October 12, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
	)	
(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF DAVID MATTHEW ANDERSON CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, David Matthew Anderson, do hereby state as follows:

1. I am employed as a Senior Research Economist in the Technology Planning and Deployment Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff-in its analysis of the aspects of the Applicant's Environmental Report that concerned land use.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (DA).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

David Matthew Anderson

October 12, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
	)	
(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF JAMES MICHAEL BECKER CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, James Michael Becker, do hereby state as follows:

1. I am employed as a Staff Scientist with the Ecology Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff in its analysis of the aspects of the Applicant's Environmental Report that concerned terrestrial ecology.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (JB).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

James Michael Becker

James Michael Becker

October 12, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
	)	
(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF PHILIP M DALING CONCERNING PREFILED
DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, Philip M Daling, do hereby state as follows:

1. I am employed as a Staff Engineer with the Facility Safety Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff as the Technical Lead that provided input to the FEIS in its analysis of the aspects of the Applicant's Environmental Report that concerned the impacts of transportation of unirradiated fuel, spent fuel, and radioactive waste.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (PD).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

Philip M. Daling

October 12, 2006

UNITED STATES OF AMERICA
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BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
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EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
	)	
(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF EVA ECKERT HICKEY CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

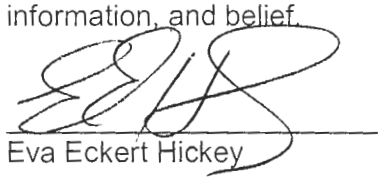
I, Eva Eckert Hickey, do hereby state as follows:

1. I am employed as a Staff Scientist with the Radiological Sciences and Engineering Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff as the Team Leader for the technical team that provided input to the FEIS.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (EH).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.



Eva Eckert Hickey

October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF JOHN A. JAKSCH CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, John A. Jaksch, do hereby state as follows:

1. I am employed as a Staff Scientist with the Risk and Decision Sciences Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff as the Social, Economic and Environmental Justice specialist for the technical team that provided input to the FEIS in its analysis of the aspects of the Applicant's Environmental Report that concerned Social, Economic and Environmental Justice.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (JJ).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

John A. Jaksch

October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
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(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF THOMAS J. KENYON CONCERNING PREFILED
DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

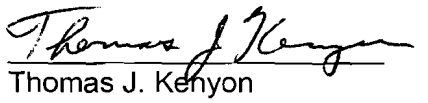
I, Thomas J. Kenyon, do hereby state as follows:

1. I am employed as a Senior Project Manager in the New Reactor Environmental Projects Branch, Division of New Reactor Licensing, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC). I am the NRC Senior Project Manager for the environmental review of Exelon Generation Company, LLC's (Exelon's) application for an early site permit (ESP) at the Exelon ESP site in Illinois. A statement of my professional qualifications is attached.

2. I was responsible for overseeing the preparation of NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS").

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (TK).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.



Thomas J. Kenyon

October 12, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
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(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF JAMES VANNER RAMSDELL, JR. CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, James Vanner Ramsdell, Jr., do hereby state as follows:

1. I am employed as a Staff Scientist with the Atmospheric Chemistry and Meteorology Technical Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff as the technical team member that provided input to the FEIS in the areas related to meteorology, air quality, noise, electromagnetic fields, reactor accident analysis, and alternatives.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (JR).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

James Vanner Ramsdell, Jr.

October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF SUSAN SARGEANT SOUTHARD CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, Susan Sargeant Southard, do hereby state as follows:

1. I am employed as a Research Scientist with the Coastal Assessment and Restoration Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff as the Aquatic Ecologist for the technical team that provided input to the FEIS in its analysis of the aspects of the Applicant's Environmental Report that concerned aquatic ecology.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (SS).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

Susan Sargeant Southard

October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
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EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
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AFFIDAVIT OF DARBY CAMPBELL STAPP CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, Darby Campbell Stapp, do hereby state as follows:

1. I am employed as a Staff Scientist with the Radiological Sciences and Engineering Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff in its analysis of the aspects of the Applicant's Environmental Report that concemed Cultural and Historical Resources.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (DCS).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

Darby Campbell Stapp

October 12, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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	)	
EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
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AFFIDAVIT OF GREGORY ALAN STOETZEL CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

I, Gregory Alan Stoetzel, do hereby state as follows:

1. I am employed as a Principal Engineer with the Safety and Health Department at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC staff as a member of the technical team that provided input to the FEIS. I provided assistance in the analysis of the Applicant's Environmental Report that concerned the radiological environment, nonradiological and radiological health impacts of construction and normal operation, and uranium fuel cycle impacts.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (GS).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

Gregory Alan Stoetzel

October 12, 2006

UNITED STATES OF AMERICA
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In the Matter of	)	
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EXELON GENERATION COMPANY, LLC.	)	Docket No. 52-007-ESP
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(Early Site Permit for Clinton ESP Site)	)	

AFFIDAVIT OF LANCE W. VAIL CONCERNING PREFILED DIRECT TESTIMONY IN THE CLINTON ESP PROCEEDING

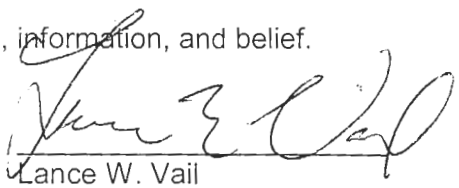
I, Lance W. Vail, do hereby state as follows:

1. I am employed as a Staff Research Engineer II with the Hydrology Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

2. As part of the NRC staff's environmental review of the Exelon ESP application, documented in NUREG-1815, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site: Final Report," July 2006 ("FEIS"), I assisted the NRC in its analysis of the aspects of the Applicant's Environmental Report that concerned hydrology.

3. I have primary technical responsibility for those portions of the NRC Staff's Prefiled Direct Testimony on Environmental Issues in the Clinton ESP Proceeding marked with my initials (LV).

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding by the environmental Project Manager, Thomas J. Kenyon. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.



Lance W. Vail

Dave Anderson
Senior Research Economist
Pacific Northwest National Laboratory
Richland, Washington
509-375-6781
Online Resume

SUMMARY

Performed, planned, managed, and published technical economic and policy analysis in the areas of regional economics, community economic development, socioeconomic impact assessment, economic and market survey analysis, energy economics, and agriculture and natural resource economics.

+ National Environmental Policy Act (NEPA) planning and economic impact modeling.
+ Nuclear Regulatory Commission Early Site Permit and License Renewal EIS Team.
+ Local economic development analytical support.
+ National and regional economic input-output modeling and analysis.
+ Economic and performance analysis of energy efficiency issues.
+ Natural resource economics including tourism, water, agriculture, forestry.
+ Environmental justice and other socioeconomic analysis.
+ Database and GIS development and application.
+ Energy efficiency policy analysis.
+ Banking regulatory performance assessment.
+ Internet measurement and web development.
+ Computer resource in most application software.

EDUCATION

M.S. Forest Economics, Oregon State University, 1991
B.S. Forest Resources, Oregon State University, 1989

EXPERIENCE

SENIOR RESEARCH ECONOMIST

Battelle Pacific Northwest Division, Pacific Northwest National Laboratory, Richland, Washington, 1991-1997, and 2001-present.

Performed, planned, managed, and published technical economic and policy analysis in the areas of regional economics, community economic development, socioeconomic impact assessment, economic and market survey analysis, energy economics, and agriculture and natural resource economics.

+ National Environmental Policy Act (NEPA) planning and economic impact modeling.
+ Nuclear Regulatory Commission Early Site Permit and License Renewal EIS Team.
+ Critical Infrastructure Protection and other DHS economic analysis.
+ National and regional economic input-output modeling and analysis.

+ Economic and performance analysis of energy efficiency issues.
+ Natural resource economics including tourism, water, agriculture, forestry.
+ Environmental justice and other socioeconomic analysis.
+ Database and GIS development and application.
+ Energy efficiency policy analysis.
+ Banking regulatory performance assessment.
+ Internet measurement and web development.
+ Computer resource in most application software.
+ Returned to the Lab in 2001 to continue this career path.

CORPORATE COMMUNITY REINVESTMENT ANALYST
Washington Mutual Bank, Community Reinvestment Resources Department, Seattle, Washington, 1997-2001.

+ Initiated and developed the analysis and reporting capability relating to the Community Reinvestment Act (CRA) at Washington Mutual, the nation's largest residential lender.
+ Analyzed and reported national, regional, and localized mortgage, consumer, and small business lending performance, including analytical mapping.
+ Developed goals and associated measures for administration of CRA lending programs nationally, including a 10-year $120 billion Community Commitment.
+ Tracked the regional economies of Washington Mutual's nationwide markets.
+ Performed detailed demographic, political, and market analyses of specific underserved banking markets such as low and moderate-income borrowers, minority markets, traditionally underserved neighborhoods, and rural markets.
+ Regularly prepared presentation materials, figures, and summaries for executive management and the CEO.
+ Supported a nationwide staff of outreach officers by providing them with market performance, regional economic, analytical mapping, and lending performance reporting products.
+ Developed large-scale databases to support corporate lending performance reporting needs.
+ Developed regulatory exam materials for use by bank examiners to aide in determining CRA compliance ratings.
+ Led the technology needs assessment effort in the Department, including complete systems reengineering and integration of internet functionality as part of a Corporate initiative.
+ Integrated CRA performance reporting systems of acquired institutions in three major corporate mergers.

RESEARCH ASSISTANT
Oregon State University, College of Forestry, Corvallis, Oregon, 1989-1991
Graduate Research Assistant in the Forest Economics program. Participated in numerous natural resource economics and policy research activities including work to develop innovative approaches to managing the recovery of the Northern spotted owl on federal lands in Oregon. Also contributed to a market research study of Alpine Lakes Wilderness permitees. Assisted in design of complex survey instrument and sampling methodology. Provided survey database technical support to several market research studies. Masters Thesis project involved modeling of tourism expenditures on the Mount Hood National Forest to determine their economic impact on the Portland metro area economy. Began as an undergraduate research assistant, 1987-89.

INDEPENDENT CONSULTANT; Self Employed. Consulted on research projects peripheral to the Oregon State University, College of Forestry. These included natural resource interpretation design, field research on resource interpretation site development, socioeconomic research, and travel and tourism research projects. Various intermittent projects for professors working on the side from 1988-1991.

RECREATION RANGER; U.S. Bureau of Land Management, Burns District, Burns Oregon.
Responsible for visitor services on the 2.7 million acre Andrews Resource Area. Duties included visitor services and monitoring within the 200,000 acre Steens Mountain Recreation Lands. Administered the "Interim Management Plan" for 1.1 million acres of proposed wilderness including inventory, reconnaissance, and restoration of damaged sites.
Undergraduate Internship: Produced visitor use report and economic valuation of Steens recreation. Summer 1988.

COMPUTER LAB TECHNICAL SUPPORT; O.S.U. College of Forestry - 1987-1989
Responsible for operation of the College's PC workstation computer facility that services the entire forestry education and research communities of Oregon State University. Helped students and staff learn computer techniques. Taught training and orientation courses. Served as teaching assistant in several computer applications courses.

PROGRAM ASSISTANT; O.S.U. Outdoor Recreation Center, Corvallis, Oregon, 1987-1990
Responsible for development and implementation of "Discovery Program". Planned and administered outdoor recreation program's trips and outdoor classes in the areas of hiking, backpacking, canoeing, nordic and alpine skiing, mountain climbing, caving, whitewater rafting, and wildlife viewing for the University community.

PARK RANGER; U.S. Army Corps of Engineers, Cottage Grove and Dorena Projects, Cottage Grove, Oregon.
Responsible for visitor services on Cottage Grove and Dorena Reservoir projects. Duties included interacting with park and campground visitors in several developed parks and campgrounds, monitoring of undeveloped primitive campsites, providing interpretive services including dam tours, and assisting in wildlife habitat restoration activities. Summer 1987.

CANNERY WORKER; Various companies and plants, Salem/Stayton/Brooks, Oregon. Jobs included raw product inspection, equipment sanitation, fork lift driver, product freezing tunnel operator, and general equipment trouble shooting. Products ranged from berries and cherry crops to corn, green beans, broccoli, and cauliflower crops. Summers 1980-1986.

COMPUTER SKILLS

Beyond proficiency in the Microsoft Office Professional suite, I am well-experienced in the following specialized packages: ArcGIS, Visual Basic for Applications, IMPLAN, Speakeasy, Parse-o-matic, MapInfo, Maptitude, SAS, SQL, and others. I have become a local computer resource to my coworkers wherever I've been.

Resume – Dave Anderson – April, 2005

ASSOCIATIONS:

Western Economics Association
International Association for Impact Assessment
Regional Science Association International
HTML Writers Guild

PUBLICATIONS:

Anderson DM, and JM Roop. 2003. "The Role of Steel in the US Economy: Decomposing the 1982-1997 Forward and Backward Linkages of the Steel Industry." In Proceedings of the 2003 ACEEE Summer Study on Energy Efficiency in Industry. ACEEE, Rye, NY.

Anderson DM, and DJ Hostick. 2003. Post Hoc Evaluation of Long-Term Goals for Energy Savings in the Buildings Sector: Lessons from Hindsight . PNNL-14262, Pacific Northwest National Laboratory, Richland, WA.

Anderson DM, DB Belzer, KA Cort, JA Dirks, DB Elliott, DJ Hostick, and MJ Scott. 2003. Methodological Framework for Analysis of GPRA Metrics: Application to FY04 Projects in BT and WIP. PNNL-14231, Pacific Northwest National Laboratory, Richland, WA.

Anderson DM. 2002. FY 2000 Buildings Energy Savings Estimates under Uncertainty: Developing Approaches for Incorporating Risk into Buildings Program Energy Efficiency Estimates. PNNL-14075, Pacific Northwest National Laboratory, Richland, WA.

Anderson DM, Scott MJ, Bunn AL, Fowler RA, Prendergast EL, Miley TB and Eschbach TO. 2002. 2001 Columbia River Recreation Survey -- Implications for Hanford Site Integrated Assessment. PNNL-13840, Pacific Northwest National Laboratory, Richland, WA.

Anderson, D. M., 1997, "Practicing Responsible Tourism: International Case Studies in Tourism Planning and Development," a book review, Journal of Regional Science 37(2):373-374, 1997.

Anderson, D. M., T. L. Marsh, D.E. Deonigi, 1996, "Developing Food Production and Consumption Information for 131I Dose Estimation: The Hanford Experience," Health Physics 71(4):578-587, October 1996.

Anderson, D. M., P. Godoy-Kain, A. Y. Gu, C. A. Ulibarri, 1996, Socioeconomic Effects of Power Marketing Alternatives for the Central Valley and Washoe Projects: 2005 Regional Economic Impact Analysis Using IMPLAN, PNNL-11411, Pacific Northwest National Laboratory, Richland, Washington, November 1996.

Anderson, D. M., P. Godoy-Kain, A. Y. Gu, C. A. Ulibarri, 1996, Socioeconomic Effects of DRAFT Power Marketing Options for the Central Valley and Washoe Projects: 2005 Regional Economic Impact Analysis Using IMPLAN, PNNL-11135, Pacific Northwest National Laboratory, Richland, Washington, April 1996.

Anderson, D. M., 1995, Economic Impact of Selected Energy-Intensive Industries on the Economies of the United States, California, Georgia, Michigan, Ohio, and Texas. Invited presentation at the First Industrial Energy Efficiency Symposium and Exposition, Washington, DC, May 1-3, 1995; sponsored by the DOE Office of Industrial Technology.

Anderson, D. M., 1995, "Everyday Travel Through Cyberspace", Inventor-Assistance Program News, No. 39, February, 1995, pp. 5-10. A publication of the Department of Energy's States Inventors Initiative.

Anderson, D. M., T. L. Marsh, D.E. Deonigi, 1994, "Developing Food Production and Consumption Information for Use in Dose Estimation", PNWD-SA-3960 HEDR, poster session presented at the Health Physics Society 39th Annual Meeting, San Francisco, California, June 26-30, 1994.

Anderson, D.M., and M. J. Scott, 1993, "Valuing the Salmon Resource: Columbia River Stocks Under Climate Change and Fisheries Enhancement", IN: Proceedings of the 27th Annual Pacific Northwest Regional Economic Conference, pp. 83-88. Northwest Policy Center, University of Washington, Seattle, Washington.

Anderson, D.M., D.J. Bates, T.L. Marsh, 1993, Estimation of 1945 to 1957 Food Consumption, PNWD-2113-HEDR, Battelle Pacific Northwest Division, Richland, Washington.

Anderson, D.M., S.A. Shankle, M.J. Scott, D.A. Neitzel, and J.C. Chatters, 1992, "Costs of Climate Change: Economic Value of the Yakima River Salmon", PNNL-SA-20998, Presented at the 67th Annual Conference of the Western Economics Association International, San Francisco, California, July, 1992.

Anderson, D.M., S.A. Shankle, M.J. Scott, D.A. Neitzel, and J.C. Chatters, 1993, "Costs of Climate Change: Economic Value of the Yakima River Salmon", Contemporary Policy Issues, XI:4, October 1993, pp. 82-94.

Anderson, D.M., 1992, Methodology for Reconstruction Historical Food Consumption Estimates, PNNL-8123-HEDR, Battelle Pacific Northwest National Laboratory, Richland, Washington.

Anderson, David M., 1991, Current and future economic impact of Mount Hood National Forest outdoor recreation consumption. Thesis (M.S.)--Oregon State University, 1992. OSU Valley Library:LD4330 1992 .A53.

Bonneville Power Administration, 1992, Yakima River Basin Fisheries Project Draft Environmental Impact Statement. DOE/BP-1899, (preparer), Pacific Northwest National Laboratory, Richland, Washington, October, 1992.

Brook M, M Kintner-Meyer, MR Brambley, and DM Anderson. 2004. "Assessing the Impacts of Energy Saving Products and Technologies: The Importance of Revealing Underlying Assumptions." In *Proceedings of the 2004 Summer Study*, pp. p4-23 through 4-35. ACEEE Proceedings, Washington, DC.

Chatters, J.C., V. Butler, M.J. Scott, D.M. Anderson, D.A. Neitzel, 1995, "A Paleoscience Approach to Estimating the Effects of Climatic Warming on the Salmonid Fisheries of the Columbia River Basin", IN: Climate Change & Northern Fish Populations, Canadian Special Publication of Fisheries and Aquatic Sciences 121, pp. 489-496, R.J. Beamish, editor, National Research Council of Canada, Ottawa, Quebec.

Cort KA, DM Anderson, DB Belzer, JA Dirks, and DJ Hostick. 2004. "Technical Appendix: GPRA 05 Building Technologies Program Documentation." In *External Report: EERE FY05 GPRA Documentation*. PNNL-SA-41706, Pacific Northwest National Laboratory, Richland, WA.

Deonigi, D.E., D.M. Anderson, G.L. Wilfert, 1994, Commercial Milk Production and Marketing in the HEDR Region, 1944-1951, PNWD-2218-HEDR, Battelle Pacific Northwest Division, Richland, Washington.

Department of Energy, 1996, Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement, DOE/EIS-0026, (preparer), Carlsbad Area Office, Department of Energy, Carlsbad, New Mexico, November 1996.

Department of Energy, 1995, Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement, DOE/EIS-0228, (preparer), Pacific Northwest National Laboratory, Richland, Washington, August, 1995.

Department of Energy, 1995, Management of Spent Nuclear Fuel from the Hanford K-Basins Draft Environmental Impact Statement, DOE/EIS-0245D, (preparer), Pacific Northwest National Laboratory, Richland, Washington, August, 1995.

Dirks JA, DJ Hostick, KA Cort, DM Anderson, SC McDonald, and JP Dion. 2004. "Scenario-Based R&D Portfolio Analysis: Informing the Tough Decisions." Presented at ACEEE 2004 Summer Study in Buildings, Pacific Grove, CA on August 23, 2004. PNNL-SA-40057, Pacific Northwest National Laboratory, Richland, WA.

Elliott DB, DM Anderson, DB Belzer, KA Cort, JA Dirks, and DJ Hostick. 2004. Methodological Framework for Analysis of Buildings-Related Programs: The GPRA Metrics Effort. PNNL-14697, Pacific Northwest National Laboratory, Richland, WA.

