological Survey Open File Report 87-585, v. 2, p. M1-110.

"Geotechnical data in seismic risk evaluations." Arango, I.: Proceedings, Eighth Pan American Congress for Soil Mechanics and Foundation Engineering p. 495-506. August 1987.

"Probabilistic assessment of seismic hazards in the Ech Cheliff Region, Algeria and seismic microzonation of urban areas in the Ech Cheliff Region, Algeria." Swan, F.H., and others: Proceedings, Eighth European Conference on Earthquake Engineering, Lisbon, Portugal. September 7-12, 1986.

"Seismic hazard methodology for the central and eastern United States, Volume 1: Methodology." with Risk Engineering, Woodward-Clyde Consultants, and Cygna Corporation. Electric Power Research Institute Publication NP-4726. 1986.

"Capturing uncertainty in probabilistic seismic hazard assessments within intraplate environments." Coppersmith, K., Youngs, R.R.: Proceedings, Third National Conference on Earthquake Engineering, Charleston, South Carolina, v. 1, p. 301-312. August 24-28, 1986.

"Seismic hazard assessment of the Hanford region, eastern Washington State." Coppersmith, K.J., and others: Proceedings, Department Of Energy Natural Phenomena Hazards Mitigation Conference, p. 169-176. October 1985.

"Implications of fault slip rates and earthquake recurrence models to probabilistic seismic hazard estimates." Youngs, R.R., Coppersmith, K.J.: Bulletin, Seismological Society of America v. 75, p. 939-964. 1985.

"Geotechnical features of Fur Seal Island design." Luscher, U., and others: Proceedings, American Society of Civil Engineers Conference on Civil Engineering in the Arctic Offshore, San Francisco. March 25-27, 1985.

PUBLICATIONS (continued)

"Assessment of confidence intervals for results of seismic hazard analysis." Kulkarni, R., Youngs, R.R., and Coppersmith, K.J.: Proceedings, Eighth World Conference on Earthquake Engineering v. 1, p. 263-270. 1984.

"Incorporation of geologic information and associated uncertainty in seismic hazard analysis." Invited paper presented at Specialty Seminar on Fundamentals of Probabilistic Risk Assessment, Stanford University, Stanford, California, July 19, 1984, and published in Earthquake Engineering Research Institute Publication No. 84-06, v. 11, p. 38-58.

"Incorporation of uncertainties in probabilistic seismic exposure analyses effects on completed seismic exposure." Sadigh, K: Invited paper presented at 78th Annual Meeting, Seismological Society of America, Earthquake Notes, v. 54, n. 1, p. 23. 1983.

"Peak horizontal and vertical accelerations, velocities and displacements on deep soil sites during moderately strong earthquakes." Sadigh, K., and Power, M.S.: Proceedings, Second International Conference on Microzonation, San Francisco, California, v. II, p. 801-811. 1978.

"Drainage effects on seismic stability of rockfill dams." Sadigh, K., and Idriss, I. M.: Proceedings, American Society of Civil Engineers Specialty Conference on Earthquake Engineering and Soil Dynamics, Pasadena, California. 1978.

Document #: 1000556 v.1

MARC STERLING

EDUCATION:

San Diego State University, San Diego, California
B.Sc. Geology, 1979

EXPERIENCE

STERLING SEISMIC SERVICES, Ltd.

8122 SOUTHPARK LANE #207
LITTLETON, COLORADO 80120

**PRESIDENT and OWNER
FEBRUARY 1994 to PRESENT**

Duties include Management of Company and Computer Systems and Software, 3D Seismic Data processing, 2D Seismic Data Processing, Shear Wave Data processing, Processing QC, Beta Testing of new products from Landmark Graphics Corporation.

AREAS OF EXPERTISE INCLUDE:

Shear Wave Processing
3D Processing & Field Design
2D Processing
Tomographic Refraction analysis and application

GEOSIGNAL, INC.

410 17th STREET
DENVER, COLORADO, 80202

**SENIOR GEOPHYSICIST
SEPTEMBER 1992 – JANUARY 1994**

Duties included: Client Contact, 3D Seismic Data processing, 2D Seismic Data Processing, Shear Wave Data processing, and Engineering surveys.

AREAS OF EXPERTISE INCLUDE:

3D Seismic Processing
Shear Wave Technology/Total Wave Field data processing
Conventional 2D Seismic Data Processing

PRODUCTION GEOPHYSICAL SERVICES INC.

6890 S. TUCSON WAY
ENGLEWOOD, COLORADO, 80112
(303) 799-8800

**VICE PRESIDENT
NOVEMBER 1981-AUGUST 1992**

Responsible for geophysical data processing operations.
Duties included: Allocation of Personnel and Computer Resources.
Client Contact, Job Scheduling, Job Status and Quality Control of High
Resolution Geophysical Data Processing. Development of processing
sequences to incorporate products of ongoing research and development projects, 3D Seismic
Data processing, 2D Seismic Data processing, Shear Wave Data processing.

This company and most of the people went through the following name changes:

ASPEN GEOPHYSICAL CORPORATION	Nov 1981- June 1985
KIM TECH INC.	June 1985- June 1987
BOLT TECHNOLOGY CORPORATION	July 1987- Sept 1989
PGS	Sept 1989- Aug 1992

AREAS OF EXPERTISE INCLUDE:

Shear Wave Technology/Total Wave Field data processing
Vertical Seismic Profile Acquisition/Processing
Crosswell Acoustic Tomography Processing
Conventional Seismic Data Acquisition/Processing
Mainframe and PC/AT/XT Computer Utilization

INTERNATIONAL GEOPHYSICS INC.
925 S. ROSEMARY ST. 3D PROCESSING
DENVER, COLORADO, 80231

**POSITION:
SUPERVISOR
SEPTEMBER 1981
to NOVEMBER 1981**

Data processing of 3 Dimensional seismic prospects from the
Overthrust Belt in Wyoming and Utah .
Quality Control of conventional seismic processing performed by
other analysts in the processing center.

WESTERN GEOPHYSICAL COMPANY
7229 S. ALTON WAY PO BOX 3118
ENGLEWOOD, COLORADO 80112
(303) 770-8660

**POSITION:
SENIOR GEOPHYSICAL ANALYST
OCTOBER 1979 - AUGUST 1981**

Seismic data processing in Western Geophysical's Denver office.
Duties included : Project Leader of Denver's Research and Special

Projects Group, Supervisor of a Conventional Data processing Group, Data processing of 3 Dimensional Seismic projects, Synthetic Modeling and Development Testing of new Computer Based applications programs.

WESTERN GEOPHYSICAL COMPANY
FILED CREW #P-19-DYNAMITE
NEBRASKA & WYOMING
FEBRUARY 1979 - SEPTEMBER 1979

POSITION:
**ASSISTANT PARTY MANAGER/
FIELD CLERK**

Seismic data acquisition in Wyoming and Nebraska.
Duties included: Control of Finance, Logistics and Supply of the Field Crews needs. With this crew I interned in all phases of the field operations before assuming control of the Logistical and Financial aspects of the operation.

Document #: 1000558 v.1