

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:

PRIVATE FUEL STORAGE, LLC
(Independent Spent Fuel
Storage Installation)

)
) Docket No. 72-22-ISFSI
)
) ASLBP No. 97-732-02-ISFSI
)
) April 30, 1999

DECLARATION OF DR. WALTER J. ARABASZ

I, Dr. Walter J. Arabasz, declare under penalty of perjury that:

1. I am a Research Professor of Geology and Geophysics at the University of Utah, and Director of the University of Utah Seismograph Stations. This Declaration is in support of the State of Utah's April 30, 1999 Motion Requiring Applicant to Apply for Rule Waiver Under 10 CFR § 2.758(b) or in the Alternative Amendment to Utah Contention L ("State's Motion"). A statement of my qualifications is attached hereto.

2. I am familiar with Private Fuel Storage's ("PFS's") license application, Safety Analysis Report, answers to the NRC Staff's Requests for Additional Information, and Commitment Resolution Information relating to seismic issues. I am also familiar with the February 1999 Geomatrix report entitled *Fault Evaluation Study and Seismic Hazard Assessment*, Volumes I-III, and supplements thereto. Additionally, I am familiar with NRC regulations, guidance documents, and environmental studies relating to seismic hazard analysis.

3. I assisted in the preparation of, and have reviewed, the State of Utah's Motion Requiring Applicant to Apply for Rule Waiver Under 10 CFR § 2.758(b) or in the Alternative Amendment to Utah Contention L. The technical facts relating to seismic hazard analysis that are presented in the State's Motion regarding PFS's Exemption Request to 10 CFR 72.102(f)(1), Seismic Design Requirement are true and correct to the best of my knowledge, and the technical conclusions drawn from those facts are based on my best professional judgment.


Dr. Walter J. Arabasz

WALTER J. ARABASZ

Birthplace and Date: Acushnet, Massachusetts, September 30, 1942.

Current Position: Research Professor of Geology and Geophysics and Director, University of Utah Seismograph Stations; University of Utah, Salt Lake City, Utah.

Address: 135 S 1460 E Rm 705 WBB, University of Utah, Salt Lake City, Utah 84112;
Tel: 801-581-7410; **Fax:** 801-585-5585; **E-mail:** arabasz@seis.utah.edu.

Education: B.S., Geology, summa cum laude, Boston College, 1964; M.S., Geology, California Institute of Technology, 1966; Ph.D., Geology (minor in geophysics), California Institute of Technology, 1971. Dissertation (supervised by Professor Clarence R. Allen): *Geological and Geophysical Studies of the Atacama Fault Zone in Northern Chile*.

Professional Positions: Post-Doctoral Research Fellow, Dept. of Scientific and Industrial Research, Geophysics Division, Wellington, New Zealand, 1970-73; Research Scientist, Lamont-Doherty Geological Observatory, 1973-74; University of Utah (1974-present): Research Professor of Geology and Geophysics (since 1983); Director, University of Utah Seismograph Stations (since 1985).

Society Affiliations: Seismological Society of America; American Geophysical Union; Geological Society of America; Earthquake Engineering Research Institute; Utah Geological Association.

Current Professional Activities: Chair, Utah Seismic Safety Commission; Member, Executive Committee, and past Chair, Council of the National Seismic System; Member, Senior Advisory Group to U.S. Geological Survey for 1999 Report to Congress on an Assessment of Seismic Monitoring in the United States; Corresponding Member, U.S. Committee for Advancement of Strong Motion Programs; Visiting Member, Infrastructure Protection Group, Utah Olympic Public Safety Committee; Member, Utah Interagency Technical Team (serving the Utah Division of Comprehensive Emergency Management).

General Statement of Experience: Dr. Walter J. Arabasz has nearly 30 years of professional experience in research, project management, consulting, and occasional teaching in observational seismology, tectonics, and earthquake hazard evaluation. He is the author or co-author of 36 published papers, 69 published abstracts and numerous technical reports. His present responsibilities at the University of Utah include seismological research and extensive project management—chiefly relating to the operation and modernization of a 100-station regional seismic network covering Utah and neighboring parts of the Intermountain area. He currently is the Principal Investigator on research projects totaling approximately \$750,000 per annum.