Elliott DB, DM Anderson, DB Belzer, KA Cort, JA Dirks, and DJ Hostick. 2004. Baseline Inputs for BEAMS: Data used in preparing Methodological Framework for Analysis of Building-Related Programs: The GPRA Metrics Effort, June 2004 . PNNL-14696, Pacific Northwest National Laboratory, Richland, WA.

Fathelrahman EM, DM Anderson, and Kinter-Meyer. 2003. "Market Penetration of Competing New Technology: A Maximum Likelihood Estimation (MLE) Approach to Modeling the Emergence of the Electronic Ballast." In Proceedings of the 2003 International Energy Program Evaluation Conference. IEPEC, Seattle, WA.

Hostick DJ, DM Anderson, DB Belzer, KA Cort, DE Deonigi, JA Dirks, NL Moore, and L Vimmerstedt. 2004. "Technical Appendix: WIP FY05 GPRA Documentation." In *External Report: EERE FY05 GPRA Documentation*. PNNL-SA-41707, Pacific Northwest National Laboratory, Richland, WA.

Hostick DJ, KA Cort, DB Belzer, JA Dirks, DB Elliott, DM Anderson, and JP Dion. 2003. "Measurement and Baseline Issues Related to Evaluating a Diverse Portfolio of Federally-Supported Building Energy-Saving Programs." In Proceedings of the 2003 International Energy Program Evaluation Conference. IEPEC, Seattle, WA.

Johnson, R. L., D. Hospodarsky, and D. M. Anderson, 1989, Economic Impact of Projected Outdoor Recreation Consumption on the Mount Hood National Forest, report prepared for the Mount Hood National Forest. Department of Forest Resources, Oregon State University, Corvallis, Oregon.

Kavanaugh, D.C., D.M. Anderson, T.L. Marsh, A.D. Lee, S. Onisko, 1994, Key Elements Affecting Manufactured Home Household Investments in Energy-Efficiency: An Empirical Analysis. DOE/BP-2335, Bonneville Power Administration, March 1994, Portland, Oregon.

Kavanaugh, D.C., and D.M. Anderson, 1993, "Regional Analysis of Alternative Energy Paths", working paper presented at the 15th Annual Conference of the International Association for Energy Economics, October 11, 1993, Seattle, Washington.

Kavanaugh, D.C., D.M. Anderson, P.J. Barton, K.F. Gygi, C.D. McGee, W.H. Monroe, L.J. Sandahl, G.A. Wright, AES Corp., 1993, A Simulation Model for Resource and Rate Impacts in the Western Area Power Administration Service Areas, PNNL-8721, Battelle Pacific Northwest National Laboratory, Richland, Washington.

Kavanaugh, D.C., D.M. Anderson, G.S. Sullivan, 1992, Economic Analysis of the Camp Pendleton Lighting Retrofit Program, report prepared for the Energy Systems Modernization Office, Pacific Northwest Laboratory, Richland, Washington.

Kavanaugh, D.C., R. Berrens, D.M. Anderson, K.R. Hughes, J.E. Englin, 1992, Approaches and Plan for the Analysis of Recreation Participation and Valuation on Federal Hydroelectric Projects on the Columbia River System, report prepared for U.S. Army Corps of Engineers, Bonneville Power Administration, and U.S. Bureau of Reclamation, by Battelle Portland, Portland, Oregon.

Kintner-Meyer M, Anderson DM and Hostick DJ. 2003. "Final Report for the Energy Efficient and Affordable Small Commercial and Residential Buildings Research Program -- Project 6.6 - Development of the Assessment Framework". PNNL-14343, Pacific Northwest National Laboratory, Richland, Washington.

Lester, M., and D.M. Anderson, 1995, The Distribution of Minority and Low-Income Populations of the Western Sacramento Region (Western Area Power Administration), BSRC-700/95/006, Battelle Seattle Research Center, Seattle, Washington.

Marsh, T.L., D.M. Anderson, W.T. Farris, T.A. Ikenberry, B.A. Napier, G.L. Wilfert, 1992, Commercial Production and Distribution of Fresh Fruits and Vegetables: A Scoping Study on the Importance of Produce Pathways to Dose, PNWD-2022-HEDR, Battelle Pacific Northwest National Laboratory, Richland, Washington.

Nuclear Regulatory Commission, 2005. Environmental Impact Statement for an Early Site Permit Regarding the Grand Gulf Early Site Permit Site. NUREG-1817 (preparer), Draft Report. Office of Nuclear Reactor Regulation, Washington, DC.

Nuclear Regulatory Commission, 2005. Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site. NUREG-1815 (preparer), Draft Report for Comment. Office of Nuclear Reactor Regulation, Washington, DC.

PNNL, 1995, IRAP Land Use Task: Preliminary Report on the Feasibility of Irrigated Agriculture Land Use on the Hanford Site, Draft PNNL Report prepared for DOE-RL, Pacific Northwest National Laboratory, Richland, Washington, September, 1995.

Roop, J.M., D. M. Anderson, D. C. Baker, J. E. Dagle, M. T. Freund, C. A. Ulibarri, 1995, Information Technology and Energy Security, PNNL Report prepared for Dept. of Energy, Office of Nuclear Nonproliferation, Battelle Pacific Northwest National Laboratory, Richland, Washington.

Roop, J.M., D. M. Anderson, R.W. Schultz, 1995, SEADS-PC: Sectoral Energy/ Employment Analysis and Data System: Methodology, Capabilities, and an Example: Employment Impacts of the Climate Change Action Plan, PNNL-10760, prepared for Dept. of Energy, Office of Economic Analysis and Competition, Pacific Northwest National Laboratory, Richland, Washington, September, 1995.

Scott MJ, DM Anderson, DB Belzer, KA Cort, JA Dirks, DB Elliott, and DJ Hostick. 2004. Impact of the FY 2005 Building Technologies Program on United States Employment and Earned Income . PNNL-14813, Pacific Northwest National Laboratory, Richland, WA.

Scott MJ, DM Anderson, DB Belzer, KA Cort, JA Dirks, DB Elliott, and DJ Hostick. 2003. Impact of 2004 Office of Energy Efficiency and Renewable Energy Buildings-Related Projects on United States Employment and Earned Income . PNNL-14209, Pacific Northwest National Laboratory, Richland, WA.

Shankle, S.A., D.M. Anderson, K.K. Humphreys, 1994, "Integrating Energy, Economics, and the Environment: The Life-Cycle Assessment State of the Art", PNNL-SA-24189, Presented at the 69th Annual Conference of the Western Economic Association International, Vancouver, British Columbia, June 29-July 3, 1994.

Shaw BR, T Paluszkiewicz, SA Thomas, DM Anderson, P Becker, AL Franklin, AY Gu, LF Hibler, SP Lane, GM Petrie, and JM Roop. 1998. Sea of Japan Environmental Instability Analysis. PNNL-12047, Pacific Northwest National Laboratory, Richland, WA

Shelby, B., J. R. Goodwin, M. R. Brunson, and D. M. Anderson, 1989, Impacts of Recreation Use Limits in the Alpine Lakes Wilderness, report prepared for the Wenatchee National Forest. Department of Forest Resources, Oregon State University, Corvallis, Oregon.

Stucky, D.J., S.A. Shankle, D.M. Anderson, 1992, Analysis of Natural Gas Supply Strategies at Fort Drum, PNNL-8227, Battelle Pacific Northwest National Laboratory, Richland, Washington.

Ulibarri, C. A., H. S. Seely, D. B. Willis, D. M. Anderson, 1996, Water, Energy, and the Farm Sector, PNNL-11136, Presented at the 71st Annual Conference of the Western Economic Association International, San Francisco, California, June 28-July 2, 1996.

Western Area Power Administration, 1997, 2004 Power Marketing Final Environmental Impact Statement, DOE/EIS-0232, (preparer), Sierra Nevada Customer Service Region, Western Area Power Administration, Sacramento, California, February, 1997.

Western Area Power Administration, 1996, 2004 Power Marketing Draft Environmental Impact Statement, DOE/EIS-0232, (preparer), Sierra Nevada Customer Service Region, Western Area Power Administration, Sacramento, California, April, 1996.

Western Area Power Administration, 1995, Energy Planning and Management Program Final Environmental Impact Statement, DOE/EIS-0182, (preparer), Prepared by Battelle Portland, Portland, Oregon, July, 1995.

Western Area Power Administration, 1993, Energy Planning and Management Program Draft Environmental Impact Statement, DOE/EIS-0182, (preparer), Prepared by Battelle Portland, Portland, Oregon, March, 1993.

RESUME

JAMES M. BECKER

Research Scientist
Ecology Group
Natural Resources Division
Battelle, Pacific Northwest National Laboratories

EDUCATION

B.S. Range and Wildlife Science, Minor German, Brigham Young University, 1983-1987
M.S. Wildlife Ecology, University of Washington, 1987-1989
German Academic Exchange Service Wildlife Research Associate, University of Munich, Germany, 1990-1991

EXPERIENCE

Mr. Becker has been a research scientist with Battelle for the past 12 years, during which he has been involved in Battelle's environmental activities based in Washington State, USA (10 years), and in Europe (Geneva, Switzerland) (2 years). Mr. Becker's interests include: 1) environmental impact analysis, i.e. assessing the impacts of human disturbance on biological systems for regulatory compliance, 2) ecological and human health risk assessment, 3) natural resource damage assessment, and 4) restoration of damaged ecosystems and habitat enhancement for wildlife.

The following are examples of projects/clients to which he has provided major contributions:

NEPA Analyses for EIS

- Flathead Agency Irrigation Division EIS/BA, Bureau of Indian Affairs, Montana, Aquatic & Terrestrial Ecology Leader
- Grand Gulf Nuclear Power Station, Early Site Permit (for a new nuclear reactor) EIS, U.S. Nuclear Regulatory Commission (NRC), Mississippi, Terrestrial Ecology Task Leader
- Clinton Nuclear Power Station, Early Site Permit EIS, NRC, Illinois, Terrestrial Ecology Task Leader
- Hanford Site Solid Waste EIS, DOE, Washington, Ecology Task Leader
- Arkansas Nuclear One, Unit 2 Power Station, Re-licensing EIS, NRC, Arkansas, Terrestrial Ecology
- Moab Uranium Mill Tailings EIS, U.S. Department of Energy (DOE), Utah, Terrestrial Ecology and Biological Assessment
- Hanford Solid Waste EIS, DOE, Washington, Ecology Task Leader
- Sonora/Arizona Interconnection Project EIS, DOE, Ecology Task Leader
- Waste Isolation Plant EIS, DOE, New Mexico, Terrestrial Ecology Task Leader
- Surry Nuclear Power Station Re-licensing EIS, NRC, Virginia, Terrestrial Ecology
- Bald Eagle Biological Assessment, Surry Nuclear Power Station Re-licensing EIS
- McGuire Nuclear Power Plant Re-licensing EIS, NRC, North Carolina, Terrestrial Ecology

Other Environmental Impact Analyses for Regulatory Compliance

- Boliden Apirsa mine tailings release, Guadiamar River, Spain

- Ecological Compliance Assessment Project, DOE, Washington State
- Environmental Standard Review Plan, NRC, Washington DC, Terrestrial Ecology
- Biological Resources Management Plan and Mitigation Strategy, DOE, Washington State
- Fort Irwin Environmental Impact Analysis, U.S. Department of the Army, California

Ecological and Human Health Risk Assessment

- Site-Specific Terrestrial Ecological Evaluations for Contaminated Sites at Fort Lewis and Yakima Training Center (compliant with Washington *Model Toxics Control Act -- Terrestrial Ecological Evaluation Procedures*)
- Evaluation of Environmental Impacts of Offshore Oil Activities and Associated Coastal Facilities on the Marine Environment of the Sonda de Campeche
- AGIP Oil Well Blowout Ecological and Human Health Risk Assessments, Trecate, Italy
- Columbia River Comprehensive Impact Assessment, Washington State, USA
- Eielson Air Force Base (hydrocarbon contamination) Ecological Risk Assessment, Alaska, USA

Restoration of Damaged Ecosystems and Habitat Enhancement

- Impact Analysis of Ungulate Browsing, Munich, Germany
- Revegetation of Mine Spoils, Utah, USA
- Forage Enhancement for elk and deer, Utah, USA

Natural Resource Damage Assessment

- EniChem DDT contamination, Milan, Italy

PROFESSIONAL RECOGNITION AND AFFILIATIONS

- Manuscript reviewer for the *Wildlife Society Bulletin*
- Wildlife Society member
- German Academic Exchange Service Fellowship (1990-1991)
- Appointed to the Intercollegiate Range Plant Identification Team at Brigham Young University (1986)
- Tuition scholarships to Brigham Young University awarded by the Department of Botany and Range Science (1985 and 1986)

LANGUAGES

- English (mother tongue)
- German (speak, read, and write fluently)
- Italian (write at a technical level, speak, and read)
- French (speak, read, and write)

Dual citizenship USA/Italy – possess a valid Italian passport

PAPERS

B.L. Tiller, C. McKinstry, and J.M. Becker. 2006. Flush Response of Wintering Bald Eagles to Boating and Vehicle Disturbance on the U.S. Department of Energy Hanford Site, South-central Washington State (in preparation).

Becker, J.M. and C. McKinstry. 2004. Response of Winter Birds to Soil Remediation along the Columbia River at the Hanford Site. Environmental Monitoring and Assessment 93(1):277-286.

Becker, J.M., C.S. Abernethy, and D.D. Dauble. 2003. Identifying the Effects on Fish of Changes in Water Pressure During Turbine Passage. Hydro Review 22(5):32-42.

Becker, J.M. 2002. Response of Wintering Bald Eagles to Industrial Construction in Southeast Washington. Wildlife Society Bulletin 30:875-878.

Brandt, C.A., J.M. Becker, and A. Porta. 2002. Distribution of Polycyclic Aromatic Hydrocarbons in Soils and Terrestrial Biota after a Spill of Crude Oil in Trecate, Italy. Environmental Toxicology and Chemistry: Vol. 21, No. 8, pp. 1638–1643.

Becker, J.M., C.A. Brandt, and D.D. Dauble. 1998. Species Selection for an Ecological Risk Assessment of the Columbia River at the Hanford Site, Washington, USA. Environmental Toxicology and Chemistry 17(11):2354-2357.

Becker, J.M., T. Quinn, and K.J. Raedeke. 1996. Seeding Herbs to Enhance Cervix Forage and Reforestation in Pacific Northwest Conifer Forests: A Review. Journal of Sustainable Forestry, 3(2/3):29-44.

SYMPOSIA

Brandt, C.A. and J.M. Becker. 1995. Sitewide Biological Risk Assessment Eielson Air Force Base, Alaska: Risks to Terrestrial Receptors from Diverse Contaminants. ASME Fifth International Conference on Radioactive Management and Environmental Remediation 2: 1529-1533.

Brandt, C.A., J.M. Becker, D.D. Dauble, T.O. Eschbach, and A.L. Bunn. 1998. Species Selection for a Screening-Level Ecological Risk Assessment of the Columbia River at the Hanford Site. ANS Topical Meeting: Risk-Based Performance Assessment and Decision Making Conference.

TECHNICAL REPORTS

Becker, J. M., J. L. Downs, and K. B. Larson. 2005. Site-Specific Terrestrial Ecological Evaluations Fort Lewis Agreed Order Sites. PNNL-15426. Prepared by Pacific Northwest National Laboratory for Fort Lewis Restoration Program, Fort Lewis, Washington. October.

Becker, J.M. 2003. Characterization of Herpetofauna along the Columbia River at the Hanford Site. Unpublished Report. Prepared by Pacific Northwest National Laboratory for Fluor Hanford, Inc., Richland, Washington.

Becker, J.M. 2003. Characterization of Ichthyofauna along the Columbia River at the Hanford Site. Unpublished Report. Prepared by Pacific Northwest National Laboratory for Fluor Hanford, Inc., Richland, Washington.

Becker, J.M. 2002. Evaluation of Potential Effects of the Proposed License Renewal for Surry Power Station, Units 1 and 2, on the Bald Eagle (*Haliaeetus leucocephalus*). Prepared by Pacific Northwest National Laboratory for the U.S. Nuclear Regulatory Commission, Washington, D.C.

DOE-RL (U.S. Department of Energy, Richland Operations Office). 2002. Mitigation Action Plan for the U.S. Department of Energy, Hanford Site, Immobilized Low-Activity Waste (ILAW) Disposal Site Construction.

Sackschewsky, M.R. and J.M. Becker. 2001. 200 Area Dust Mitigation Strategies. PNL-13883. Pacific Northwest National Laboratory, Richland, Washington. Prepared for CH2M Hill Hanford Group.

Sackschewsky, M.R., J.M. Becker, and C. Duberstein. 2001. Ecological Evaluation of the 200 Areas of the Hanford Site. Prepared by Pacific Northwest National Laboratory for Bechtel Hanford, Inc., Richland, Washington.

Becker, J.M., C.A. Brandt, A.L. Bunn, T.B. Miley, M. T. Kingsley, and L. Schwartz. 2001. Biota History Matching in Support of the System Assessment Capability (Rev. 0). Pacific Northwest National Laboratory, Richland, Washington.

Jacob, L., J.M. Becker, and P. Duarte. 2000. Metals Effects and Accumulation in Agricultural Plants and Soils Underlying Mine Waste Deposits in the Guadiamar River Basin, Spain. January.

Becker, J.M. 1999. Valutazione del Rischio Umano Associato alla Presenza degli Idrocarburi Policiclici Aromatici Provenienti dal Blowout del Greggio del Pozzo Trecate No. 24 nelle Acque dell'Aquifero Superficiale, negli Alimenti, e nei Suoli. Febbraio.

Mage, R., J.M. Becker, and L. Jacob. 1998. Soil Sampling Quality Control. Prepared for Boliden Apirsa following failure of its mine tailings impoundment in the Guadiamar River basin, Spain.

Becker, J.M. 1999. Rapporto Riassuntivo del Censimento Aviario, Trecate No. 24 Blowout. Ottobre.

Becker, J.M., C.A. Brandt, D.D. Dauble, A.D. Maughan, and T.K. O'Neil. 1996. Species for the Screening Assessment: Columbia River Comprehensive Impact Assessment. March 1996, DOE-RL-96-16-B, Rev. 0.

DOE-RL (U.S. Department of Energy, Richland Operations Office). 1996. Biological Resources Mitigation Strategy. DOE/RL-96-88, Rev. 0 (in draft). DOE-RL, Richland, Washington.

DOE-RL (U.S. Department of Energy, Richland Operations Office). 1996. Hanford Site Biological Resource Management Plan. DOE/RL 96-32, Rev. 0 (in draft). DOE-RL, Richland, Washington.

Brandt, C.A., J.M. Becker, N.A. Cadoret, J.A. Hall, M.R. Sackschewsky, and B.L. Tiller. 1995. National Training Center Ft. Irwin Ecological Resource Assessment.

Brandt, C.A., J.M. Becker, D.D. Dauble, C.J. Driver, T.K. O'Neil, and K.M. Probasco. 1995. Ecological Risk Assessment AGIP Oil Well No. 24 Blowout, Trecate, Italy.

Brandt, C.A., J.M. Becker, and K.M. Probasco. 1994. Ecological Risk Assessment AGIP Oil Well No. 24 Blowout, Trecate, Italy.

Becker, J.M. 1993. A preliminary Survey of Selected Structures on the Hanford Site for Townsend's Big-eared Bat (*Plecotus townsendii*). PNL-8916, Pacific Northwest Laboratory, Richland, Washington.

PRESENTATIONS

Becker, J.M. and A. Porta. 1999. Valutazione del Rischio Umano Associato alla Presenza degli Idrocarburi Policiclici Aromatici Provenienti dal Blowout del Greggio del Pozzo Trecate No. 24 nelle Acque dell'Aquifero Superficiale, negli Alimenti, e nei Suoli. Presentation to the regional governmental authorities of Piemonte, Italy. March, 1999.

Becker, J.M., C.A. Brandt, D.D. Dauble, A.D. Maughan, and T.K. O'Neil. 1996. Species selection methodology for an ecological assessment of the Columbia River at the Hanford Site. SETAC 17th Annual Meeting, Washington, D.C., 17-21 November 1996.