He has been affiliated, since its inception, with the U.S. National Earthquake Hazards Reduction Program—variously as a Principal Investigator of funded research, as a participant in dozens of workshops and conferences, and as a member of peer review panels. He has served on numerous national and state advisory and policy-making committees, including the Committee on Seismology of the National Research Council (1989-1994), the Board of Directors of the Seismological Society of America (1994-1997), the Council of the National Seismic System (1993-present), and the Utah Seismic Safety Commission (1994-present). Since 1977 he has routinely provided professional consulting services on earthquake hazard evaluations for dams, nuclear facilities, and other critical structures and facilities for engineering firms, the International Atomic Energy Agency, the Department of Energy, the Soil Conservation Service, the Bureau of Reclamation, the Electric Power Research Institute, and the State of Utah.

Walter J. Arabasz

SELECTED PUBLICATIONS AND REPORTS SINCE 1990

- Arabasz, W. J., editor, 1990, Earthquake instrumentation for Utah, report and recommendations of the Utah Policy Panel on Earthquake Instrumentation, Utah Geological and Mineral Survey Open-File Report 168.
- McGuire, R. K., and Arabasz, W. J. 1990, An introduction to probabilistic seismic hazard analysis, in Ward, S. H., ed., Geotechnical and environmental geophysics, Vol. 1: Review and tutorial: Society of Exploration Geophysicists, Investigations in Geophysics No. 5, p. 333-353.
- Pechmann, J. C., Nava, S. J., and Arabasz, W. J., 1991, Seismological analyses of four recent moderate (M_L 4.8 to 5.4) earthquakes in Utah, Final Report to the Utah Geological Survey, Salt Lake City, Utah, Contract No. 89-3659, 107 p.
- Smith, R. B., and Arabasz, W. J., 1991, Seismicity of the Intermountain seismic belt, in Slemmons, D. B., Engdahl, E. R., Zoback, M. D., Zoback, M. L., and Blackwell, D., eds., Neotectonics of North America: Geological Society of America, Decade Map Volume 1, p. 185-228.
- Arabasz, W. J., Pechmann, J. C., and Brown, E. D., 1992, Observational seismology and the evaluation of earthquake hazards and risk in the Wasatch front area, Utah, in Gori, P. L., and Hays, W. W., eds., Assessment of regional earthquake hazards and risk along the Wasatch Front, Utah: U. S. Geological Survey Professional Paper 1500-A-J, p. D1-D36.
- Arabasz, W. J., 1992, Earthquake basics for dam safety [extended abs.]: Abstracts and Proceedings, Utah Department of Natural Resources, The State of Utah Dam Safety Workshop, March 19, 1992, Salt Lake City, 9 pp.
- Hill, D. P., and others, including W. J. Arabasz, 1993, Remote seismicity triggered by the M 7.5 Landers, California, earthquake of June 28, 1992: *Science*, v. 260, p. 1617-1623.
- Pechmann, J. C., Arabasz, W. J., and Brown, E. D., 1993, Seismotectonics of the 1987-88 Lakeside, Utah, earthquakes: *Seismological Research Letters*, v. 64, p. 225-238.
- Arabasz, W. J., and Hill, S. J., 1994, Aftershock temporal behavior and earthquake clustering in the Utah region [abs.]: *Seismological Research Letters*, v. 65, p. 32.
- Arabasz, W. J., 1994, Fundamentals of the Wasatch Front's earthquake threat: Proceedings, Seminar 1: Economic Impacts of a Large Earthquake, Earthquake Engineering Research Institute Wasatch Front Seismic Risk Regional Seminar; Salt Lake City, Utah, November 1994, p. 1-1 to 1-25.
- Arabasz, W. J., 1994, Wasatch Front seismicity and expectable strong ground motion: Proceedings, Seminar 2: Earthquake Research and Mitigation, Earthquake Engineering Research Institute Wasatch Front Seismic Risk Regional Seminar; Salt Lake City, Utah, November 1994, p. 2-1 to 2-40.
- Nava, S. J., Arabasz, W. J., and Pechmann, J. C., 1994, The M 5.9 Draney Peak, Idaho (Idaho-Wyoming border) earthquake of February 3, 1994—A preliminary report [abs.]: *Seismological Research Letters*, v. 65, nos. 3/4, p. 239.