Brandt, C.A., J.M. Becker, Dauble, D.D., T.K. O'Neil. 1996. Impacts of an oil well blowout near Trecate, Italy on ecological resources. SETAC 17th Annual Meeting, Washington, D.C., 17-21 November 1996.

Doctor, P.G., T.K. O'Neil, M.R. Sackschewsky, J.M. Becker, E.J. Rykiel, T.B. Walters, C.A. Brandt, and J.A. Hall. 1996. Integrated environmental decision support tool based on GIS technology. SETAC 17th Annual Meeting, Washington, D.C., 17-21 November 1996.

Brandt, C.A., and J.M. Becker. 1995. Sitewide Biological Risk Assessment Eielson Air Force Base, Alaska: Risks to Terrestrial Receptors from Diverse Contaminants. ASME Fifth International Conference on Radioactive Waste Management and Environmental Remediation, Berlin, September 1995.

PHILIP M. DALING - Staff Engineer
Facility Safety Group
Environment, Safety, and Health Directorate
Pacific Northwest National Laboratory

Education

B.S. Physical Metallurgy, Washington State University (1981)

Summary of Experience

Mr. Daling's experience involves work in several fields. Job responsibilities have included radioactive and hazardous material processing safety analysis; radioactive materials transportation safety, risk, and cost analysis; radioactive waste management safety and economics; nuclear reactor system safety and risk analysis; mine systems safety analysis; and risk-based decision management. Following are descriptions that exemplify his responsibilities in these areas.

Systems Safety and Risk Analysis.

Mr. Daling was a task leader and principal technical contributor to development of safety basis documentation for a project that would result in solidification of a portion of K-Basin sludge at the PNNL Radiochemical Processing Laboratory (RPL). This was a multi-disciplinary project that involved the design, installation, testing, and operation of a mixing and solidification system. Mr. Daling's responsibilities included preparation of a preliminary safety analysis report for the project, including development of a Preliminary Hazards Analysis (PHA), identification and analysis of design basis accidents, safety classification of systems, structures, and components, and development of Technical Safety Requirements. Mr. Daling was also involved in management of the interface between the sludge owner and PNNL, including preparation of an interface control document and technical support to preparations to transport sludge from K-Basins to RPL.

Mr. Daling was project manager and principal technical contributor to a safety assessment regarding management of highly-radioactive sludge currently located in a spent nuclear fuel storage basin at the Hanford Site. This was a multi-year, multi-disciplinary project that evaluated the hazards and risks of transporting and offloading the sludge into an underground double-shell storage tank at Hanford's 200 East Area. Mr. Daling's primary responsibilities included project management and coordination as well as conducting hazards identification and analyses, evaluation of natural phenomena hazards, analysis of various design basis accidents (including assessments of the frequencies, release phenomenology, and onsite and offsite radiological and toxicological dose consequences), development of technical safety requirements, and identification of safety class systems, components, and structures. The document prepared as a result of this project has been extensively peer reviewed and submitted to the Washington State Department of Ecology to support decision-making about future sludge management operations.

Mr. Daling was a technical contributor to a criticality feasibility study on various management options for highly-radioactive sludge stored at the K reactor spent fuel storage basins at Hanford. The study examined the sludge management options in terms of their potential for preventing accidental nuclear criticality during interim storage of the sludge. Detailed chemistry and neutronics investigations were performed to determine whether or not each sludge management option could provide adequate criticality safety under all normal and credible abnormal storage conditions. The feasibility study concluded that there are two viable options; storage of untreated sludge in a geometrically-safe storage system or pretreatment (dissolution followed by

rapid precipitation and addition of neutron absorbers) and subsequent storage in a standard design double shell storage tank. Mr. Daling's primary responsibilities included preparation of the main report and coordination of the detailed chemistry and neutronics analyses. This document was submitted to the Washington State Department of Ecology to support decision-making about future sludge management operations.

Mr. Daling managed and contributed technically to the preparation of a series of safety assessment documents for existing and future waste management and processing facilities on the Hanford Site. These safety assessments are being performed for the Westinghouse Hanford Co. To date, Mr. Daling has been responsible for the technical analyses in support of a Safety Analysis Report (SAR) supplement for storage of irradiated fuels in the Hanford Site's Solid Waste Burial Ground, for a Preliminary Safety Analysis Report for a low-level liquid waste condensate treatment facility, and for a SAR supplement for disposal of decommissioned, defueled submarine reactor compartments. Mr. Daling was also responsible for preparation of umbrella safety analysis documentation for the entire Solid Waste Burial Ground, including preparation of an interim safety basis (ISB) and a SAR using the format and content requirements given in DOE Order 5480.23. In addition, Mr. Daling was responsible for performing the technical analyses necessary to authorize a high-level liquid waste supernate volume reduction campaign for Hanford's 242-A Evaporator facility. In addition, Mr. Daling performed atmospheric dispersion and consequence analyses in support of a 242-A Evaporator SAR revision related to elevated releases of ammonia due to feed blending errors. Mr. Daling's responsibilities in these projects included program management, sponsor relationships, technical safety analyses (including preliminary hazards analysis, development of source terms, consequence analysis, estimation of routine radiological exposures, and preparation of all other section of a SAR such as design criteria, site description, QA, operational safety requirements, and conduct of operations), and interface with facility designers.

Mr. Daling was task leader and key technical contributor to major revisions and updates to PNNL nuclear facility Safety Analysis Reports. The PNNL nuclear facilities included the 324 and 325 Buildings, which are laboratory facilities in the 300 Area of the Hanford Site. Mr. Daling's responsibilities included preparation of the accident analysis chapters of the SARs, including selection of design-basis accident scenarios, assessments of the frequencies of the design-basis accidents, accident phenomenology, and consequence analyses as well as preparing the accident analysis text and responding to internal and external comments. His responsibilities have included the preparation of complete new SARs as well as development of a Supplement that deals with processing of tritium fuel rods that were irradiated in a commercial nuclear power plant. Mr. Daling has also prepared numerous Unreviewed Safety Question Determinations to support new activities planned for the 324 and 325 laboratories.

Mr. Daling was project manager and technical contributor to a probabilistic risk assessment of condensed-phase organic-nitrate reactions that could potentially occur in Hanford's underground radioactive waste storage tanks. The risk assessment consisted of several tasks, including derivation of probabilistic fuel and moisture content descriptions for the tanks (including analysis of variance modeling to represent fuel and moisture conditions in tanks that have little or no characterization data), tank response to the reaction (temperature and pressure profiles), radioactive and hazardous material aerosolization and release, reaction initiator frequency analysis, consequence analysis, and tank-by-tank probabilistic risk calculations. Mr. Daling's responsibilities included overall project management and coordination, development of initiator frequencies, and integration of all parts of the organic-nitrate risk assessment model to develop the risk estimates.

Mr. Daling was manager and principal technical contributor to a project that prepared safety analysis documentation for a PNL facility that is planned to thermally treat mixed and hazardous chemical wastes generated at PNL facilities. The facility is being designed around a glass melter thermal treatment concept. The facility also includes mixed and hazardous waste storage capabilities, waste characterization facilities,

offgas treatment, grouting capabilities, and laboratory space. The project included preparation of Hazard Classification, Safety Classification of Systems, Components, and Structures, and Preliminary Safety Analysis Report documents.

Mr. Daling was task leader and principal technical contributor for a facility siting evaluation for construction of a natural gas distribution system and gas-fired steam heating systems in Hanford's 300 Area. The study developed minimum separation distance criteria from nearby nuclear facilities for siting the gas pipelines and boilers. His responsibilities included developing the minimum separation distances based on the potential damage to the nuclear facilities from boiler overpressurization explosions, natural gas explosions in the boiler annex buildings, natural gas flame jets from ruptured pipelines, and boiler annex building fires.

Mr. Daling was a technical contributor to a safety audit and inspection of nuclear waste management facilities in Belgium. The study was sponsored by the Belgian Ministry of Economic Affairs and the Secretary of Energy and was performed by staff members from Battelle-Frankfurt FRG as well as from Battelle-Pacific Northwest Laboratories. The audit encompassed the waste treatment, transport, and storage facilities of the SCK/CEN Waste, in Mol, and Belgoprocess, in Dessel, Belgium. The audit included onsite inspections, reviews of safety documentation, and identification and assessment of hazards at these facilities.

Mr. Daling was a task leader and key technical contributor to the NRC's Spent Fuel Project Office reviews of spent fuel storage and transportation cask licensing submittals (SARs and SARPs). Mr. Daling's responsibilities include independent technical review and confirmatory calculations of several sections of the licensee submittals, including the accident analysis, operating procedures, and technical specifications for storage casks and the containment evaluation, operating procedures, and technical specifications chapters of transportation cask submittals. He has participated in reviews, preparation of Requests for Additional Information, communication with licensees and NRC staff, and preparing the related sections of the NRC Safety Evaluation Reports that were developed based on the reviews.

Mr. Daling was project manager and principal technical contributor to a value-impact analysis of potential resolutions to a NRC Generic Safety Issue regarding the reliability of HVAC and room cooler systems at commercial nuclear power plants. This multi-year, multi-disciplinary project examined the effects of alternative strategies for improving the reliability of HVAC/room cooler systems whose functions are to maintain ambient temperatures in safety-related areas of nuclear power plants at levels acceptable for equipment operation. Major activities in the project include an assessment of vulnerabilities to HVAC/room cooler failures, assessment of room heatup rates following loss of room cooling, assessment of the effects of elevated room temperatures on the reliability of safety-related equipment, and an assessment of the core damage frequencies, public risks, and costs associated with room cooler failures and the potential resolutions.

Mr. Daling was manager and technical contributor to a multi-million dollar research program sponsored by the U.S. Nuclear Regulatory Commission's Office of Nuclear Regulatory Research (RES). The objective of this program is to develop and implement a methodology to quantify risks, radiation doses, and costs associated with safety issues involving nuclear power plants. This information has been used by RES to rank safety issues for further investigation and possible implementation. Mr. Daling's responsibilities included program management, business development, client support/interface, and technical contributions to the development of quantitative cost and risk impact information.

Mr. Daling was a task leader and technical contributor to a value-impact assessment of proposed revisions to Regulatory Guide 1.78 that provides guidance to NRC licensees on control room habitability evaluations. Mr. Daling was responsible for preparation of quantitative and qualitative evaluations of the extent to which the proposed revisions would affect current licensees, impacts on licensee costs, and the impacts on public and

worker risk. A detailed value-impact assessment document was published and used in NRC rulemaking activities regarding the proposed revisions.

Mr. Daling was Technical Contributor to a project that investigated the engineering and safety implications of bivalve, sediment, and corrosion fouling in nuclear power plant service water systems. This project was sponsored by the Nuclear Regulatory Commission. Mr. Daling was responsible for identifying and evaluating the engineering characteristics of nuclear power plants that make them susceptible to fouling. He was also responsible for identifying events that could either be caused directly by biofouling or could be exacerbated by the presence of biofouling in nuclear power plant raw water systems. Mr. Daling is currently responsible for preparation of a cost/benefit analysis in support of NRC rulemaking decisions (i.e., regulatory analysis) on alternative fouling surveillance and control programs proposed to be implemented at nuclear power plants.

Mr. Daling was the Task Leader and Technical Contributor in a project to compile a handbook of safety assessment methods applicable to the mining industry sponsored by the Bureau of Mines. He was responsible for evaluating current safety analysis procedures for relevance to the mining industry and mine operator's needs. He documented applicable procedures in a manual with detailed instructions on their use. The handbook was compiled to encourage the mining industry to use modern safety analysis techniques to prevent accidents by anticipating hazardous situations and potential accident sequences.

Mr. Daling was the principal author and technical contributor to a safety manual for the impactor shaft sinking system sponsored by the U.S. Bureau of Mines. This manual identified procedures and practices for the impactor site personnel that can improve the operational safety of the system. A safety analysis technique called the "Management Oversight and Risk Tree"(MORT) analysis was used to identify hazardous conditions and to suggest ways to eliminate or mitigate these hazards.

Radioactive and Hazardous Materials Transportation.

Mr. Daling was manager and principal technical contributor to the transportation impact analysis that supports the Hanford Solid Waste Management Environmental Impact Statement. Mr. Daling's responsibilities included development of input data and preparation of input files for the computer code (RADTRAN) used to calculation radiological transportation impacts. He also researched and collected data used to calculate non-radiological impacts of vehicular accidents and routine emissions of hydrocarbon pollutants. The transportation impact analysis included assessments of the impacts of onsite and offsite transport of wastes and construction materials to support the EIS alternatives, including route-specific assessments of the radiological and non-radiological impacts nation-wide as well as in Washington and Oregon, assessment of rail versus truck shipping options, and the impacts of potential sabotage or terrorist activities.

Mr. Daling was a key contributor to the transportation sections of the Comment Response Document for the Yucca Mountain EIS. He was responsible for reviewing and developing responses to hundreds of transportation-related comments on the Draft EIS from the public, regulators, and others. This effort involved a complex coordination of responses from numerous technical staff involved in preparing the EIS as well as the technical team preparing the Comment Response Document.

Mr. Daling was project manager and principal technical contributor to a life-cycle cost and risk analysis of alternative potential truck and rail/intermodal configurations for transportation of low-level radioactive wastes from DOE generators to the Nevada Test Site disposal areas. The costs and risks associated with continued use of existing highway routes that travel over Hoover Dam and through Las Vegas to the NTS were quantified and compared to the risks of alternative highway routing configurations that avoid Hoover Dam and Las Vegas. The feasibility, costs, and risks associated with two alternative truck/rail

intermodal configurations in which LLW shipping containers would be loaded onto trucks at generator sites and shipped to a nearby railhead, transferred from the trucks to railcars, transported by rail to Nevada, and then transferred to trucks for the rest of the trip to the NTS disposal areas were also evaluated.

Mr. Daling was project manager and principal technical contributor to assessments of the risk of transporting selected nuclear weapons components in the Safe-Secure Trailer (SST). A risk-based methodology was used to determine the public health risks associated with these shipments and compare the results with acceptable risk guidelines established by the DOE. Mr. Daling's responsibilities included overall project coordination and integration between the sponsor (Mason and Hanger - Silas Mason Co., Inc., operators of the Pantex Plant), DOE - Albuquerque, Sandia National Laboratories, and Lawrence Livermore National Laboratory, overall preparation of the risk assessment document and comment response documents, coordination and interface with the DOE independent review panels, and preparation of the containment analysis, quality, and operations chapters.

Mr. Daling was task manager and principal technical contributor to three environmental impact statements in support of Early Site Permit activities for licensing, constructing, and operating advanced nuclear power reactors. Mr. Daling's responsibilities included preparation of the environmental impact analysis for transporting spent nuclear fuel, unirradiated fuel, and wastes to and from advanced nuclear power plant sites. A total of seven advanced reactor designs and eleven potential sites were considered in the environmental impact statements. He was responsible for characterizing the waste and fuel shipments, determining route characteristics, implementing the RADTRAN 5 computer code to calculate the radiological impacts, and using historical data to calculate nonradiological impacts.

Mr. Daling managed and performed the transportation impact analysis in support of a generic environmental impact statement on decommissioning of nuclear facilities. PNNL prepared the GEIS for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. His responsibilities included characterization of potential waste and material shipments, evaluation of the routine and accident impacts associated with transporting decommissioning wastes and materials, integration with other impact analyses, and document preparation.

Mr. Daling was task leader and major technical contributor to an analysis of the environmental impacts of transporting high-burnup spent nuclear fuel from commercial light waste reactors to the spent fuel disposal facility at Yucca Mountain, Nevada. The study examined the environmental impacts of transporting spent nuclear fuel with burnups up to 75,000 MWd/MTU. Mr. Daling implemented the RADTRAN computer code to quantify the environmental impacts of routine transport and accidental releases of spent nuclear fuel in transit. The analysis was used by the NRC to support decision-making about allowing utilities to increase fuel burnup.

Mr. Daling was a project manager and technical contributor to an assessment of the safety of the ATMX Railcar system for transportation of Department of Energy Defense Program transuranic (TRU) wastes. The study was conducted in support of a Department of Transportation (DOT) certification activity for the railcar. Mr. Daling's responsibilities included project management, preparation of the radiological and economic consequence estimates for severe accidents involving the railcar, estimation of the probabilities of the accidents, and development of comparisons of the consequences of the accidents with other accidents involving nonradioactive hazardous materials (i.e., chlorine and PCB accidents).

Mr. Daling was task manager and technical contributor to the transportation impact analysis in support of the Medical Isotope Production Reactor Environmental Impact Statement. The purpose of the EIS was to evaluate the environmental impacts of various alternatives for production of Molybdenum-99, a radioactive

isotope that decays to metastable Technetium-99m, a radioactive isotope that is widely used in medical diagnostic procedures. Mr. Daling's responsibilities included task management, conducting the transportation risk analyses, preparation of the transportation impact documentation, and responding to public and stakeholder comments. The EIS prepared as a result of this work received the Award of Excellence in the category of Technical Reports from the Society of Technical Communications.

Mr. Daling was technical contributor to independent review of the transportation impact analysis for the Waste *Isolation Pilot Plant Disposal Phase Final Supplemental EIS* and contributed to development of comment responses and preparation of the final transportation impact analysis sections. Mr. Daling was also a key contributor and participant to the Public Hearings conducted to obtain comments on the Draft EIS. He staffed an information booth to answer questions from the public and stakeholders and provide information on the transportation impacts calculated in the Draft EIS.

Mr. Daling has developed Health and Safety and Transportation impact analysis chapters of several supplements to the *Waste Isolation Pilot Plant EIS*. The supplements he has supported include one for an Astrophysics Laboratory in the underground areas of the WIPP Facility, construction and operation of an Actinide Physics Laboratory to support WIPP operations, and one on disposal of polychlorinated biphenyl (PCB)-commingled TRU waste. His responsibilities included collection of relevant technical information, hazards identification and evaluation, transportation impact analysis, and report preparation.

Mr. Daling was a project manager and technical contributor to a study that evaluated the quantitative effects of human factors on the safety of spent fuel transportation. The study, which was conducted for the DOE-Defense Programs, evaluated the effects of three areas of human performance: 1) driver training; 2) adherence to procedures during shipping cask handling and loading activities; and 3) quality assurance during shipping cask design and manufacturing activities. Mr. Daling performed most of the technical work as well as the project management activities.

Mr. Daling was principal technical contributor under subcontract to Jacobs Engineering to prepare the transportation impact analysis for the *Tank Waste Remediation System Environmental Impact Statement*. Mr. Daling's responsibilities included collection of necessary source term data, development of transportation accident risk inputs, such as accident probabilities and release fractions for vitrified high-level waste forms and secondary wastes, and calculating transportation impacts using the RADTRAN 4 computer code. He was also responsible for calculating routine (incident-free) radiological impacts as well as nonradiological impacts of transporting vitrified HLW to an offsite geologic repository.

Mr. Daling was task manager and principal technical contributor to a study that evaluated the radiological and nonradiological impacts of transportation of tritium fuel cycle materials in support of the New Production Reactor Environmental Impact Statement. Mr. Daling's responsibilities included general task management, development of radiological release terms for transportation accidents involving various materials, application of computerized radiological consequence models to estimate population and individual doses, estimation of transportation accident risks, and estimation of routine exposures to crewmembers and non-crew bystanders and passersby.

Mr. Daling was a technical contributor to an analysis of radiation doses in a postulated spent fuel transportation system. This study was conducted by PNL for the DOE-Office of Civilian Radioactive Waste Management. Mr. Daling's responsibilities include task management and principal technical contributor to the analysis of in-transit radiation doses. Key activities in this analysis include time-and-motion analyses of in-transit truck and rail shipment operations, estimation of routine doses to transport workers and the public for the "reference" system, estimation of doses for a system that incorporates a centralized storage and handling

facility, and estimation of the changes in in-transit doses that would result from implementation of various alternatives to the two system configuration options.

Mr. Daling was a task leader and technical contributor for a project that prepared the Hanford Defense Waste Environmental Impact Statement regarding the management of U.S. Defense Program radioactive wastes at the Hanford site. Mr. Daling's responsibilities included development of the environmental impacts associated with transportation of Hanford defense wastes to various potential disposal locations and representation of PNL and DOE at a series of public workshops. Both radiological and nonradiological impacts were evaluated.