- Pechmann, J. C., and Arabasz, W. J., 1995, The problem of the random earthquake in seismic hazard analysis: Wasatch Front region, Utah, *in* Lund, W. R., ed., Environmental and engineering geology of the Wasatch Front region: Utah Geological Association Publication 24, p. 77-93.
- Pechmann, J. C., Walter, W. R., Nava, S. J., and Arabasz, W. J., 1995, The February 3, 1995, M_L 5.1 seismic event in the trona mining district of southwestern Wyoming: Seismological Research Letters, v. 66, no. 3, p. 25-34 [minor correction, including revision of magnitude to M_L 5.2, added in v. 66, no. 4, p. 28].
- Arabasz, W. J., and Nava, S. J., 1995, Jordanelle Reservoir: Status of test monitoring for reservoir-induced seismicity [abs.]: Seismological Research Letters, v. 66, no. 2, p. 24.
- Arabasz, W. J., and Hill, S. J., 1996, Applying Reasenbergs' cluster-analysis algorithm to regional earthquake catalogs outside California [abs.]: Seismological Research Letters, v. 67, no. 2, p. 30.
- Arabasz, W. J., and Wyss, M., 1996, Significant precursory seismic quiescences in the extensional Wasatch Front region, Utah [abs.]: Eos (Transactions American Geophysical Union), v. 77, no. 46, p. F455.
- Arabasz, W. J., Nava, S. J., and Phelps, W. T., 1997, Mining seismicity in the Wasatch Plateau and Book Cliffs coal mining districts, Utah, USA, *in* Gibowicz, S. J., and Lasocki, S., eds., Rockbursts and Seismicity in mines: Rotterdam, A.A. Balkema, p. 111-116.
- Arabasz, W. J., 1998, Do regional seismic networks in the U.S. have a future?: Seismological Research Letters, v. 69 no. 6, p. 513-515.
- Arabasz, W. J., 1998, Utah's earthquake information needs—New technologies and solutions: Fault Line Forum (published by Utah Geological Survey), v. 14, no. 12, p. 1-4.
- Arabasz, W. J., and Pechmann, J. C., 1998, Earthquake data-base issues for seismic hazard analysis in the Utah region [abs.]: Proceedings Volume, Basin and Range Province Seismic-Hazards Summit, Utah Geological Survey Miscellaneous Publication 98-2, p. 31.
- Arabasz, W. J., and Nava, S. J., 1999, Historical seismicity and a user's guide to earthquake data in northern Utah, southeastern Idaho, and southwestern Wyoming, *in* Spengler, L. E., ed., Utah Geological Association Publication [in prep.]

Walter J. Arabasz

PROFESSIONAL CONSULTING

Consulting in Earthquake-Hazard Evaluation and Earthquake Seismology:

1. Rollins, Brown and Gunnell, Inc., Provo, Utah (1977). Site-response analysis for proposed hospital in Logan, Utah.
2. International Atomic Energy Agency, Vienna, Austria (Short-Term Expert, Chile, 1979). Seismotectonic considerations in northern Chile, 21°-27°S, with respect to the siting of a nuclear power plant.
3. Weidlinger Associates, Menlo Park, California (1980). Geological and geophysical information relevant to site-dependent ground motions at Wing V (Wyoming-Nebraska-Colorado).
4. EG&G Idaho, Inc. (Department of Energy), Idaho Falls, Idaho (1980-81). Preparation and presentation of proposal for seismic risk zone revision in southeast Idaho to International Conference of Building Officials.
5. EG&G Idaho Inc. (Department of Energy), Idaho Falls, Idaho (1982). Document review: "Site Investigation at Idaho National Engineering Laboratory, LMFBF Large Developmental Plant (LDP), Conceptual Design Study—Phase III."
6. Lindvall, Richter and Associates, Los Angeles, California (1981-82). Seismic safety investigation of eight Soil Conservation Service dams in southwestern Utah.
7. U.S. Bureau of Reclamation, Engineering and Research Center, Denver, Colorado (1982-83). Review and analysis of geologic, seismotectonic, and design data for the proposed Jordanelle Dam, Bonneville Unit, Central Utah Project, Utah. (Consultant review by W.J. Arabasz, R. H. Jahns, and R.B. Peck.)
8. EG&G Idaho, Inc. (Department of Energy), Idaho Falls, Idaho (1983). Member, Geotechnical Advisory Panel to assist EG&G Idaho, Inc. and D.O.E. regarding programmatic efforts toward site characterization of the Idaho National Engineering Laboratory for the proposed siting of a NEW Production Reactor Facility.
9. Electric Power Research Institute, Palo Alto, California (1984). Participant, "Data Needs Workshop; regarding data management plan and tectonic evaluation for earthquake hazards in the eastern U.S.; participant in and editor of "Proceedings of a Seminar on Defining Tectonic Mechanisms Causing Earthquakes in the Eastern United States."
10. Dames & Moore, Golden, Colorado/Electric Power Research Institute (EPRI), Palo Alto, California (1984-85). Member of "Seismic Hazard Methodology Team," EPRI Seismic Hazards Research Program, for evaluation of earthquake hazards in the eastern United States for the siting of nuclear generating facilities. (Participation in 7 formal workshops, 2 academic seminars, and 3 series of interactive meetings with 6 teams of tectonic evaluation contractors in the central and eastern U.S.).

11. Electric Power Research Institute, Palo Alto, California (1985-87). Participation in scientific review, technical description, and comparative evaluation of EPRI seismic hazard methodology for the central and eastern United States.
12. U.S. Bureau of Reclamation, Engineering and Research Center, Denver, Colorado (1986-87). Review and analysis of geologic, seismotectonic, and design data for the proposed Jordanelle Dam, Bonneville Unit, Central Utah Project. (Consultant review by R. B. Peck, W. J. Arabasz, G. S. Tarbox, and D. D. Campbell.)
13. U.S. Bureau of Reclamation, Engineering and Research Center, Denver, Colorado (1988). Review and evaluation of seismotectonic conclusions and details of final embankment dam design for Jordanelle Dam, Bonneville Unit, Central Utah Project. (Consultant review by R.B. Peck, W.J. Arabasz, and T.G. McCusker.)
14. Dames & Moore, Los Angeles, California (1989). Member of advisory panel for project on seismic code decisions under risk, sponsored by the National Science Foundation.
15. Lawrence Livermore National Laboratory, Livermore, California (1990-91). Member of Seismicity and Tectonic Expert Group, New Production Reactors Project, Idaho National Engineering Laboratory Site.
16. U.S. Bureau of Reclamation—Engineering and Research Center, Denver, Colorado, and Regional Office, Salt Lake City, Utah (1990-92). Review and evaluation of foundation conditions, ongoing geologic mapping procedures, and seismic-safety aspects of the Jordanelle Dam, Bonneville Unit, Central Utah Project. (Consultant review by W.J. Arabasz, R.B. Peck, and D.D. Campbell.)
17. Science Applications International Corporation, Las Vegas, Nevada (1991). Member of Peer Review Group for *Early Site Suitability Evaluation of the Potential Repository Site at Yucca Mountain, Nevada*.
18. Geomatrix Consultants, San Francisco, California (1991-92). Member of expert panel, Electric Power Research Institute-High Level Waste (EPRI-HLW) project to assess earthquake and tectonic issues for the proposed high-level nuclear waste repository at Yucca Mountain, Nevada.
19. Risk Engineering, Inc., Golden, Colorado (1992-94). Investigator for Seismology as part of a *Seismic Hazard Study for Systematic Evaluation Program, Rocky Flats Plant*, conducted for EG&G Rocky Flats, Inc. and sponsored by the U.S. Department of Energy.
20. Woodward-Clyde Federal Consultants, Las Vegas, Nevada (1993-94). Technical reviewer for (1) *Topical Report: Methodology to Assess Seismic Hazards at Yucca Mountain* and (2) *Seismic Design Inputs for the Exploratory Studies Facility at Yucca Mountain*.
21. U.S. Bureau of Reclamation, Engineering and Research Center, Denver, Colorado (1994). Review of design, construction, and operation of Jordanelle Dam and Reservoir, Bonneville Unit, Central Utah Project, Utah. (Consultant review by W.J. Arabasz, D.D. Campbell, and R.B. Peck.)
22. Jack R. Benjamin & Associates, Inc., Mountain View, California (1994). Technical reviewer for *Probabilistic Seismic Hazard Assessment for the U.S. Army Chemical Demilitarization Facility, Tooele, Utah*.