Mr. Daling was task leader and principal contributor to the transportation impact analysis in support of the EIS on management of spent nuclear fuel currently in storage at the K basin storage facility, Hanford Site. Mr. Daling was responsible for assessments of the radiological and nonradiological impacts of various spent fuel management alternatives, including development of input data for transportation impact analysis and highway and rail routing analysis computer codes as well as preparation of the transportation impact appendix and main text sections of the EIS dealing with transportation impacts.

Mr. Daling was project manager and technical contributor to an assessment of the transportation impacts associated with transportation of irradiated N-Reactor fuels in support of a fuel characterization program being conducted at a PNL facility. Mr. Daling's responsibilities included preparation of input data for a transportation risk assessment computer code (e.g., release fractions, accident probabilities, atmospheric dispersion, etc.), running the computer code, and preparing the documentation for the transportation impact analysis.

Mr. Daling was task leader and technical contributor to a transportation impact analysis for shipment of Low-Specific-Activity (LSA) nitric acid from the Hanford Site to three Eastern United States ports. Mr. Daling was responsible for assessments of radiological and nonradiological impacts, including development of source term data, release fractions, and accident frequencies as well as atmospheric dispersion and hazardous chemical consequences of potential nitric acid releases en route. He was co-author with the client on a published report of this work, which was used to support an Environment Assessment and Categorical Exclusion for these shipments.

Mr. Daling was task leader and technical contributor to an Environmental Assessment on the transportation of cesium and strontium capsules from their offsite locations to the Hanford Site. Mr. Daling was responsible for preparation of the transportation impact analysis using the RADTRAN 4 computer code. Mr. Daling was also responsible for the interface with the outside organizations (e.g., State of Idaho) who had comments and/or questions on the transportation portions of the EA.

Mr. Daling was task manager and principal technical contributor to an Environmental Assessment regarding the handling and transportation of radioactive vitrified glass incorporating large quantities of Cs-137 and Sr-90. These vitrified glass canisters were prepared at the Hanford Site and are to be shipped overseas to the Federal Republic of Germany for use in a high-level waste disposal research program. Mr. Daling's responsibilities included development of radiological and nonradiological impacts estimates as well as preparation of the EA.

Mr. Daling was a task leader and technical contributor to Supplements 1 and 2 of the Three Mile Island Programmatic Environmental Impact Statement. For the preparation of Supplement 1, Mr. Daling evaluated the radiological and nonradiological impacts of transporting alternative treated forms of accident-generated water from TMI to various disposal facilities. Supplement 2 addressed treatment, transport, and disposal of

various low-level wastes projected to be generated as a result of alternative decontamination and decommissioning strategies.

Mr. Daling was a project manager and technical contributor for a spent nuclear fuel transportation cost and logistics project. This project was part of the Department of Energy's (DOE) Commercial Spent Fuel Management Program. The objective was to provide near- and long-term estimates of needed spent fuel transportation system capacity and hardware for use by DOE to encourage the construction and operation of needed equipment. Mr. Daling was project manager for a study that is evaluating the spent fuel shipping cask handling capabilities at commercial nuclear power stations in the U.S. Mr. Daling prepared an analysis of design and licensing issues for a spent nuclear fuel storage/transport system; was involved in a first-of- a-kind storage/transport system demonstration, and monitored development of design and construction rules for spent fuel transportation systems.

Mr. Daling was task leader and major technical contributor to a study that provided a preliminary evaluation of the maximum cargo capacity of spent fuel shipping casks. The study involved elementary thermal, structural, and shielding evaluations of a variety of potential shipping cask designs. In a separate study for the MRS Program, Mr. Daling developed estimates of the costs of transporting various radioactive waste materials, including spent fuel, high-level wastes, and transuranic wastes. This information was used to evaluate the transportation costs associated with a range of potential MRS facility designs and siting options.

Radioactive and Hazardous Chemical Waste Management.

Mr. Daling is a project manager and technical contributor to the DOE Office of River Protection's technical and programmatic risk management program. Mr. Daling is responsible for preparing and updating the *River Protection Project Integrated Risk Management Guide* that provides guidance and risk management procedures for conducting integrated risk analyses and integrating risk information from ORP and its two prime contractors. Mr. Daling is also responsible for preparing monthly briefings for ORP senior management on the status of critical technical and programmatic risks, leading and conducting ORP reviews of contractor risk assessments, and preparing/updating the ORP *Critical Risk Management List* document. As a part of this project, Mr. Daling was granted a copyright for developing Topographic Risk Assessment©, which is a methodology and software tool for displaying risk data for complex projects and allows users to adjust and manipulate project schedules, risk information, and visual displays simultaneously. Mr. Daling has also led or contributed to a number of ORP oversight reviews, including a review of the hazardous chemical source term documentation for Hanford's tank wastes and the material selection process employed by the Waste Treatment Plant (WTP) Contractor. Mr. Daling also conducted an assessment of the risks associated with alternative emergency diesel generator configurations for the WTP, risks and costs associated with alternative WTP Analytical Laboratory configurations, cost and risk tradeoffs associated with providing rail service to the WTP Site, and cost and risk tradeoffs associated with alternative delisting strategies for immobilized low-activity waste. Mr. Daling also participated in the ORP Project Controls activity, including development and preparation of performance metrics for ORP Managers to monitor WTP performance, development of forward-looking performance predictions used during WTP baseline reviews, and participation in technical integration activities intended to align the WTP Contractor and Tank Farm Contractor and support development of an integrated technical baseline for the two contractors.

Mr. Daling was a task leader and technical contributor to a design activity for a proposed facility for treating Savannah River Site tank wastes. The facility is intended to process low cesium salt solutions in preparation for treatment in the Defense Waste Processing Facility vitrification plant. Mr. Daling's responsibilities included conducting and documenting a preliminary hazards analysis and a technical and programmatic risk assessment of the proposed facility design.

Mr. Daling was a key technical contributor to a project funded by the U. S. Department of Energy to develop a comprehensive risk-based cleanup strategy for Hanford that 1) protects the public, workers, and environment from unacceptable risks, and 2) fits within a reduced annual funding profile. Battelle-PNL staff participated on a team that developed this strategy along with participants from Westinghouse Hanford Co. and Bechtel Hanford Inc. The risk-based strategies were developed through a systems analysis approach that analyzed the cleanup mission, identified cleanup objectives (such as risk reduction, land use, and facility mortgage reduction), analyzed the existing baseline strategy in terms of its costs and levels of risk reduction, developed cleanup alternatives and compared those alternatives against the objectives, and derived conclusions and recommendations regarding the current strategy and potential risk-based strategies. This project developed a framework and set of tools for dealing with changes in anticipated funding levels, regulatory requirements, cleanup standards, and Congressional initiatives. Land-supply curves, cost profiles, risk profiles, mortgage-reduction curves, and minimum operations costs tools were developed for all major Hanford site cleanup activities, including facility deactivation, decontamination, decommissioning, tank waste remediation, groundwater remediation, and environmental restoration activities. Mr. Daling's responsibilities included preparation of worker risk and safety estimates and contributing to assessments of long-term public risks and risks from acute releases (i.e., accidents).

Mr. Daling was task leader and technical contributor to an analysis of the No-Action Alternative in the Yucca Mountain Repository Environmental Impact Statement. The project supported an evaluation of the human health consequences of long-term storage of commercial spent nuclear fuel and high-level waste in concrete and steel storage systems at surface facilities (as opposed to a deep geologic disposal facility). Mr. Daling's responsibilities included development and application of a computer code to model long-term degradation of concrete and steel barriers postulated to be placed around commercial spent fuel at reactor sites, dissolution of the uranium oxide waste form, and estimation of the flux (mass per unit time) of uranium dioxide released to the environment. Degradation and release computations are sensitive to parameters encountered on the earth's surface, such as rainfall composition, rainfall pH, ambient temperatures, and ambient humidity. The computer model was applied to support an assessment of the human health consequences of long-term surface-based storage of spent nuclear fuel vs. disposal in a deep geologic repository.

Mr. Daling was task leader and principal technical contributor to the River Protection Project Mission Analysis Report. The RPP MAR defines the mission and describes the top-level functions that must be conducted to accomplish the mission, and defines the requirements that must be met to achieve these functions. This document defines the upper tier of the technical requirements and project scope that the Department of Energy, Office of River Protection (ORP) will manage and control as part of baseline management. The RPP participants, including the tank farms operating contractor and the pretreatment and vitrification plant contractor, use this document as a starting point to develop the lower level functions and requirements necessary to conduct the work. Mr. Daling was responsible for describing the current situation (initial state), determining the desired outcome (end state), and establishing the top-level functions and requirements that will transform the initial state to the end state, describing the physical architecture for the preferred alternative to accomplish the functions and requirements, and describing the major risks.

Mr. Daling is leading a task to support integration of sound decision management principles into decision-making on the Hanford Site. His responsibilities have included supporting development and implementation of a formal Decision Management procedure whereby decision-makers and analysts agree before an engineering study or cost/benefit analysis is conducted on the scope and technical performance information to be developed, receive updates on the status and findings of the study as it progresses, and are then briefed on the results when the study is complete. The decision-makers then consider the technical results of the study in addition to their own values, stakeholder values, and programmatic concerns before making the decision. Formal documentation of the study and the decision are then prepared.

Mr. Daling was project manager and major technical contributor to a program that evaluated the radiological and nonradiological risks in the DOE commercial waste management system. The first phase of the project consisted of a review of risk information relative to waste disposal repositories and Monitored Retrievable Storage (MRS) facilities in the literature and development of preliminary risk estimates based on this information. In the second phase of this project, probabilistic risk assessment methods were applied to the most recent facility designs to produce comprehensive risk estimates. Mr. Daling's responsibilities included task management, detailed fault tree modeling and quantitative evaluation of accident sequences, integration of accident frequencies and consequence estimates, development of a methodology for identification and screening of potential accident initiating events, and coordination/integration with other contractors in DOE's waste program.

Mr. Daling was project manager and principal technical contributor to a study that developed accident frequencies for operation of four double-walled storage tanks for liquid high-level wastes. His responsibilities included development of fault tree models for the accident scenarios, quantitative evaluation of accident frequencies, and coordination with the tank design team.

Mr. Daling was a project manager and major technical contributor to development of a systems engineering dose analysis model for the DOE-Office of Civilian Radioactive Waste Management. Mr. Daling's responsibilities included project management, development of algorithms that were coded into the model, development of the data that were required to exercise the model, and interface with other research organizations that were providing related model inputs.

Mr. Daling was a major technical contributor to a project that evaluated the radiological dose impacts in commercial spent fuel management system without an MRS Facility. The purpose of the study was to evaluate the risks and doses in a system in which the functions of the proposed MRS Facility are performed at reactor sites. Mr. Daling's responsibilities included evaluating the routine dose and accident risk impacts associated with transportation of spent fuel to a disposal repository. The project was funded by the Department of Energy.

Mr. Daling was a major technical contributor to a project that evaluated the cost and safety impacts of various nuclear waste treatment and immobilization strategies for high-level and transuranic wastes. Cost and safety data were developed for the entire nuclear waste management system, including waste treatment facilities, transportation, and underground disposal repository facilities. This project was funded by the U.S. Department of Energy.

Mr. Daling was task leader and principal contributor to an analysis of commercial transuranic wastes that are generated in a non-reprocessing nuclear fuel cycle. This analysis included a survey of transuranic waste inventories and characteristics, development of alternative waste treatment strategies, development of proposed waste acceptance requirements, and establishment of the design basis for the geologic disposal of these wastes. Mr. Daling was also a technical contributor to a similar characterization and evaluation program for spent fuel disassembly hardware and other non-fuel bearing components. Both projects were funded by the DOE Office of Civilian Radioactive Waste Management.

Mr. Daling was technical contributor to a research project that compared the costs for a nuclear waste management system based on disposal of high-level wastes (HLW) as a borosilicate glass versus a crystalline ceramic waste form. A systems analysis approach was used to compare the costs for treatment (immobilization), transportation, and disposal of the two HLW forms. This project was sponsored by the U.S. DOE's Commercial Waste Treatment Program.

Mr. Daling was a major contributor to the NRC Nuclear Fuel Cycle Risk Assessment Project. He prepared descriptions of the spent fuel and high-level and transuranic waste storage facilities as well as the description of the transportation of radioactive materials in all aspects of the nuclear fuel cycle.

Mr. Daling was technical contributor to the Liquefied Gaseous Fuels (LGF) Safety Studies Project sponsored by the U.S. Department of Energy. This project was designed to provide safety and environmental control information and guidance to the DOE, industry, regulatory bodies, and the general public. The information was developed to assist decision makers regarding the transportation, handling, and storage of liquefied gaseous fuels. Mr. Daling was responsible for developing and evaluating fault trees for a task that evaluated a liquefied natural gas (LNG) peakshaving facility's release prevention and control systems.

PUBLICATIONS

System Safety and Risk Analysis

Daling, P. M., M. D. Danielson, J. C. Lavender, Y. Liu, H. K. Phan, and R. H. V. Gallucci. 1997. *Preliminary Safety Assessment - Transfer of K Basin Sludge into Double Shell Tank 241-AW-105*. HNF-MR-0541, Rev. B. Prepared for Duke Engineering and Services, Hanford Inc., Richland, Washington.

Daling, P. M. et al. 1997. *Feasibility Report on Criticality Issues Associated with Storage of K Basin Sludge in Tank Farms*. HNF-SD-WM-ES-409, Rev. 0. Duke Engineering and Services, Hanford Inc., Richland, Washington.

Daling, P. M. et al. 1993. *Value-Impact Analysis of Generic Issue 143, "Availability of Heating, Ventilation, and Air Conditioning (HVAC) and Chilled Water Systems*. NUREG/CR-6084, PNL-8750. Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. et al. 1994. "Value Impact Assessment for Resolution of Generic Issue 143 - Availability of HVAC and Chilled Water Systems," in *Proceedings of the 23rd DOE/NRC Nuclear Air Cleaning and Treatment Conference*, Buffalo, New York, July 25-28, 1994. NUREG/CP-0141, CONF-940738. Harvard Air Cleaning Laboratory, Boston, Massachusetts.

Daling, P. M. et al. 1995. "Assessment of Costs and Benefits Associated with Resolution of Generic Issue 143 - Availability of HVAC and Chilled Water Systems," in *Nuclear Technology*, Volume 109, No. 3. American Nuclear Society, La Grange Park, Illinois.

L.B. Sasser and P.M. Daling. 1999. *Recommendations for Revision of Regulatory Guide 1.78.* NUREG/CR-6624, Pacific Northwest Laboratory, Richland, Washington.

G. H. Saito, P. M. Daling, et al. 1994. *Solid Waste Burial Ground Interim Safety Basis*. WHC-SD-WM-SARR-028 and WHC-SD-WM-ISB-002. Prepared for Westinghouse Hanford Co., Richland, Washington.

Daling, P. M. et al. 1991. *Disposal of Submarine Reactor Compartments in the Solid Waste Burial Grounds*. WHC-SD-WM-SAR-038, Addendum 7 (DRAFT). Prepared for Westinghouse Hanford Co. by Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. et al. 1991. *Retrievable Storage of Irradiated Fuels in the Solid Waste Burial Grounds*. WHC-SD-WM-SAR-038, Addendum 5. Prepared for Westinghouse Hanford Co. by Pacific Northwest Laboratory, Richland, Washington.

Daling, PM, and TM Graham. 1999. "Hand Calculation of Safe Separation Distances Between Natural Gas Pipelines and Boilers and Nuclear Facilities in the Hanford Site 300 Area," *in Nuclear Technology*, Vol 126, No. 1, American Nuclear Society, LaGrange Park, Illinois (April 1999).

Daling, P. M., and T. M. Graham. 1997. *Minimum Separation Distances for Natural Gas Pipeline and Boilers in the 300 Area, Hanford Site*. PNNL-11660, Rev. 0, D01812-01-0-01, Rev. 0. Pacific Northwest National Laboratory, Richland, Washington.

Daling, P. M., and J. C. Lavender. 1997. *Technical Support for Authorization of 242-A Evaporator Campaign 97-2, Hanford Site, Richland, Washington*. PNNL-11641. Pacific Northwest National Laboratory, Richland, Washington.

Daling, P. M. et al. 1990. *Preliminary Safety Analysis Report -- B-Plant Condensate Treatment Facility*. WHC-SD-W007-PSAR-001 (DRAFT). Prepared for Westinghouse Hanford Co. by Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. et al. 1992. *Solid Waste Burial Ground Safety Analysis Report*. WHC-SD-WM-SAR-053 (DRAFT). Prepared by Westinghouse Hanford Co. and Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. 1991. *Preliminary Safety Evaluation Document - Hazardous Waste Treatment Facility*. Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. and W. C. Milstead. 1989. "Application of a Methodology to Determine Priorities of Nuclear Power Plant Safety Issues," in *Nuclear Engineering and Design*. 115 (1989) 273-279. Elsevier Science Publishers, North-Holland, Amsterdam.

Daling, P. M. 1987. "Application of A Methodology to Determine Priorities for Nuclear Power Plant Safety Issues," presented at *Fifteenth Water Reactor Safety Information Meeting*, October 26-30, Gaithersburg, Maryland. PNL-SA-15164.

Andrews, W. B., P. M. Daling, et al. 1983, 1984, 1985, 1987, and 1995. *Guidelines for Nuclear Power Plant Safety Issue Prioritization Information Development*. NUREG/CR-2800 and Supplement Nos. 1, 2, 3, 4, and 5, PNL-4297 and Supplement Nos. 1, 2, 3, 4 and 5. Pacific Northwest Laboratory, Richland, Washington.

Andrews, W. B., P. M. Daling, et al. 1986. *A Ranking of Sabotage/Tampering Avoidance Technology Alternatives*. NUREG/CR-4462, PNL-5690. Pacific Northwest Laboratory, Richland, Washington.

Neitzel, D. A., K. I. Johnson, P. M. Daling, and T. Y. Chang. 1989. "Improving the Reliability of Service-Water Systems at Nuclear Power Plants," in *Transactions of the Seventeenth Water Reactor Safety Information Meeting*. NUREG/CP-0105. U. S. Nuclear Regulatory Commission, Washington D.C.

Neitzel, D. A., K. I. Johnson, and P. M. Daling. 1989. "Improving the Reliability of Service-Water Systems at Nuclear Power Plants," in *Nuclear Plant Journal*. May-June 1989, Vol. 7, No. 3. EQES Inc., Glen Ellyn, Illinois.

Daling, P. M., D. L. Stiles, S. A. Weakley, and K. I. Johnson. 1988. *Regulatory Analysis for Generic Issue 51: Improving the Reliability of Open-Cycle Water Systems*. NUREG/CR-5234. Pacific Northwest Laboratory, Richland, Washington.

Neitzel, D. A., K. I. Johnson, T. L. Page, J. S. Young, and P. M. Daling. 1984. *Bivalve Fouling of Nuclear Power Plant Service-Water Systems. Volume 1: Correlation of Bivalve Biological Characteristics and Raw-Water System Design*. NUREG/CR-4070 Vol 1, PNL-5300 Vol 1. Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M., K. I. Johnson. 1985. *Bivalve Fouling of Nuclear Power Plant Service-Water Systems. Volume 2: Current Status of Surveillance and Control Techniques.* NUREG/CR-4070 Vol 2, PNL-5300 Vol 2. Pacific Northwest Laboratory, Richland, Washington.

Henager, C. H., P. M. Daling, K. I. Johnson. 1985. *Bivalve Fouling of Nuclear Power Plant Service-Water Systems. Factors That May Intensify the Safety Consequences of Biofouling*. NUREG/CR-4070 Vol 3, PNL-5300 Vol 3, Pacific Northwest Laboratory, Richland, Washington.

Schneider, K. J., P. M. Daling, et al. *Nuclear Fuel Cycle Risk Assessment: Description of Representative Non-Reactor Facilities*. NUREG/CR-2873, PNL-4306. Pacific Northwest Laboratory, Richland, Washington.

Daling, P.M., J.C. Lavender. 1986. *Comparative Safety Assessment of Underhand vs. Overhand Cut-and-Fill Stoping*. Prepared for the Bureau of Mine, Spokane, Washington, by Battelle, Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M., J. C. Kerkering. 1983. "Using Computers to Enhance the Safety of Mining Operations." Paper presented at *First Conference on the Use of Computers in the Coal Industry*, August 1-3, 1983, Morgantown, W. Virginia. BN-SA-1687.