23. TRW Environmental Safety Systems, Inc., Vienna, Virginia (1995). Member of expert team for seismic source characterization for a probabilistic seismic hazard assessment of a high-level nuclear waste repository at Yucca Mountain, Nevada.
24. Rutherford & Chekene, San Francisco, California (1995). Technical review and consulting advice on seismicity and ground-motion considerations for design of a manufacturing plant at Lehi, Utah, for Micron Technology, Inc.
25. TRW Environmental Safety Systems, Inc., Vienna, Virginia (1995). Organizer and chair of plenary session of FOCUS'95—Methods of Seismic Hazard Evaluation (a topical meeting co-sponsored by the American Nuclear Society and the Geological Society of America, September 18-20, 1995, Las Vegas, Nevada).
26. William Lettis & Associates, Inc., Walnut Creek, California (1995). Technical review and consulting advice on seismic source characterization for the stability evaluation of Lake Almanor and Butt Valley Dams, California.
27. Parsons Brinckerhoff, Salt Lake City, Utah (1995-96). Member of Seismic Advisory Committee to Utah Department of Transportation for seismic hazard analysis of the I-15 interstate highway corridor (consulting undertaken under a University of Utah contract).
28. TRW Environmental Safety Systems, Inc., Vienna, Virginia (1996-98). Member of expert team for seismic source characterization for a probabilistic seismic hazard assessment of a high-level nuclear waste repository at Yucca Mountain, Nevada.
29. Utah Department of Environmental Quality (1998-present). Seismicity and earthquake expert for evaluation of a proposed high-level radioactive waste storage facility in Skull Valley, Tooele County, Utah (consulting undertaken under a University of Utah contract).
30. Los Alamos National Laboratory, Los Alamos, New Mexico (1999). Member of Laboratory Seismic Review Committee, Nuclear Materials and Stockpile Management Program, an advisory group on the Laboratory's seismic risks and hazards and related technical and operational activities (consulting contract pending).

Walter J. Arabasz

RESEARCH FUNDING—LAST FIVE YEARS**1994-95**

Seismic network operations along the Wasatch Front urban corridor and adjacent Intermountain seismic belt (FY95): \$209,000, U. S. Geological Survey, 1/1/95-12/31/95, lead PI.

Seismicity, ground motion, and crustal deformation— Wasatch Front, Utah, and adjacent Intermountain seismic belt (FY95): \$120,000, U. S. Geological Survey, 1/1/95-12/31/95, Co-PI.

Cooperative agreement for seismic event monitoring and analysis, Jordanelle Damsite, Bonneville Unit, Central Utah Project: \$54,247, U. S. Bureau of Reclamation, 10/1/94-9/30/95, PI.

Calibration of size and correlation of coal-mining-related seismicity with extraction rates, Wasatch Plateau and Book-Cliffs mining districts: \$6,206, University of Utah Mineral Leasing Funds, 7/1/94-5/31/95, PI.

M_w 5.9 Draney Peak, Idaho, earthquake evaluation: \$35,140, Idaho National Engineering Laboratory, 8/31/94-12/31/95, Co-PI.

Development of rapid earthquake response: \$10,000, unrestricted grant from the Union Pacific Foundation, 2/24/95-2/23/96, PI.

Seismograph Stations: \$340,400, State of Utah, 7/1/94-6/30/95, Director.

1995-96

Seismic network operations along the Wasatch Front urban corridor and adjacent Intermountain seismic belt (FY96): \$200,000, U. S. Geological Survey, 1/1/96-12/31/96, lead PI.

Seismicity, ground motion, and crustal deformation— Wasatch Front, Utah, and adjacent Intermountain seismic belt (FY96): \$100,000, U. S. Geological Survey, 5/1/96-4/30/97, Co-PI.

Cooperative agreement for seismic event monitoring and analysis, Jordanelle Damsite, Bonneville Unit, Central Utah Project: \$47,000, U. S. Bureau of Reclamation, 10/1/95-9/30/96, PI.

Collaborative work with coal mine operators for further study of mining-related seismicity, Wasatch Plateau and Book-Cliffs mining districts: \$6,200, University of Utah Mineral Leasing Funds, 7/1/95-6/30/96, PI.

M_w 5.9 Draney Peak, Idaho, earthquake evaluation: \$35,140, Idaho National Engineering Laboratory, 8/31/94-12/27/96, Co-PI.

Development of rapid earthquake response: \$10,000, unrestricted grant from the Union Pacific Foundation, 2/24/96-2/23/97, PI.

I-15 Corridor Seismic Advisory Committee: \$1,972, Parsons Brinckerhoff (for Utah Department of Transportation), 12/1/95-8/31/96, PI.

Seismograph Stations: \$350,500, State of Utah, 7/1/95-6/30/96, Director.

1996-97

Seismic network operations along the Wasatch Front urban corridor and adjacent Intermountain seismic belt (FY97): \$275,000, U. S. Geological Survey, 1/1/97-12/31/97, lead PI.

Studies of earthquake processes to assess time-varying hazard and risk—Wasatch Front, Utah, and adjacent Intermountain Seismic Belt: \$100,000, U. S. Geol. Surv., 5/1/97-4/30/98, Co-PI.

Cooperative agreement for seismic event monitoring and analysis, Jordanelle Damsite, Bonneville Unit, Central Utah Project: \$47,000, U. S. Bureau of Reclamation, 10/1/96-9/30/97, PI.