Daling, P. M. and C. A. Geffen. 1983. *Evaluations of System Safety Assessment Methods for Mining Industry*. Contract J0225005, prepared for the U.S. Bureau of Mines by Battelle, Pacific Northwest Laboratories, Richland, Washington.

Daling, P. M. and C. A. Geffen. 1983. *User's Manual of System Safety Assessment Methods for Mine Safety Officials*. Contract J0225005, prepared for the U.S. Bureau of Mines by Battelle, Pacific Northwest Laboratories, Richland, Washington.

Daling, P. M. and C. A. Geffen. 1981. *Safety Analysis of the Impactor Shaft Sinking System - Safety Manual*. Contract J0100002, prepared for the U.S. Bureau of Mines by Battelle, Pacific Northwest Laboratories, Richland, Washington.

Pelto, P. J., P. M. Daling, et al. 1982. *Analysis of LNG Peakshaving Facility Release Prevention Systems*. PNL-4153. Pacific Northwest Laboratory, Richland, Washington.

Radioactive and Hazardous Material Transportation

Daling, P. M. et al. 2003. Appendix H, "Traffic and Transportation," in *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Benton County, Washington.* DOE/EIS-0286F. U. S. Department of Energy, Richland Operations Office, Richland, Washington.

Daling, P.M., S.B. Ross, and B.M. Biwer, 1999. *Life-Cycle Cost and Risk Analysis of Alternative Configurations for Shipping Low-Level Radioactive Waste to the Nevada Test Site*. DOE/CH/CRE-6-1999. Prepared for the U.S. Department of Energy, Center for Risk Excellence, Chicago Operations Office, Argonne, Illinois.

Daling, P.M., S.B. Ross, and B.M. Biwer, 2000. "Assessment of Modal Options for Transporting Low-Level Radioactive Waste to the Nevada Test Site," presented at *Conference on Radiation Protection and Our National Priorities: Medicine, the Environment, and the Legacy*, September 17-21, Spokane, Washington.

P.R. Siebach, P.M. Daling, S.B. Ross, and B.M. Biwer, 2000. "Life-Cycle Evaluation of Alternative Configurations for Shipping Low-Level Radioactive Waste to the Nevada Test Site," presented at the *Third Dixie Lee Ray Memorial Symposium, Global Carbon Management and Sequestration Technologies, Life-Cycle Analysis*, August 29-31, 2000, Washington D.C.

Daling, P. M. et al. 1994. *Transportation System Risk Assessment for Shipment of W71 Rear Assembly Components in the Safe-Secure Trailer (U)*. Pacific Northwest Laboratory and Mason and Hanger, Silas Mason, Co., Inc. Amarillo, Texas (Secret Restricted Data).

Daling, P. M. et al. 1994. *Transportation System Risk Assessment for Shipment of W56 Subassemblies in the Safe-Secure Trailer (U)*. Pacific Northwest Laboratory and Mason and Hanger, Silas Mason, Co., Inc. Amarillo, Texas (Secret Restricted Data).

U.S. Nuclear Regulatory Commission. 2005. *Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site*. NUREG-1815. Office of Nuclear Reactor Regulation, Washington D.C.

U.S. Nuclear Regulatory Commission. 2004. *Draft Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site*. NUREG-1811. Office of Nuclear Reactor Regulation, Washington D.C.

U.S. Nuclear Regulatory Commission. 2001. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities - Supplement Dealing with Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1. Office of Nuclear Reactor Regulation, Washington D.C.

Daling, P. M. and M. S. Harris. 1994. *Transportation Impact Analysis for Shipment of Irradiated N-Reactor Fuel and Associated Materials*. PNL-10249. Pacific Northwest Laboratory, Richland, Washington.

U. S. Department of Energy. 1995. *Medical Isotope Production Project: Molybdenum-99 and Related Isotopes - Environmental Impact Statement*, Appendix B: Analysis of Transportation Impacts. DOE/EIS-0249-F. Washington D.C.

Ramsdell, J.V., P.M. Daling, et al. 2001. *Environmental Effects of Extending Fuel Burnup Above 60 GWd/MTU*. NUREG/CR-6703. Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. et al. 1991. *Transportation Plan, New Production Reactor at the Hanford Site*. WHC-EP-0340. Prepared for Westinghouse Hanford Co., Richland, Washington, by Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M., D. A. Seaver, M. S. Harris, J. C. Lavender. 1989. *The Impacts of Human Performance on the Risk of Spent Nuclear Fuel Transportation.* DRAFT REPORT. Pacific Northwest Laboratory, Richland, Washington.

U. S. Department of Energy. 1994. *Environmental Assessment, Return of Isotope Capsules to the Waste Encapsulation and Storage Facility, Hanford Site, Richland, Washington*. DOE/EA-0942. Washington D.C.

U. S. Department of Energy. 1994. *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement, Volume 1 Appendix A, Hanford Site Spent Nuclear Fuel Management Program*. DOE/EIS-0203-D. Washington D.C.

U. S. Department of Energy. 1996. *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington.* DOE/EIS-0245D and DOE/EIS-0245F. Richland, Washington.

U. S. Department of Energy. 1996. *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement.* DOE/EIS-0189. Richland, Washington.

U. S. Department of Energy. 1995. *Environmental Assessment for Characterization of Stored Defense Production Spent Nuclear Fuel and Associated Materials at the Hanford Site.* DOE/EA-1030. Richland, Washington.

Adcock, F.E. and E. F. Lombardi (compilers). 1989. *ATMX Railcar Containment System Safety Assessment*. RFE-8901. Rocky Flats Plant, Golden, Colorado.

J. R. Green and P. M. Daling. 1994. *Transportation Impact Analysis for the Shipment of Low Specific Activity Nitric Acid*. WHC-SD-TP-RPT-015, Rev. 0. Westinghouse Hanford Corp., Richland, Washington.

Daling, P. M., A. K. Stalker, M. S. Harris, and A. L. Franklin. 1988. *Environmental Assessment: Handling and Transportation of Isotopic Heat Sources*. DOE/EA-0358. Prepared for the U. S. Department of Energy, Richland, Washington.

U.S. Nuclear Regulatory Commission. 1987. Appendix D of *Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from the March 29, 1979 Accident at Three Mile Island Nuclear Station Unit 2*. NUREG-0683, Supplement 2. Washington D.C.

Daling, P. M. et al. 1987. "Analysis of Impacts for Transportation of Hanford Defense Wastes." Appendix I in *Final Environmental Impact Statement: Disposal of Hanford Defense High-level, Transuranic, and Tank Wastes*. DOE/EIS-0113. U.S. Department of Energy, Washington D.C.

Schneider, K. J., P. M. Daling, et al. 1987. *Analysis of Radiation Doses From Operation of Postulated Commercial Spent Fuel Transportation Systems*. DOE-CH/TPO-001. Prepared by Pacific Northwest Laboratory, Richland, Washington.

Daling, P.M. 1986. "An Assessment of the Spent Fuel Shipping Cask Handling Capabilities of Commercial Light Water Reactors". Presented at *Waste Management 1986.* March 4, 1986, Tucson, Arizona. PNL-SA-13395.

Daling, P. M., G. W. McNair, W. B. Andrews. 1985. "Considerations in the Selection of Transport Modes for Spent Nuclear Fuel Shipment." Paper presented at the *Spent Nuclear Fuel Transportation Seminar*, July 29-31, Chicago, Illinois. PNL-SA-13327.

Daling, P. M., G. J. Konzek, A. J. Lezberg, E. F. Votaw, M. I. Collingham. 1985. *Spent Nuclear Fuel Shipping Cask Handling Capabilities of Commercial Light Water Reactors.* PNL-5384, Pacific Northwest Laboratory, Richland, Washington.

Konzek, G. J., P. M. Daling. 1984. *Spent Fuel Shipping Cask Handling Capability Assessment of 27 Selected Light Water Reactors.* PNL-5236, Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. 1984. *Near-Term Commercial Spent Fuel Shipping Cask Requirements*. PNL-5284, Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. and R. L. Engel. 1983. *Analysis of Near-Term Spent Fuel Transportation Hardware Requirements and Transportation Costs*. PNL-4575, Pacific Northwest Laboratory, Richland, Washington

Daling, P. M. and R. L. Engel. 1983. "Shipping Cask Demand Associated with United States Government Storage of Commercial Spent Fuel." Paper presented at *7th International Symposium on Packaging and*

Transportation of Radioactive Materials (PATRAM-83), May 15-20, 1983, New Orleans, Louisiana. PNL-SA-10679.

Daling, P. M. and R. L. Engel. 1982. "Defense TRU Waste Transportation and Receiving Simulation." In *Proceedings of ANS Topical Meeting on Treatment and Handling of Radioactive Wastes*. April 19-22, 1982. Richland, Washington.

Radioactive Waste Management

Daling, P. M. 2003. *River Protection Project Integrated Risk Management Guide.* DOE/ORP-2002-07. U.S. Department of Energy, Office of River Protection, Richland, Washington.

Daling, P. M. 2003. *River Protection Project Critical Risk Management List*. Draft Report. U.S. Department of Energy, Office of River Protection, Richland, Washington.

Holton, L. K., P. M. Daling, et al. 2003. *Design Description Report for a Modular Treatment System to Remove Sr, Actinide, and Cs from the Savannah River Site Tank Wastes.* Draft Report for Publication. Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M., et al. 2002. *Environmental Assessment for the Actinide Chemistry and Repository Science Laboratory*. DOE/EA-1404. U. S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

Daling, P. M., et al. 2001. *Environmental Assessment Conducting Astrophysics and Other Basic Science Experiments at the WIPP Site*. DOE/EA-1304. U. S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

Daling, P. M., et al. 2001. *Supplement Analysis to the WIPP SEIS-II for Disposal of PCB-Commingled TRU Waste at WIPP*. DOE/EIS-0226-S-2. U. S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

Hesser, W. A., P. M. Daling, et al. 1995. *Development of a Risk-Based Approach to Hanford Site Cleanup*. PNL-10651. Pacific Northwest Laboratory, Richland, Washington.

Pelto, P. J., P. M. Daling, et al. 1998. *Analytical Approach for Estimating Releases of Spent Nuclear Fuel and High-Level Waste for the Yucca Mountain Environmental Impact Statement No-Action Alternative*. Battelle Pacific Northwest Division, Richland, Washington.

U.S. Department of Energy, 2000, *River Protection Project Mission Analysis Report*, DOE/ORP-2000-10 (Final Draft), Office of River Protection, Richland, Washington.

Meacham, J. E., P. M. Daling, et al. 1996. *Safety Criteria for the Organic Watch List Tanks at the Hanford Site*. WHC-SD-WM-SAR-033, Rev. 1. Westinghouse Hanford Co., Richland, Washington.

Daling, P. M. 1996. *Decision Document - Low-Level Waste Feed Staging Strategy*. WHC-SD-WM-TI-788. Prepared for Westinghouse Hanford Co., Richland, Washington.

R. W. Jacobson, P. M. Daling, et al. 1996. *Alternatives Generation and Analysis for Utilization Alternatives for the 244-A Double-Contained Receiver Tank (DCRT)*. WHC-SD-AGA-314-006. Westinghouse Hanford Co., Richland, Washington.

Galbraith, J. D., and P. M. Daling. 1997. *Decision Document: Phase I Intermediate Waste Feed Staging System Design Requirements*. WHC-SD-WM-TI-800, Rev. 0. Numatec Hanford Corp., Richland, Washington.

Daling, P. M. 1991 (DRAFT). *Technical Reference Manual for the System Engineering Dose Analysis Model (SEDAM)*. Pacific Northwest Laboratory, Richland, Washington.

Daling, P. M. et al. 1990. "A Literature-Based Preliminary Characterization of Risks in the Nuclear Waste Management System," in *Proceedings of the International Topical Meeting on High-Level Radioactive Waste Management*. April 8-12, 1990. Las Vegas, Nevada. Published by the American Nuclear Society, LaGrange Park, Illinois.

P. M. Daling et al. 1989. *Preliminary Characterization of Risks in the Nuclear Waste Management System Based on Information in the Literature*. PNL-6099. Pacific Northwest Laboratory, Richland, Washington.

P. M. Daling and J. C. Lavender. 1989. *Preliminary Identification and Screening of Accident Sequences for a Nuclear Waste Repository* DRAFT. Pacific Northwest Laboratory, Richland, Washington.

Hampel, G., Daling, P., Dinsmore, S., Gramatte, W., and Nikodem, H. 1989. *Safety Aspects of an Audit of the Belgian Nuclear Waste Facilities at SCK/CEN-Waste, Mol, and Belgoprocess, Dessel*. BF-V-67.144-1. Battelle- Institute E.V., Frankfort Am Main.

Daling, P. M., L. K. Mudge, J. C. Lavender, and K. S. Murthy. 1988. *Accident Frequencies for Operation of Four Aging-Waste Storage Tanks in the AQ Tank Farm, Hanford Site, Washington*. DRAFT REPORT. Pacific Northwest Laboratory, Richland, Washington.

Schneider, K.J., P. J. Pelto, P. M. Daling, J. C. Lavender, and B. A. Fecht. 1988. "Radiation Dose Impacts From Variations in the Transportation-Related Activities in a System For Management of Spent Nuclear Fuel," in *Nuclear Technology* July 1988, Vol 88 No.1. American Nuclear Society, LaGrange Park, Illinois.

Schneider, K.J., P. J. Pelto, P. M. Daling, J. C. Lavender, and B. A. Fecht. 1986. *Preliminary Assessment of Radiological Doses in Alternative Waste Management Systems Without an MRS Facility*. PNL-5872, Pacific Northwest Laboratory, Richland, Washington.

Daling, P.M., R.W. McKee, G.B. Mellinger, J.D. Ludwick. 1986. *Repository Disposal Requirements for Commercial Transuranic Wastes*. PNL-5597, Pacific Northwest Laboratory, Richland, Washington.

Luksic, A. T., P. M. Daling, et al. 1986. *Spent Fuel Disassembly Hardware and Other Non-fuel Bearing Components: Characterization, Disposal Cost Estimates, and Proposed Repository Acceptance Requirements*. PNL-6046, Pacific Northwest Laboratory, Richland, Washington.

McKee, R. W. P. M. Daling, et al. 1986. *Waste Management System Alternatives for Treatment of Wastes From Spent Fuel Reprocessing*. PNL-6005. Pacific Northwest Laboratory, Richland, Washington.

Bloomster, C. H., P. M. Daling, et al. 1985. *Analysis of the Costs of Cesium-137 Recovery From West Valley High-Level Wastes for Use in Making Glass Canisters for the Federal Republic of Germany*. Draft Final Report. Pacific Northwest Laboratory, Richland, Washington.

McKee, R. W., L. L. Clark, P. M. Daling, J. F. Nesbitt, J. L. Swanson. March 1984. "Economic Analysis of Waste Management Alternatives for Reprocessing Wastes." Presented at *Waste Management '84.* March 11-15, Tucson, Arizona.

Daling, P. M., R. W. McKee, L. E. Wiles, and W. L. Partain. 1983. "An Economic Comparison of Crystalline Ceramic and Borosilicate Glass Waste Forms for High-Level Waste Disposal." Paper presented at *Second International Symposium on Ceramics in Nuclear Waste Management*, April 24-27, 1983, Chicago, Illinois.

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Environmental Technology Division

Education

M.S.	Health Physics, Georgia Institute of Technology	1980
B.S.	Biology, with an option in Health Physics, Virginia Polytechnic Institute and State University	1978

Experience

Ms. Hickey has worked at Battelle for twenty five years as a project manager and technical group manager. Her areas of health physics expertise include emergency preparedness for nuclear and hazardous material facilities, environmental impact evaluation, decontamination and decommissioning, operational health physics, air monitoring instrumentation and environmental monitoring.

Emergency Preparedness/Management. Ms. Hickey has worked in the area of emergency preparedness since 1979. She was a member of National Council on Radiation Protection and Measurements Scientific Committee 46-14, "Radiation Protection Issues Related to Terrorist Activities that Result in the Dispersal of Radioactive Material", and co-authored the NCRP report, which was published in late 2001. Currently she is supporting a major project for the Department of Homeland Security, where her primary focus is assessing the status of comprehensive emergency preparedness for the Seattle Washington region. She is also assisting King County in enhancing its emergency response plan to respond to an event resulting in radiological materials in the County sewer system.

Ms. Hickey has been involved in the U.S. Nuclear Regulatory Commission and U. S Department of Energy Emergency Management programs, has observed and assessed over 70 NRC/FEMA evaluated exercises at 50 sites in the U.S., and has conducted in-depth emergency preparedness appraisals at many sites. She was involved in the development of the NRC guidance for post-Three Mile Island requirements (NUREG-0654, NUREG-0696, NUREG-0814, NUREG-0737) and was involved in the development of the NRC's comprehensive emergency preparedness appraisal program and subsequent inspection programs. These programs not only involved on-site emergency response, but also in-depth review of local emergency planning and coordination.

While at Battelle, Ms. Hickey served as the Technical Leader for NRC's multi-million dollar Emergency Preparedness program, which had over 20 staff and a like number of contractors. She managed a variety of projects that supported the overall program. Her primary areas of expertise are in emergency dose assessment, environmental monitoring, emergency instrumentation, in-plant surveys, contamination and exposure control and protective actions. Ms. Hickey has performed similar activities for DOE in emergency management guidance development, exercise observation and program evaluation.

Ms. Hickey has been involved in the development and conduct of many training courses and workshops, both for NRC and DOE, in the areas of emergency exercise observation and evaluation, scenario development, exercise conduct, emergency plan reviews and overall emergency preparedness and management. She has also been involved in the development and conduct of exercises, for both NRC and DOE, for fixed facilities and for hazardous material transportation.

Ms. Hickey currently manages an emergency preparedness project for DOE. This project provides technical support in development of regulatory guidance, emergency program enhancement and evaluation, exercise observation, and scenario development for exercises for all types of hazardous material facilities.

Environmental. Ms. Hickey has supported NRC in the preparation of numerous environmental impact statements, including Supplemental Environmental Impact Statements for the relicenseing of commercial nuclear reactors as well as environmental impact statements for early site permits for new nuclear power reactors. These reviews include site audits and discussions with state, local and federal representatives associated with the action. She provided technical support to the NRC on updating and revising a standard review plan for the review of environmental protection issues related to nuclear power plant licensing and is currently the task lead for the Environmental review of one of the first three early site permit applications.

Instrumentation and Air Sampling. Ms. Hickey managed a joint NRC and DOE project that developed the ANSI standards for instrument performance and testing. Ms. Hickey was the manager and lead author for an NRC project that developed NUREG-1400, *Air Sampling in the Workplace*, which is a guide for operational health physicists for developing or improving air sampling programs at NRC licensed facilities to support the implementation of the revised 10 CFR Part 20 requirements. In addition, Ms. Hickey provided technical assistance to NRC licensed fuel fabrication facilities in adjusting Derived Air Concentrations to meet the requirements in 10 CFR 20. She has been involved in performing qualitative air flow studies (i.e., smoke testing) at selected Hanford facilities as a means of evaluating the adequacy of air sampler and monitor locations.

Program Evaluation and Assessments. Since joining Battelle, Ms. Hickey has managed and been involved in numerous projects related to the development and conduct of appraisals, program assessments and inspections. She was project manager and technical group leader supporting a major NRC project that developed and conducted intensive appraisals and inspections in support of emergency preparedness following the accident at Three Mile Island. She has conducted more than 70 appraisals, audits and inspections at NRC licensed and DOE facilities. In many cases she was the team leader for a PNL team including health physicists, nuclear engineers, human factors experts, computer scientists and safety and security experts. In addition to her NRC emergency preparedness support, she was a major contributor to a project for DOE HQ that

developed assessment procedures for evaluating the oversight of DOE in the areas of health physics, industrial hygiene and emergency management.

Decommissioning. Ms. Hickey was the task leader for the development of the revision to NUREG-0586, *Generic Environmental Impact Statement of Decommissioning of Nuclear Facilities*. Ms. Hickey also assisted in the development of regulatory guidance for the NRC to provide to licensees of nuclear power plants that are planning to or have permanently ceased power operations. Ms. Hickey provided technical support to the NRC during its review of the Trojan Nuclear Plant's Decommissioning Plan.