Continued studies of coal-mining-related seismicity, Wasatch Plateau and Book-Cliffs mining districts: \$5,915, University of Utah Mineral Leasing Funds, 7/1/96-6/30/97, PI.

Development of rapid earthquake response: \$10,000, unrestricted grant from the Union Pacific Foundation, 2/24/97-2/23/98, PI.

Seismograph Stations: \$361,900, State of Utah, 7/1/96-6/30/97, Director.

1997-98

Seismic network operations along the Wasatch Front urban corridor and adjacent Intermountain seismic belt (FY98): \$274,538, U. S. Geological Survey, 1/1/98-12/31/98, lead PI.

Studies of earthquake processes to assess time-varying hazard and risk—Wasatch Front, Utah, and adjacent Intermountain Seismic Belt: \$100,000, U. S. Geol. Surv., 5/1/97-10/31/98, Co-PI.

Cooperative agreement for seismic event monitoring and analysis, Jordanelle Damsite, Bonneville Unit, Central Utah Project: \$49,750, U. S. Bureau of Reclamation, 10/1/97-9/30/98, PI.

M_w 5.9 Draney Peak, Idaho, earthquake evaluation: \$25,206, Idaho National Engineering Laboratory, 6/18/97-6/30/98, Co-PI.

Development of rapid earthquake response: \$10,000, unrestricted grant from the Union Pacific Foundation, 2/24/97-2/23/98, PI.

Seismic characterization of coal-mining seismicity in Utah for CTBT monitoring: \$58,960, Lawrence Livermore National Laboratory, 2/28/98-2/28/99, lead PI.

Seismograph Stations: \$370,500, State of Utah, 7/1/97-6/30/98, Director.

1998-99

Seismic network operations along the Wasatch Front urban corridor and adjacent Intermountain seismic belt (FY99): \$248,739, U. S. Geological Survey, 1/1/99-12/31/99, lead PI.

Cooperative agreement for seismic event monitoring and analysis, Jordanelle Damsite, Bonneville Unit, Central Utah Project: \$50,000, U. S. Bureau of Reclamation, 10/1/98-9/30/99, PI.

Seismic characterization of coal-mining seismicity in Utah for CTBT monitoring: \$58,960, Lawrence Livermore National Laboratory, 2/28/98-2/28/99, lead PI.

Development of rapid earthquake response: \$10,000, unrestricted grant from the Union Pacific Foundation, 2/24/98-2/23/99, PI [renewal award for 1999-2000 pending].

Studies of earthquake processes to assess time-varying hazard and risk—Wasatch Front, Utah, and adjacent Intermountain Seismic Belt: \$100,000, U. S. Geological Survey, 5/1/97-10/31/98, Co-PI.

Seismograph Stations: \$381,200, State of Utah, 7/1/98-6/30/99, Director.

Walter J. Arabasz

SCHOLARLY JOURNAL REVIEW, PROPOSAL REVIEW, AND EDITORIAL SERVICE†

1975-1980s	Reviewer for Geological Society of America, <i>GSA Bulletin and Geology</i>
1976-1990	Reviewer for the <i>Bulletin of the Seismological Society of America</i>
1977-1980s	Reviewer of proposals for National Science Foundation, Geophysics Division
1978-1980s	Reviewer for <i>Journal of Geophysical Research</i>
1980-1982	Reviewer of proposals for National Science Foundation, Polar Earth Science Program
1981-1982, 1985-1996	Reviewer of proposals to U.S. Geological Survey Earthquake Hazards Reduction Program
1983-1985	Reviewer of proposals to National Science Foundation, Crustal Structure and Tectonics Program
1985	Reviewer for U.S. Geological Survey, manuscripts submitted to <i>Open-File Report</i> series
1985-1988	Associate Editor, <i>Bulletin of the Seismological Society of America</i>
1986	Reviewer for <i>Tectonophysics</i>
1988	Reviewer for <i>PAGEOPH</i> , special issue on seismicity in mines
1992-1997	Reviewer of proposals for National Science Foundation, Geophysics Division
1995-present	Reviewer for <i>Earthquake Engineering Research Institute Monograph Series</i>
1995-96	Reviewer for <i>Earthquake Spectra</i>
1996	Reviewer for the <i>Bulletin of the Seismological Society of America</i>
1997	Reviewer for University of Utah Research Committee
1998	[See entry above under "-present"]

†Exclusive of technical peer-review performed on a consulting basis
(see Professional Consulting)