Operational Health Physics. Ms. Hickey has provided technical support to DOE and NRC in health physics and industrial hygiene. Ms. Hickey has been involved in the preparation of guidance to support the DOE Orders with respect to 10 CFR 835 and the Radiological Control Manual (RCM), and NRC guidance to support 10 CFR 20 requirements. She has conducted radiological audits and appraisals at various Hanford facilities. She has contributed to the preparation of radiological sections of Safety Analysis Reports (SARs). Ms. Hickey was the project manager and primary contributor to the draft Pantex Radiological Control Manual and has been involved in projects at Pantex related to the implementation of the RCM and 10 CFR 835. Ms. Hickey has been a technical contributor to projects, for both NRC and DOE, related to residual radioactivity and contamination surveys at nuclear power plants and other nuclear facilities.

From February through August 1985, Ms. Hickey was a Senior Radiological Engineer for Hydro Nuclear Services, Inc. (HNS). She was project manager for a six person team providing technical assistance to Georgia Power Company (GPC) in the areas of health physics, chemistry and emergency preparedness. In addition, Ms. Hickey was project manager for the development and conduct of the Hatch Nuclear Plant 1985 emergency preparedness exercise.

In 1979, Ms. Hickey (Eckert) was an environmental engineer (co-op) for the Nuclear Regulatory Commission, Region II and provided support to NRC inspectors during nuclear reactor inspections and during the Three Mile Island accident investigation.

Professional Affiliations

National Council on Radiation Protection and Measurements Scientific Committee 46-14, "Radiation Protection Issues Related to Terrorist Activities that Result in the Dispersal of Radioactive Material"

Member of the Board of Directors for the Health Physics Society 2004-2007

Member of the Health Physics Finance Committee 2004-2007

President of the Columbia Chapter Health Physics Society 1994-95.

Member of the national Health Physics Society since 1981.

HPSSC Working Group "Methods for evaluating radiation protection requirements for handling radioactive material."

HPSSC Working Group “Air Sampling”

Member and Chair of the Health Physics Society Summer School Committee 1986 - 1989 and member 1992 - 1999.

Member of the Columbia Chapter Health Physics Society (CCHPS) since 1980. President-elect for 1993-94.

Member of the CCHPS Public Information and Publicity Committee 1983 - 1984.

CCHPS Assistant Newsletter Editor 1984 - 1986.

CCHPS Newsletter Editor 1987 - 1989.

CCHPS Member of the Program Committee 1990 – 1995

Publications and Presentations

E.E. Hickey and JW Poston Sr. 2002, “An Overview of NCRP Report No. 138 on Terrorist Activities”. Presented at the 8th Topical Meeting on Emergency Preparedness and Response, Washington DC, November 2002.

National Council on Radiation Protection and Measurements. 2001. *Management of Terrorist Events Involving Radioactive Material*. NCRP Report No. 138. National Council on Radiation Protection and Measurements, Bethesda, Maryland.

E.E. Hickey. 1999, “The Care and Feeding of Your Emergency Program: Enhancing Effectiveness” Presented at the 7th Topical Meeting on Emergency Preparedness and Response, Santa Fe New Mexico, September 1999.

E.E. Hickey, R Harty, L.H. Thonus, M.T. Masnik, “A Look at the Postulated Accidents for Permanently Shutdown Reactors” Presented at the 7th Topical Meeting on Emergency Preparedness and Response, Santa Fe New Mexico, September 1999.

T.A. Kevern, E.E. Hickey, “Emergency Event Classification with Imperfect Information” Presented at the 7th Topical Meeting on Emergency Preparedness and Response, Santa Fe New Mexico, September 1999.

Strom, D.J., R. Harty, E.E. Hickey, R.L. Kathren, J.B. Martin, and M.S. Peffers. 1998. *Collective Dose as a Performance Measure for Occupational Radiation Protection Programs: Issues and Recommendations*. PNL-11934. Pacific Northwest National Laboratory. Richland, Washington.

G.J. Vargo, J.S. Durham, E.E. Hickey, P.S. Stansbury, G.R. Cicotte, "Review of ALARA Plan for

Activities at the 105K-East Fuel Storage Basin," PNL-9826 Rev.2, Septemeber 1994.

E. E. Hickey, G. A. Stoetzel and S. A. McGuire, "Air Sampling In The Workplace - A Document To Support the Revised Regulatory Guide 8.25," PNL-SA-19011A presented at the Annual Health Physics Society, July 1991.

E. E. Hickey, G. A. Stoetzel, D. J. Strom, G. R. Cicotte, C. M. Wiblin, S. A. McGuire, "Air Sampling in the Workplace," NUREG-1400, U.S. Nuclear Regulatory Commission, September 1993.

Eva Eckert Hickey, "Optimization of Emergency Preparedness Planning", PNL -7380. Prepared for the Department of Energy

Eva Eckert Hickey, "Optimization of Emergency Preparedness Planning", PNL-SA-17740A, presented at the Annual Health Physics Society meeting in June 1990.

J. G. Stephen, L. G. Faust, J. M. Selby, E. E. Hickey, "Population and Worker Doses at DOE Sites and Commercial Generating Stations", PNL-SA-16698S, presented at the American Nuclear Society meeting in June 1989.

W. E. Kennedy, and E. E.Hickey, "Estimated Collective Exposures from U.S. Department of Energy Operations", PNL-SA-16617, presented at the American Nuclear Society meeting in June 1989.

E. E. Hickey, and W. E. Kennedy, "A Review of Environmental Radiological Data from U.S. DOE Nuclear Sites", PNL-SA-16516A, presented at the Health Physics Society meeting in June 1989.

J. M. Selby, E. E. Hickey, K. L. Swinth, "Radiation Protection Instrumentation - A Comparison of U. S. International Standards", PNL-SA-16265, presented at the Health Physics Society Midyear Topical Meeting on Instrumentation in December 1988.

J. M. Selby, E. E. Hickey, K. L. Swinth, "Comparison of U. S. and International Standard for Radiation Protection Instrumentation", PNL-SA-14747, presented at the 7th International Radiological Protection Agency Congress.

E. E. Hickey, V. L. Magnus, "Reducing Exposure to ALARA When Refueling DOE's N Reactor", PNL-SA-13644A, presented at the Annual meeting of the Health Physics Society, June 1986.

J. L. Kenoyer, E. E. Hickey, B. J. Greenspan, K. L. Swinth, "Performance Evaluation of Radioactive Aerosol Monitors Used in the Workplace”, given at 1987 AIHA Meeting in Montreal, May 1988.

E. E. Hickey, A. E. Desrosiers, T. J. McKenna, "The Relationship Between Emergency Action Levels and Protective Action Decision Making", PNL-SA-11066, presented an the Annual

Health Physics Society Meeting in June 1983.

M. P. Moeller, G. F. Martin, J. D. Jamison, and E. E. Hickey, "A New Method for Presenting Offsite Radiological Monitoring Team Data at Annual Emergency Preparedness Exercises", presented at the American Nuclear Society Topical Meeting in September 1986.

G. F. Martin, E. E. Hickey, G. A. Stoetzel, E. F. Bates, "The Emergency Preparedness Evaluation Program for Research and Test Reactors", PNL-SA-11969, presented at the Annual American Nuclear Society Meeting in June 1984.

G. F. Martin, E. E. Hickey, M. P. Moeller, F. Kantor, "Radiological Data For Scenarios Used During Annual Exercises At Nuclear Generating Facilities", PNL-SA-12906, presented at the Annual Health Physics Society Meeting in July 1985.

G. F. Martin, E. E. Hickey, M. P. Moeller, D. H. Schultz, G. W. Bethke, "Report to the NRC on Guidance for Preparing Scenarios for Emergency Preparedness Exercises at Nuclear Generating Stations", PNL-6931, NUREG CR-3365.

E. E. Hickey, G. A. Stoetzel, J. B. Martin, F. G. Pagano, "Emergency Exercises: Commonly Observed Problems", given at the American Nuclear Society Winter Meeting in November 1983.

E. E. Hickey, J. R. Lewis, M. Lindell, "Criteria for Evaluation of emergency Response Facilities", PNL-3929, NUREG 0814 (draft for comment).

C. D. Corbit, E. E. Hickey, J. G. Myers, "Production Assurance Program Radiological Engineering Studies Status Report", UNI-3615.

E. E. Hickey, R. O. Zimmerman, and G. V. DeLisle, "A Passive Automated Personnel Accountability System for Reactor Emergency Preparedness", PNL-SA-15527A, presented at the Annual Meeting of the Health Physics Society, July 1988 and presented at the ANS Topical Meeting in September 1988.

Significant Contributions to Government Agency Publications for which the Preparing Agency is Author

U.S. Nuclear Regulatory Commission. 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 10 NUREG-1437 Regarding St. Lucie Nuclear Power Plant Units 1 and 2.* NUREG-1437 Supplement 10. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 8 NUREG-1437 Regarding North Anna Power Station Units 1 and 2.* NUREG-1437 Supplement 8. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 7 NUREG-1437 Regarding Surry Power Station Units 1 and 2.* NUREG-1437 Supplement 7. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1 Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586, Supplement 1. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5 NUREG-1437 Regarding Turkey Point Nuclear Plant Units 3 and 4.* NUREG-1437 Supplement 5. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 2001. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 3 NUREG-1437 Regarding Arkansas Nuclear One, Unit 1.* NUREG-1437 Supplement 3. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 2 NUREG-1437 Regarding Oconee Nuclear Station.* NUREG-1437 Supplement 2. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 1 NUREG-1437 Regarding Calvert Cliffs Nuclear Power Plant.* NUREG-1437 Supplement 1. U.S. Nuclear Regulatory Commission, Washington, DC.

U.S. Department of Energy. 1997. *Emergency Management Guide, Program Elements Volume IV.* DOE G 151.1-1. U.S. Department of Energy, Washington, D.C.

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M.S. Resource Economics, Oregon State University
Ph.D. Resource Economics (integrated minor in environmental engineering, statistics and biological sciences), Oregon State University

Experience

Summary: 30 years-professional experience on a variety of environmental problems working for the Federal government and private sector. This professional experience includes: Preparing environmental impact statements (EISs) for the Nuclear Regulatory Commission (NRC) and U.S. Department of Energy (USDOE); improving management and reporting mechanisms at EPA, Super Fund's Office of Program Management; managing Battelle's participation in an Office of Civilian Waste Radioactive Management privatization RFP; performing cost and finance analysis in support of TWRS privatization; conducting analytical assessments in support of Hanford programs; performing cost/benefit analysis in support of USEPA national air pollution standards; quantifying the environmental costs of water pollution impacts and restoration (e.g., Clean Lakes Program); developing market incentives to meet environmental goals or to mitigate/compensate for environmental degradation (e.g., water effluent trading, wetlands mitigation banking); developing innovative approaches to nonpoint source (NPS) best management practices (BMP) (e.g., using cottonwood hybrids to take up nutrients from NPS and selectively harvesting the trees for fiber production); evaluating innovative technologies to clean up NPS pollution sources inexpensively (e.g., dairy lagoons and irrigation return flow drains in Washington's Yakima River Valley). Several of the environmental innovations worked on while at EPA are now included in national environmental acts or as official Agency policy. Experience with most environmental legislation including the Clean Air and Water Acts, Toxics Substances Control Act, and Superfund.

Professional Experience

Project Manager, 1994 to present, Environmental Policy and Risk Management, Environmental Technology Division, Battelle-Pacific Northwest Division, Richland, WA

The purpose of the Environmental Technology Division is to develop, demonstrate and implement innovative science and technology solutions to environmental problems. Using a systems approach, the Division works closely with clients (USDOE, other government and industry clients) to identify impacts, risks, costs, policy and institutional aspects of decision options. The purpose of the Environmental Policy and Risk Management Group is to evaluate the policy, regulatory, risk and economic impacts/effects of such decision options.

As a Program Manager, responsible for developing and managing programs in applied economics and the policy/regulatory/institutional aspects of environmental management. Interacted with management and staff across the Laboratory to build programs and market capabilities. Responsibilities include discerning future business and programmatic directions and, working with others, taking steps to position -- in advance -- PNNL in these areas. Ensuring project/program staffing, product quality and financial management are also part of the responsibilities of the position. Work with staff and Laboratory managers to define and implement programs for the Laboratory designed to build and extend core staff capabilities into promising market areas.

Was instrumental in commercializing a Battelle technology known as InStreem^{TM}, which has many applications in cleaning up water pollution in situ. Initiated a demonstration of the technology at a dairy waste lagoon in the Yakima Valley. The dairy has 2700 milking head. With private firm, developed an agreement to evaluate independently the technology during the yearlong demonstration. The firm, after evaluating InStreem^{TM}, decided to enter into a reseller's agreement for exclusive rights to sell InStreem^{TM} to dairies in the Pacific Northwest, California and the Carolinas. Recognized by Battelle during the 2001 Recognition and Rewards banquet as a Key Contributor

to commercializing the technology.

Recently completed the aesthetics, scenic resources and environmental justice sections for USDOE's Hanford Site (Washington State) draft solid waste environmental impact statement. For the NRC, was lead author for the socioeconomic, environmental justice and environmental impacts of alternatives to license renewal of the Edwin I. Hatch Nuclear Plant, Units 1 and 2, located in Georgia. Lead for completing the socioeconomic and environmental justices (EJ) sections for the Turkey Point Units 3 and 4 nuclear power plants located in south Miami-Dade County, Florida, and St. Lucie Units 1 and 2 located in St. Lucie County, Florida. Lead for preparing the socioeconomic, environmental justice and environmental impacts of alternatives sections for re-licensing of North Anna (Virginia) and Catawaba (South Carolina) nuclear power plants. Also, provided consulting assistance to team members working on re-licensing of other nuclear power plants for NRC.

Completed a project leading a PNNL team in assisting USDOE's Office of Civilian Radioactive Waste and Management (OCRWM) in developing a competitive (privatized) procurement. The procurement's purpose is to rely on the competitive forces and power of the marketplace to accept, transport and deliver spent nuclear fuel (SNF) from private nuclear power plants to a Federal Facility for storage and disposal. For the procurement to succeed, and be financed by the private sector financial markets, OCRWM must establish realistic, well-defined and equitable allocations of the financial risks. The PNNL team advised OCRWM in how to "balance" these risks to protect the Government's interest while ensuring, to the maximum extent possible, the broadest participation in response to the procurement by qualified contractors. Helped OCRWM in defining special business terms and conditions as they apply to issues such as termination for convenience, idle capacity and facility, minimum order quantities, economic price adjustments to account for inflation and uncontrollable circumstances (e.g., change in laws or regulations) that may occur over an extended contract performance period.

Initiated (with others) a cross-Laboratory exploration of water resources management as a new program for the Laboratory, focusing initially on the Yakima River of Washington State. These efforts have now been subsumed under a larger Laboratory initiative focusing on agricultural and natural resource management in the Pacific Northwest. Water use management for a junior water right irrigation district in the Yakima Valley (Washington) was evaluated during the 1994 drought in Washington State. Initiated discussions on water effluent trading in the Yakima River basin (currently on hold over funding issues). A grant, awarded by Washington's Department of Ecology through the South Yakima Conservation District (SYCD), enabled the development of a computerized economic model evaluating the costs of establishing poplar trees (cottonwood hybrids) vis-à-vis other agricultural crops. In August 1999, Ecology awarded another grant to evaluate a Battelle technology (InStreem^{TM}) designed to clean up polluted irrigation return flow drains in the Yakima Basin.

Other selected accomplishments include: Conducting economic, financial and risk assessment analysis for USDOE's Hanford Site tank waste privatization project; leading the initial contract acquisition phase of the U.S. Department of Energy's privatization program on Hanford tank waste rededication; collecting and analyzing stakeholder and public involvement issues for Hanford's Baseline Environmental Management Reports (BEMRs) on future site clean up levels and associated costs; developing (with others) performance measures for Hanford site cleanup.

Department Manager, 1992 to 1994, Technology Planning Analysis Department, Technology Policy Analysis Center, Battelle-Pacific Northwest Division, Richland, WA

The Technology Policy Analysis Department (TPAD) was one of four departments in the Technology Planning Analysis Center (TPAC). The Center's expertise was in technology management -- the science and art of helping technology effectively meet national needs. Important program areas for the Center included global climate change, environmental restoration and waste management, energy policy and national security and defense. TPAD worked with government agencies and industry to integrate technology into society. The Department did this by helping clients in overcoming potential regulatory, institutional, organizational and economic barriers to implementation. Seven technical groups encompassing economics, environmental policy and planning, technology integration, organizational effectiveness and utility economics and analysis comprised the Department. It had 90 plus

professional staff and a programmatic budget of approximately $30 million for FY-94.

As Department Manager, was responsible for the line side of a matrixed organization. As such, was responsible for strategic, senior hires; building the technical foundation and capability of the staff; managing and ensuring that they produced top quality products on time and within budget for our supporting clients. Supported business area leaders in monitoring the quality of the Departments inputs to large projects spanning several Laboratory centers or departments was also a responsibility. Was ultimately responsible for all financial, facilities and equipment management for the Department and ensuring that Center standards and performance measures for human resource activities (including hiring, performance review, etc.) were met. With the other department and Center managers, helped define and implement the Center's vision through appropriate actions within the Department, including developing a Department vision consistent with the Centers. Served as acting Center Manager during the Manager's absence.

Other selected accomplishments include: Managed the business volume of the Department, growing it approximately 15 percent per year. Grew the professional FTEs of the Department from 75 to 96 FTE (January 1994). Formed and staffed a seventh technical group in the Department, focusing on environmental planning issues surrounding the Hanford site. Strategically identified several new business opportunities in the environmental and energy arena; identified integrated resources planning as a potential business area in the environmental arena. Other activities include provided staff to conduct risk assessment and management of hazardous waste site restoration; supported regional resource economic valuation/tradeoffs and sustainable development. With others, hired seven very senior, nationally known staff for key placement within the Department or Center to affect movement into strategic business areas. Served on the Center's Technical Advisory Group charged with strengthening the technical foundation of the Center. Chaired the Center's Risk Technical Advisory Group charged with deciding the Center's future course in risk assessment and management and the hiring of senior technical talent. Co-project director on a cross-Battelle project, sponsored by the U.S. Coast Guard, focusing on oil spills and its pollution prevention enforcement program. Major accomplishments of the Coast Guard project included the development of a national pollution-ticketing program and a national environmental award to be presented to industries exhibiting exemplary behavior in environmental protection.

Project Manager, 1991 to 1992, Technology Planning Analysis Center, Battelle-Pacific Northwest Division, Washington, D.C.

Program manager in the Technology Planning Analysis Center (TPAC) composed of three departments and 200 plus employees. The mission of the Center was to guide the development and application of technology to address national needs. Key projects areas for the Center included global climate change, environmental restoration and waste management and energy policy, among others.

As program manager in TPAC's Washington, D.C. office, provided leadership in environmental policy analysis and research to the Center and Laboratory. Worked with cross-laboratory Department and Center managers to conceptualize, develop and explore the market potential for a risk management program at the Laboratory. The purpose was to help develop a framework for integrating the technical areas required to support risk management within the Laboratory and to provide insight into future research needs and directions. Project manager on a cross-Battelle project, sponsored by the U.S. Coast Guard, focusing on oil spills and its pollution prevention enforcement program. Provided consultative services to staff within the Center on a number of environmental and energy projects.

Deputy Director, 1989 - 1991, Office of Program Management, Office of Emergency and Remedial Response, U. S. Environmental Protection Agency, Washington, D. C.

Deputy Director of a staff office comprised of four branches (60 people) with diverse crosscutting responsibilities, including: policy, strategic planning, communications and budgeting; resources, information, publication docket, and contract management and oversight; general office administration. As Deputy Director of the Office, had full functional responsibilities of the Director during her absence. Served as the policy advisor to the Director;

coordinated and managed quick turnaround projects within the Office of Program Management (OPM) and across the Office of Emergency and Remedial Response (OERR) -- i.e., Superfund; managed the Federal Management Financial Integrity Act (FMFIA) across OPM and OERR. Helped develop the analytical processes for measuring the progress and environmental benefits of the Superfund program. Was responsible for overseeing the information and data management activities and support systems for OERR and producing management reports from the systems. Assisted the Director, OPM in the internal management of the Office; oversaw personnel management issues; ensured Office work plans were updated and reflected current project status; monitored controlled correspondence and ensured preparation of timely, high quality responses; and worked with staff on individual career development plans.

A selected list of accomplishments includes: Developed (with others) the framework for measuring the environmental benefits of the Superfund program consistent with the Agency's increased emphasis on risk reduction; provided leadership in assessing contractor competition and means of increasing competition as part of Superfund's Long Term Contracting Study. Managed the OERR tracking/reporting system for the Superfund Management Review (SMR) study, or "90 day study," which helped set the future course of the Superfund program. Established a process enabling quick turnaround reporting to OERR and the Office of Solid Waste and Emergency Response (OSWER) on the status of 150+ projects under the SMR. Wrote bimonthly management reports reporting OERR SMR accomplishments that set the standard for future reporting processes by emphasizing the individual SMR's project's accomplishments and overall programmatic importance; managed the production of OERR's annual FMFIA report.

Chief, Water, Toxics and Pesticide & Senior Economist/Expert Consultant, 1982 - 1989, Regulatory Innovations Staff, Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency, Washington, D. C.

The Regulatory Innovations Staff's ((RIS), formerly known as the Regulatory Reform Staff) basic mission was to develop innovative policy approaches that encourage industry, government and private individuals to take positive action to achieve beneficial environmental results. Such action could involve stronger efforts to comply with environmental standards or voluntary initiatives outside the regulatory arena.

The Water, Toxics and Pesticides Section (WTPS) was responsible for all RIS innovations concerned with water, toxics and pesticides pollution, and identified and helped resolve critical issues hindering the implementation of regulatory innovations in these media. As Chief, WTPS (1984 - 1989), managed all WTPS's functions including supervisory and program/project management and conducted and/or managed studies concerned with regulatory impact and legal, environmental and economic issues associated with analysis and implementation of innovations. As Expert Consultant and later Senior Economist (1982 -1984), had complete technical responsibility for the Staff's economic studies. Conducted regulatory impact, legal, environmental and economic analysis in support of new reform initiatives and innovations. Served the Agency as a national expert in the use of economic/market/regulatory incentives to achieve pollution control within the existing regulatory framework.

In both positions, provided directly, or through staff, counsel to senior Agency management and staff (e.g., Administrator, Deputy Administrator and Assistant Administrators); wrote policy statements; represented RIS and the Office of Policy, Planning and Evaluation (OPPE) on inter- and intra-Agency task forces or work groups; conducted special studies upon request; and presented and published technical papers. A partial list of accomplishments includes completed the first approved point/nonpoint trading of water pollutant loads in the Nation at Dillon Reservoir in Colorado; initiated the reform concept of Wetlands Mitigation Banking; served as the Assistant Administrator's (OPPE) senior staff representative on the Administrator's Inter-Agency Task Force on Nonpoint Source Water Pollution; provided analytical support to the Agency's Air Emissions Trading Policy; gave technical support to Agency program offices in developing fees to fund programs (e.g., marine/estuarine and wetlands programs) while accomplishing other policy/environmental goals; and furnished economic analytical support to the Administrator's Agency Task Force on Fees.

Note that many of the environmental innovations initiated and/or analytically supported while at OPPE are now

included within national environmental acts, are in pending legislation, or are official EPA policy.

Senior Associate and Manager, 1981 - 1982, Rogers, Golden and Halpern, Reston, Virginia

As senior associate and manager of Rogers, Golden, and Halpern's (RG&H) Washington, D.C. area office, was responsible for providing economic expertise and developing clients for the firm in Washington D.C., Virginia, and Maryland. Contributed technical expertise in the areas of energy-environmental and cost-risk-benefit analysis, economic impact assessment and analysis, and evaluation of policy and regulatory issues.

Specific expertise extended to regulatory impact, policy, and economic issues concerned with air and water quality, energy-environmental tradeoffs and impacts, resource recovery, solid and hazardous wastes, human health, and energy development. Wrote several proposals with other consulting firms in response to government Request for Funding Proposals (RFPs), enabling RG&H to reach the last phases of "best and final" negotiation on 80% of the proposals written.

Staff Economist and Group Leader, 1979 - 1981, Systems Analysis and Assessment Division, Los Alamos National Laboratory, Los Alamos, New Mexico

As Staff Economist, responsible for planning, implementing and conducting or managing programs on energy/environmental issues for the Federal Government. Served as consultant and provided assistance to the public and private sectors. Invited participant to international and national symposia and workshops, and project leader for the Four Corners Study funded by the National Commission on Air Quality (NCAQ) (four institutions, 55 professional staff involved). The NCAQ study was produced under the auspices of the Clean Air Act (CAA) 1977. The project results were used in a report to Congress for CAA reauthorization.

As Group Leader, managed a multi-disciplinary group of 17 professional and support staff (economists, engineers and ecologists) conducting research and assessment of energy/environmental problems in the West. The Group focused on policy questions, social and economic issues, biological and ecological constraints, health and safety issues and visibility and local air quality problems associated with energy development.

Economics Program Coordinator and Operations Research Analyst, 1975 - 1979, Corvallis Environmental Research Laboratory, Environmental Protection Agency, Corvallis, Oregon

Developed, initiated and technically managed a multi disciplinary environmental (air, water, human health) economic program. Program emphasis was on developing economic techniques for use by EPA in evaluating regulatory programs. Responsible for EPA's national, secondary air pollution standards economic benefits program. Project research was conducted in-house, extramurally and by establishing agreements with other Federal agencies. Five professionals were associated with the program. Served as a technical resource on environmental-energy questions, and provided assistance on policy matters concerned with these questions to Federal and State governments and the private sector. In addition, continued programs developed in D. C. as described immediately below.

Operations Research Analyst, 1973 - 1975, Office of Research and Development, Environmental Protection Agency, Washington, D. C.

Conducted research and policy analysis on environmental pollution. Had Agency responsibility for preparing a report to Congress on the economic and legal aspects of waste oil recycling. Served on several Agency working groups concerned with waste automotive oil, pesticides and solid waste. Charged by the Office of Research and Development to review and work with the Office of Solid Waste Programs to ensure the quality of economics studies produced by that Office. Established EPA's air pollution health economic research program in support of the Agency's primary air quality standards.

Operations Research Analyst, 1972 - 1973, Office of Solid Waste Management Programs, Environmental Protection Agency, Washington, D. C.

Assisted in writing rules and regulations, and conducted economic impact analysis, for Section 19 (A) of the Federal Environmental Pesticide Control Act. Completed an environmental impact appraisal for the regulations. Worked on developing an interagency agreement with US Department of Agriculture for disposing of "Agent Orange" in an environmentally safe manner. Served on several Agency working groups and inter-Agency task forces concerned with agricultural and silvicultural waste disposal.

Professional Recognition

2004 Key Contributor Award, Presented by Battelle at the Recognition and Rewards Banquet, April 2004.

Outstanding performance award for the St. Lucie nuclear power plant re-licensing EIS. 2003.

Outstanding performance award for the Hanford Solid Waste EIS. 2003.

Outstanding performance award for the Chernobyl New Safe Confinement Project. 2003.

2001 Key Contributor Award, Presented by Battelle at the Recognition and Rewards Banquet, April 2002.

Outstanding Performance for extraordinary perseverance in experimental deployment of the InStreem^{TM} technology for Agricultural Water Treatment. October 2001.

Outstanding Performance Award for support to the U. S. Nuclear Regulatory Commission's Environmental Review Team. August 2001.

PNNL Outstanding Performance Award for efforts and leadership in addressing local and regional water quality through the Benton County Water Conservancy Board, November 1999.

PNNL Outstanding Team Performance Award, Waste Disposal Integration Team, March 1999.

USDOE, Office of Civilian Waste Radioactive Management (OCRWM) award from the Acting Director, OCRWM for outstanding contribution to the OCRWM's RFP on privatizing transportation of spent nuclear fuel -- award presented in Washington, D. C. by OCRWM's Acting Director, 1998.

PNNL Outstanding Team Performance Award, Tank Waste Rededication Contract Support Team, 1997

PNNL Outstanding Team Performance Award, Employee Time Reporting, 1995.

EPA Bronze Medals for exceptional public service, 1984, 1987 and 1991.

Certificate of award for noteworthy contribution and special achievement in the Environmental Protection Agency, 1975

Research Fellow (Predoctoral Air Pollution Special Fellowship, sponsored by the National Air Pollution Control Administration and Department of Health, Education and Welfare), Oregon State University, 1968 - 1971

Publications

Jaksch, John A. (with others). Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management. Office of Civilian Radioactive Waste Management. Draft RFP Number

DE-RP01-98RW00320. September 1998.

Jaksch, J. A. (with Paul Kearns, Mark Weimar, Barry Robinson, Marvin Laster, Lawrence Scully, William Lemeshewsky, Rob Gilbert and Neil Brown.) "The Use of Innovative Contract Terms and Conditions to Achieve a Balanced Risk Allocation for Privatization Initiatives." Waste Management 98 Conference Paper. Tucson, Arizona

Jaksch, John A. (with Michael J. Scott and Judith Vesper). "An Agricultural Economic Model for Environmental Preservation." Paper presented at the Thirty-Second Annual Pacific Northwest Regional Economic Conference – Conflict and Collaboration: how Government, Business, and Academia shape the Pacific Northwest Economy. Olympia, Washington. May 7 – 9, 1998.

Jaksch, J. A. (with M. J. Scott., O.H. Paananen, T.E. Redgate, and C.A. Ulibarri). 1998. Evidence of Cost Growth Under Cost-Plus and Fixed-Price Contracting. PNNL-11984. Pacific Northwest National Laboratory, Richland, Washington.

Jaksch, J. A. (with Kenneth Picha, Jeff Yocum, Ben Gannon, Mark Weimar and Kim DeTienne. June 1998. "Comparison of Cost Growth and Waste Remediation Costs at Savannah River and West Valley." In Theoretical, Methodological and Empirical Approaches to Cost Savings: A Compendium, Mark R. Weimar Editor. Pacific Northwest National Laboratory, PNNL-11987, September 1998.

Scott, M. J., L.W. Vail, J.A. Jaksch, K.K. Anderson, C.O. Stöckle, and R.G. Evans. 1999. "Early Warning of ENSO Events for Regional Agriculture." PNNL-SA-31245. Presented at the NOAA Economics and Human Dimensions Investigators Meeting, Tucson, Arizona, April 26, 1999. Pacific Northwest National Laboratory, Richland, Washington.

Scott, M.J., J. Jaksch, K. Anderson, and C. Stöckle. 1999. "Value of Improved Climate Forecasting for Irrigated Agriculture." Presented at the 1999 Spring Meeting, American Geophysical Union, June 4, 1999, Boston, Massachusetts. PNNL-SA-31245. Pacific Northwest National Laboratory, Richland, WA.

Scott, Michael J., Lance W. Vail, John A. Jaksch, Kevin K. Anderson, and Claudio O. Stöckle. 2000. "Climate Forecasts and Water for Regional Irrigated Agriculture." PNWD-SA-5050. Presented at the Pacific Northwest Regional Economic Conference, April 27-29, 2000. Bellingham, Washington.

Scott, Michael J., Lance W. Vail, John A. Jaksch, and Kevin K. Anderson. 2000.
"Considerations for Management of Irrigation Water with Climate Variability." PNWD-SA-5069. Presented at the American Geophysical Union Spring 2000 Meeting, May 30-June 2, 2000, Washington, D.C.

Jaksch, John A. (with Robert L. Kerr and Steven J. Anderson). Crosscutting Analysis of Trading Programs – Case Studies in Air, Water, and Wetlands Mitigation Systems. *Nine Case Studies Appendices A – I.* Learning from Innovations in Environmental Protection. Research Paper Number 5. National Academy of Public Administration, Washington, D.C. June 2000...

Jaksch, John A. Mark Weimar, Joan Young, William Taylor, Peter Furlong, Roger Feldman, and Raymond DiPrinzio. 2001. "Privatization: The Use of Risk, Economic, and Finance Models to Ensure Its Success." Journal of Project Finance. 2001. Volume 6, No. 4. Winter edition. pp. 37 to 47.

STATEMENT OF PROFESSIONAL QUALIFICATIONS OF THOMAS J. KENYON OCTOBER 2006

CURRENT POSITION

Senior Environmental Project Manager
New Reactor Environmental Projects Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

Since joining the U.S. Nuclear Regulatory Commission in 1980, Mr. Kenyon has been a Project Manager for a diverse set of licensing and operating reactor projects. His professional experience includes the coordination of licensing reviews for operating facilities licensed after 1980, design certification reviews of advanced reactor designs, environmental license renewal reviews of operating reactors, and environmental early site permit reviews. These reviews require him to be acquainted with a broad spectrum of technical and scientific areas related to the construction and operation of nuclear power facilities.

EDUCATION

B.S. University of Michigan, nuclear engineering 1976

CURRENT PROJECT

Senior Environmental Project Manager for the Exelon Early Site Permit (ESP) Application Review (February 2003 - Present). Mr. Kenyon is responsible for the overall coordination of the National Environmental Policy Act (NEPA) review of the Exelon ESP application. In general, his responsibilities included coordinating the development of and issuing requests for additional information, the Draft Environmental Impact Statement (DEIS), and the Final Environmental Impact Statement. In this capacity, he coordinated the reviews of NRR technical staff and their contractors who independently evaluated the environmental impacts of constructing and operating a nuclear power facility. His duties included conducting public meetings to provide information to the public and to solicit comments on the scope of the review and the DEIS. In addition, he coordinated the disposition of public comments and interfaced with local, State, Tribal, and Federal officials regarding the NEPA review.

PAST PROJECTS

1. **Senior Environmental Project Manager for License Renewal Application Reviews (June 1999 - May 2003).** Mr. Kenyon was responsible for the overall coordination of the National Environmental Policy Act (NEPA) review of license renewal applications. In general, his responsibilities included coordinating the development of and issuing requests for additional information, the Draft Supplemental Environmental Impact Statement (DSEIS), and the Final Supplemental Environmental Impact Statement for several projects. In this capacity, he coordinated the reviews of NRR technical staff and their contractors who independently evaluated the environmental impacts of operating a

nuclear power facility for 20 years beyond the date of the original operating license. His duties included conducting public meetings to provide information to the public and to solicit comments on the scope of the review and the DSEIS. In addition, he coordinated the disposition of public comments and interfaced with local, State, Tribal, and Federal officials regarding the NEPA review. He has performed this function for the following commercial nuclear plants: Calvert Cliffs, Units 1 and 2; Arkansas Nuclear One, Units 1 and 2; and Ft. Calhoun, Unit 1.

2. **Project Manager for Future Application Readiness Assessment (March 2001 - January 2002).** Mr. Kenyon served as a Project Manager for preliminary early site permit activities while developing input for the *Future Licensing and Inspection Readiness Assessment* report, dated August 2001. His responsibilities included developing schedule and resource input for future reactor applications, coordinating input with regional and NRR staff, participating in management briefings, and interfacing with Commission staff, ACRS, stakeholders (industry representatives, public interest groups, interested members of the public), and the press on future licensing efforts.

3. **Senior Environmental Project Manager on Extended Fuel Burnup Review (January 2000 - February 2001).** Mr. Kenyon coordinated a review within NRC offices of the environmental effects of extending fuel burnup above 60 GWd/MTU and resolved key issues regarding the acceptability of extended burnup fuels.

4. **Senior Project Manager for Decommissioning Reviews (December 1998 - June 1999).** Mr. Kenyon was involved with developing rulemaking, regulatory analysis, and regulatory guides to enable or enhance the decommissioning process.

5. **Senior Project Manager for the AP600 Design Certification Review (August 1989 - December 1998).** Mr. Kenyon was responsible for the overall coordination of a licensability review and design certification review of the Westinghouse AP600 reactor design. In this capacity, he coordinated the reviews of NRR technical staff and their contractors who independently evaluated the adequacy of the design of the AP600. In general, his responsibilities included coordinating the development of and issuing requests for additional information, the Draft Safety Evaluation Report, and the Final Safety Evaluation Report. He met with the Advisory Committee on Reactor Safeguards to discuss the results of the staff's review and address questions raised by the Committee. During this time, he developed several Commission papers on policy, technical, and scheduler matters.

6. **Senior Project Manager on the EPRI ALWR Requirements Document Review (July 1989 - August 1992).** Mr. Kenyon was responsible for the overall coordination of the review of the Electric Power Research Institute (EPRI) Advanced Light Water Reactor (ALWR) Requirements Document (evolutionary and passive). In this capacity, he coordinated the reviews of NRR and RES technical staff and their contractors who independently evaluated the Requirements Document for both the evolutionary and passive ALWR designs. In general, his responsibilities included coordinating the development of and issuing requests for additional information, the Draft Safety Evaluation Reports, and the Final Safety Evaluation Reports. He met with the Advisory Committee on Reactor Safeguards to discuss the results of the staff's review and

address questions raised by the Committee. During this time, he developed several Commission papers on policy, technical, and scheduler matters.

7. **Technical Assistant (March 1989 - July 1989).** Mr. Kenyon served as Technical Assistant to the Deputy Division Director responsible for technical safety matters relating to currently operating nuclear power plants. In this capacity, he was responsible for developing policy matters for the review and approval of new designs, including standard designs, to be used in future applications for construction and operation of a nuclear power plant. He served as a liaison with special committees, ad hoc groups, senior representatives of public utilities, reactor applicants, and others, in work involved in anticipating and identifying major nuclear safety problems and issues, and in the analysis and resolution of reactor technology problems.

8. **Project Manager for the RESAR SP/90 Preliminary Design Approval Review (April 1987 - March 1989).** Mr. Kenyon was responsible for the overall coordination of the review of the Westinghouse RESAR SP/90 preliminary design approval application. In this capacity, he coordinated the reviews of NRR technical staff and their contractors who independently evaluated the adequacy of the design of the RESAR SP/90. In general, his responsibilities included coordinating the development of and issuing requests for additional information, the Draft Safety Evaluation Report, and the Final Safety Evaluation Report. He met with the Advisory Committee on Reactor Safeguards to discuss the results of the staff's review and address questions raised by the Committee. During this time, he developed several Commission papers on policy, technical, and scheduler matters.

9. **Project Manager for the Watts Bar Near-Term Operating License Review (January 1981 - April 1987).** Mr. Kenyon was responsible for the overall coordination of the review of the Watts Bar operating license review. In this capacity, he coordinated the reviews of NRR technical staff and their contractors who independently evaluated the adequacy of the Watts Bar application for an operating license. In general, his responsibilities included coordinating the development of and issuing requests for additional information, the Draft Safety Evaluation Report, the Final Safety Evaluation Report, and the operating license. He met with the Advisory Committee on Reactor Safeguards to discuss the results of the staff's review and address questions raised by the Committee.

10. **Project Manager for the Sequoyah Near-Term Operating License Review (June 1980 - September 1981).** Mr. Kenyon was responsible for assisting the Senior Licensing Project Manager during the licensing of the Sequoyah Nuclear Plant. In this capacity, he helped coordinate the reviews of NRR technical staff and their contractors who independently evaluated the adequacy of the Sequoyah application for an operating license. In general, his responsibilities included coordinating the development of and issuing licensing supplements to the Final Safety Evaluation Report.

11. **Nuclear Engineer, Radiological Control Division, Norfolk Naval Shipyard (August 1976 - June 1980).** Mr. Kenyon was responsible for the preparation and review of procedures involving repair and/or replacement of reactor plant equipment and associated work for ships in the U.S. nuclear Navy. In addition, he wrote procedures

directing the installation, operation, testing and removal of equipment for liquid waste processing, high-efficiency particulate (HEPA) filter installation and testing, and environmental monitoring. He was also the primary designer for radiological contamination containment bags at the shipyard.

11/05

RESUME

JAMES V. RAMSDELL, JR.

Staff Scientist
Applied Atmospheric Science
FUNDAMENTAL SCIENCE DIRECTORATE
Battelle, Pacific Northwest Laboratories

EDUCATION

B.S.	General Sciences, Oregon State University, Corvallis, Oregon	1961
M.S.	Meteorology, Oregon State University	1962
	Graduate Study, Atmospheric Sciences, University of Washington, and Joint Center for Graduate Study, Richland, Washington	1968-1976

EXPERIENCE

Mr. Ramsdell has been a member of the Battelle staff since 1967. He has worked as an individual contributor, as a member of intra- and interdisciplinary research teams, and as a project leader for intra- and interdisciplinary research teams. His areas of expertise include: research planning and organization, dispersion modeling, and applied atmospheric boundary layer description. He has reviewed manuscripts for the editors of: *Science*, *Journal of Climate and Applied Meteorology*, *Atmospheric Environment*, *Health Physics*, *Nuclear Technology*, *Solar Energy*, and the *Journal of Energy*, and he has been on review teams for the U.S. Department of Energy, the U.S. Nuclear Regulatory Commission, the U.S. Environmental Protection Agency, and the National Research Council. In addition, he has made presentations to National Academy of Sciences Review Panels and to the U.S. Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards.

- Review of Early Site Permit Applications. Mr. Ramsdell is the manager of a project assisting the U.S. Nuclear Regulatory Commission in reviewing applications and preparing environmental impact statements for Early Site Permits (ESP) for new nuclear power plants. These permits are authorized in a part of the NRC's regulations that has not been tested. Three ESP applications were submitted in the fall of 2003. Draft EISs for public comment were completed in late 2004 and early 2005. More than 1,000 sets of comments were received on each the first two EISs. Final EISs will be completed in 2006.

- Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Mr. Ramsdell is the manager of a project that is performing the 10-year update of the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437. This document lists and evaluates environmental issues related to renewal of operating licenses for nuclear power plants. Where possible, the document reaches generic conclusions on the environmental impacts. These conclusions, along with the conclusions reached in site specific supplements, form the bases for staff recommendations to the Nuclear Regulatory Commission on the environmental acceptability of renewing nuclear power plant operating licenses.

- Environmental Impact Statements for Nuclear Power Plant License Renewal. Mr. Ramsdell is the manager of a project that is preparing site specific supplements to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437. Seventeen of these supplements have been completed, and work is underway on supplements for several more nuclear plants. These supplements contain site-specific reviews of environmental issues related to renewal of nuclear power plant operating licenses for which generic conclusions could not be reached in NUREG-1437. In addition, the supplements address issues that were not considered previously, or for which there is new information.

- Tornado Climatology. In April 2005, Mr. Ramsdell completed an update of the 1986 climatology of tornadoes in the contiguous United States that was prepared for the U.S. Nuclear Regulatory Commission. The climatology, which covers more than 46,000 tornado segments observed between 1950 and August 2003, estimates tornado strike probabilities for 1°, 2°, and 4° latitude and longitude boxes. Design wind speeds with probabilities of being exceeded of 10^{-5}, 10^{-6}, and 10^{-7} per year are also estimated for these boxes. Design wind speeds are also estimated for three regions of the country at the three probability levels.

- Generic Environmental Impact Statements for Decommissioning Nuclear Power Plants. Mr. Ramsdell was part of a PNNL team that reviewed the environmental impacts of decommissioning nuclear power reactors. Based on the results review, the team prepared an update to NRC's *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586.

- Dispersion Modeling. Mr. Ramsdell is a lead scientist in development of applied atmospheric dispersion models at Battelle. He specializes in development of models for atypical applications. He has developed and validated models for dispersion under low wind speed conditions and for dispersion in the vicinity of buildings. He developed a set of models to evaluate potential consequences of a release of material associated with a potential collapse of the shelter covering the Chernobyl Unit 4 reactor. He developed and validated the dispersion model used in Hanford Environmental Dose Reconstruction (HEDR) Project, which examined the consequences of the release of ^{131}I from the Hanford Site, and he developed the atmospheric dispersion model that is part of the U.S. Nuclear Regulatory

Commission's Radiological Assessment System for Consequence AnaLysis (RASCAL).

Each of these models represented an advance in the state of the art of applied dispersion modeling. The models of dispersion in low wind speed conditions and in the vicinity of buildings are being considered by the U.S. Nuclear Commission for use as standard models for regulatory purposes. The Chernobyl model included multiple plumes with variation of particle sizes and densities as a function of distance within a Gaussian model framework. The RATCHET code, developed for the Centers for Disease Control and Prevention as part of the HEDR Project, explicitly treats uncertainty in the input data to produce a range of estimates of concentration in the environment that are consistent with the available data and has become the standard dispersion model for use in Dose Reconstruction Studies for DOE sites. RASCAL is used by the U.S. Nuclear Regulatory Commission and others to estimate source terms, atmospheric dispersion, and doses during emergencies at nuclear power plants. Version 3.0 of RASCAL includes a model for UF_6 releases at fuel cycle facilities. This new model combines a dense-gas dispersion model with a thermodynamic model of the reaction of UF_6 and water.

Mr. Ramsdell also assisted in upgrading the atmospheric dispersion models in the GENII code; upgrading the atmospheric dispersion models used for assessing nuclear power plant control room habitability; and development of a Monte Carlo model to estimate release rates from environmental monitoring data.

- Environmental Impacts of Extending Reactor Fuel Burnup Above 60 GWd/MTU. Mr. Ramsdell led a study to evaluate the environmental impacts of increasing the burnup of reactor fuel (increasing the energy extracted from the fuel). This study included evaluation of changes in the radionuclide inventory in the fuel and releases of radionuclides to the gaps in fuel rods as burnup increases, changes in impacts associated with the front-end of the nuclear fuel cycle and normal reactor operations, changes in potential impacts of postulated reactor accidents, changes in impacts of transportation of spent nuclear fuel, and the economic effects of increasing fuel burnup.

- Environmental Review Plans. Mr. Ramsdell managed a project to review and update the U.S. Nuclear Regulatory Commission's *Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants*. These environmental standard review plans (ESRPs) had not been updated since they were written in the late 1970s. The updated document, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, NUREG-1555, was published for public comment in October 1997. The final document was published in March 2000. A supplement to the ESRPs, dealing specifically with environmental reviews associated with nuclear power plant license renewal, was also published in March 2000.

  As part of this project, PNNL assisted the NRC staff in preparation of a supplement to its *Final Environmental Statement Related to the Operation of the Watts Bar Nuclear Plant, Units 1 and 2*. Another portion of the project involved assisting the NRC staff in

identification of the measures necessary to ensure that activities in and around nuclear power plants comply with and further the purposes of the Endangered Species Act.

- Emergency Response Planning. Mr. Ramsdell has been an NRC observer for nuclear power plant emergency exercises and a member of emergency response facility appraisal teams. He has been involved in several studies related to emergency response planning. He led a team that reviewed criteria used by NRC to evaluate dispersion models for emergency response applications. The review covered the areas of: non-buoyant releases from buildings and building vents, elevated release diffusion rates, and identification of fumigation conditions and fumigation climatology.

- Extreme Wind Analyses. Mr. Ramsdell was lead scientist in the development of techniques for estimating extreme winds for use by the NRC in probabilistic risk assessments. This work has led to new techniques for adjusting extreme winds to a standard measurement height and computation of tornado strike probabilities. Published products include a tornado climatology for the contiguous United States and a report that describes a procedure for estimating extreme winds using readily available wind data.

- Environmental Impact Statements. Mr. Ramsdell has contributed to both the preparation of environmental impact statements for Battelle's industrial customers and the review of statements submitted to the Nuclear Regulatory Commission. In 1974 he wrote a detailed review of the instrumentation for meteorological monitoring programs at nuclear power plant sites. Mr. Ramsdell is involved in the continuing evaluation of the environmental impacts of the development of the Department of Energy's Hanford Area.

- Wind-Induced Bridge Motions. The Federal Highway Administration sponsored a Battelle study of wind-induced motions of the cable-stayed bridge between Pasco and Kennewick, Washington. Mr. Ramsdell was responsible for the installation and maintenance of wind instruments and the data collection and analysis for this study. Data analysis included description of winds associated with bridge motion in terms of threshold speeds, critical approach angles for the onset of motion and gust spectra. Coherence of the horizontal and vertical wind components along the span was also examined.

- Wind Energy Conversion. Battelle provided technical and management support for the Wind Characteristics Program Element of the Department of Energy's Wind Energy Program. From Battelle's initial involvement in February 1976 through June 1977, Mr. Ramsdell was the Principal Investigator of the Program Element. In that capacity, he coordinated the wind characteristics research funded through the Program Elements. He participated in the program as a scientist and contract monitor. He has organized and conducted several wind characteristics workshops.

- Wind Measurement. As a part of the research for the Department of Energy's Wind Energy Program, Mr. Ramsdell pursued various aspects of wind measurement. He has helped develop a short course on selection of sites for the installation of wind energy conversion systems; he has written chapters on wind instrumentation and measurement for several books and reports; he has conducted a wind tunnel evaluation of inexpensive anemometer systems, and he has examined strategies for efficient use of a limited number of instruments for estimating the wind recourse at a large number of locations.

- Wind Speed Time Series Simulation. The economic evaluation of large wind energy conversion systems requires the matching of available wind energy with energy demand on an hour-by-hour basis. Mr. Ramsdell developed a Monte Carlo simulation model to generate wind speed time series that have the correct statistical characteristics. The model is capable of duplicating known seasonal and diurnal variations in the mean wind, as well as the hour-to-hour correlation between wind speed observations.

- Nuclear Energy Center Evaluations. In the middle and late 1970s, Mr. Ramsdell was involved in the evaluation of the energy center concept. He concentrated on the environmental impact of the energy releases from energy center cooling systems, and has considered both wet and dry cooling systems. He also examined the meteorological factors associated with multiple-reactor contamination following an accidental release of radioactive material in a nuclear energy center. In 1976, Mr. Ramsdell was the project leader for an interdisciplinary study of the postulated weather modification effects of large energy releases. That study examined the potential ecological and economic effects that might result from the weather modification as well as estimated the magnitude of the modification.

- V/STOL Air Craft Operations in an Urban Area. From 1972 through 1974, Mr. Ramsdell was principal investigator for an extensive state-of-the-art review and analytical and experimental study of meteorological problems associated with terminal area operations of Vertical/Short Take-Off and Landing (V/STOL) aircraft. The first phase of this study included identification of those meteorological parameters that significantly affect V/STOL operation. In the second phase of the study, an extensive data collection program was completed that included the measurements of both temporal and spatial features of models of turbulence below an altitude of 200 feet. Analysis of these data led to models of turbulence in an urban area.

- Atmospheric Diffusion and Transport. Mr. Ramsdell has been involved in atmospheric transport and diffusion studies since 1967. His experience includes collection and analysis of diffusion data from Hanford, Vandenberg Air Force Base in California, and Plowshare nuclear cratering experiments at the Nevada Test Site. He published the diffusion data collected at Hanford between 1959 and 1974.

PROFESSIONAL AFFILIATIONS

American Meteorological Society
Health Physics Society

SUSAN L. SOUTHARD

Research Scientist II / Scientific Diver
Pacific Northwest National Laboratory
Battelle Marine Sciences Laboratory
Sequim, Washington

EDUCATION

B.S., Zoology, Miami University, 1992

EXPERIENCE

Ms. Susan Southard is a Research Scientist at the Battelle Marine Sciences Laboratory in Sequim, Washington. Since joining the Sequim Lab in 1999, she has performed fish population surveys, studied shading effects of overwater structures on nearshore marine habitats, evaluated juvenile salmonid upstream passage through culverts, monitored eelgrass transplant and reference sites, and conducted ecotoxicological bioassays. Ms. Southard is a scientific diver for the laboratory, performing habitat and population estimates and assessments, habitat restoration, sediment sampling, equipment deployment, and underwater photography and videography. She also provides support to diverse projects through technical writing, field sampling, and data processing and analysis. Ms. Southard joined Battelle in 1994, working out of the Pacific Northwest National Laboratory in Richland, Washington. While in Richland, her research focused on diverse salmonid issues in the Columbia, Snake, and Yakima River Basins. She evaluated fish screening facilities in the Yakima River Basin, supported hydroacoustic fish passage research efforts at Snake and Columbia River hydroelectric projects, studied the effects of gas supersaturated water on salmonids, contributed to preparation of environmental impact statements, and conducted teacher and student workshops on numerous aspects of aquatic ecology, including the study of benthic macroinvertebrates. Selected experiences are given below.

- Upstream Migration of Juvenile Salmon through a Culvert Test Bed (2003 to present) – Ms. Southard helped develop standardized protocols for evaluating passage success of juvenile salmon in a a full-scale physical model of a culvert system. Experiments in the experimental test bed measure hydraulic conditions (mean velocity, turbulence, and water depth) associated with various culvert designs under various slopes and flow regimes and then relate these measures to repeatable, quantitative measures of fish passage.

- Fish Predation Study at Washington State Ferry Terminals (2002) – Ms. Southard is part of a team investigating predation of juvenile salmonids by piscivorous fish. The objective of the study is to determine if predators aggregate under large overwater structures and if there is any difference in predation rates between ferry terminals and control sites.

- Light Under Docks (2000-2001) – Ms. Southard investigated means of supplying additional light under overwater structures, such as ferry terminals, for the primary purpose of mitigating loss of juvenile salmon habitat, such as eelgrass. Ms. Southard reviewed current literature and measured light passing through several off-the-shelf products such as solar tubes, deck prisms, grating, and glass blocks. The results are being used by design engineers to incorporate these light-enhancing products where they will have the greatest benefit.

- Monitoring Eelgrass Restoration Sites in Puget Sound (1999 to Present) – Ms. Southard conducts quantitative and qualitative evaluations of eelgrass restoration for mitigation purposes near several Department of Transportation ferry terminals that are undergoing construction in Puget Sound.

- Ecotoxicological Bioassays (1999 to Present) – Representative toxicology projects include conducting bioassays to evaluate open-water dredge disposal sites in Puget Sound, chronic and acute toxicity test methods for *Leptocheirus plumulosus*, and whole effluent toxicity (WET) bioassays. Animals tested include amphipods,

echinoderms, bivalves, and fish.

- Environmental Impact Statements (1994 to Present) - Ms. Southard has made significant contributions to the aquatic and terrestrial sections of environmental impact statements, assessments, and other NEPA documents written primarily for the Nuclear Regulatory Commission and the Department of Energy.

- Environmental Education (1989 to Present) - Ms. Southard is involved in a number of laboratory-sponsored education outreach programs funded by the Department of Energy and the National Science Foundation. She conducts summer aquatic ecology workshops for Washington State elementary school teachers to give them hands-on field and laboratory experiences that they can share with students. She has volunteered as a speaker in classrooms, conducted student field trips, judged science fairs, and mentored high school and college interns and faculty at the laboratory. She was a recipient of the 1997 Fitzner/Eberhardt award, a Laboratory Director's Award for outstanding contributions to science and engineering education.

- Environmental Standard Review Plan (1994-2000) - Ms. Southard prepared aquatic and terrestrial guidelines for Nuclear Regulatory Commission staff to use when conducting environmental reviews of applications related to nuclear power plants. This entailed updating a 1978 document to reflect changes in environmental legislation and regulations, executive orders, and judicial decisions. It also expanded the scope of the original document beyond construction permit applications to include other situations such as early site permits, combined construction and operating licenses, and license renewal.

- Hydroacoustic Evaluations of Fish Behavior (1994 to 1999) - Ms. Southard was Deputy Assistant Manager and Lead Data Processor for the fixed hydroacoustic project conducted during spring and summer 1999 at Bonneville Dam on the Lower Columbia River. Data were collected using split-beam and multibeam sonar devices that record three-dimensional paths of fish approaching the hydroelectric dam. Ms. Southard supervised several data technicians, analyzed and reported the findings. She gained previous experience overseeing data technicians and interpreting split- and multibeam data collected at Lower Granite Dam between 1996 and 1998 and by helping to resolve questions about fish populations in Alaskan lakes using side scan sonar in 1994.

- Fish Screen Facility Studies (1996-1999) - Ms. Southard evaluated fish screen facilities in the Yakima River Basin, Washington. She led a field team that recorded underwater video and flow measurements to ensure that 20 screen facilities met the operating criteria set by the National Marine Fisheries Service to protect juvenile salmonids. These studies were conducted for the Bonneville Power Administration as part of its salmonid enhancement efforts in the Columbia River Basin.

- Fish Culture (1994-1998) - Ms. Southard provided daily care for fish at the Pacific Northwest Laboratory's aquatic testing facility. This aquatic laboratory is used to conduct in vitro tests to answer questions difficult to resolve in the field. The Ecology Group maintains a population of rainbow trout year-round, as well as a variety of cold- and warm-water fishes and invertebrate organisms.

- Gas Bubble Research (1997) - Ms. Southard evaluated the use of ultrasound as a tool to observe gas bubbles in fish. Excess spillage at dams can result in gas supersaturation. As a result, bubbles can form in fish tissues and body fluids causing a condition termed gas bubble trauma (GBT). Bubbles forming in the heart and in arteries leading to the gills can result in asphyxiation. Real-time ultrasonic imaging equipment was modified to determine if the technology could be used to detect bubbles in the internal organs and fins of juvenile salmonids.

- Water Sampling, Species Surveys and Wetland Wildlife Monitoring (1990-1991) – Ms. Southard assisted in the management of 900 acres of marsh surrounding a nuclear power station. Responsibilities included conducting weekly species surveys, monitoring water levels and water temperatures, daily plankton sampling and subsequent analysis of the samples for species distribution under a microscope.

PROFESSIONAL AFFILIATIONS

American Fisheries Society

PUBLICATIONS (Note: Ms. Southard was formerly Ms. Sargeant and Ms. Blanton)

Journal Articles

Thom RM, GD Williams, AB Borde, JA Southard, SL Sargeant, DL Woodruff, JC Laufle, and S Glasoe. 2005. "Adaptively Addressing Uncertainty in Estuarine and Near Coastal Restoration Projects." *Journal of Coastal Research. JCR* 40(Special Issue):94-108.

Diefenderfer HL, SL Sargeant, RM Thom, AB Borde, PF Gayaldo, CA Curtis, BL Court, DM Pierce, and DS Robison. 2004. "Demonstration Dock Designed to Benefit Eelgrass Habitat Restoration (Washington)." Ecological Restoration 22(2):140-141.

Thom RM, AB Borde, S Rumrill, DL Woodruff, GD Williams, JA Southard, and SL Sargeant. 2003. "Factors Influencing Spatial and Annual Variability in Eelgrass (*Zostera marina* L.) Meadows in Willapa Bay, Washington, and Coos Bay, Oregon, Estuaries." *Estuaries* 26(4B):1117-1129.

Thom RM, SL Sargeant, P Stoltz, JA Southard, GD Williams, and AB Borde. *Submitted*. "Light Criteria for Growth and Survival of Eelgrass (Zostera marina L.) in Pacific Northwest (USA) Estuaries ." PNWD-SA-6070. *Marine Environmental Research.*

Ward, JA, HL Diefenderfer, AD Skillman, and SL Blanton. 2002. "The Use and Utility of Early Life-stage Toxicity Tests in Characterizing Contaminated Sediment." PNWD-SA-5599. Invited presentation at the Association for Environmental Health and Sciences, Twelfth Annual West Coast Conference on Contaminated Soils, Sediments, and Water, March 18, 2002, San Diego, California. Published in *Soil and Sediment Contamination: An International Journal,* Vol. 11(3), May 2002.

Geist, D.R., C.S. Abernethy, S.L. Blanton, and V.I. Cullinan. 1999. The use of electromyogram telemetry to estimate energy expenditure of adult fall chinook salmon. *Transactions of the American Fisheries Society*, 129:126-135.

Books/Book Chapters

Johnson RL, Simmons M, Simmons CS and Blanton SL. 2001. "A New Multibeam Sonar Technique for Evaluating Fine-Scale Fish Behavior Near Hydroelectric Dam Guidance Structures." PNNL-SA-34097. In *Behavioral Technologies for Fish Guidance*, American Fisheries Society Symposium, 2001, vol. 26, no. 2001, ed. C. Coutant, pp.161-170. Amer. Fisheries Society, Bethesda, MD.

Symposia / Proceedings

Thom RM, AB Borde, JA Southard, and SS Southard. 2006. "Climate-related factors of temperature and sea level affect eelgrass in the Pacific Northwest ." Abstract submitted to Pacific Estuarine Research Society 2006 Meeting, Friday Harbor, WA. PNWD-SA-7263.

Thom RM, AB Borde, JA Southard, SS Southard, GD Williams, LK O'Rourke, and LF Hibler. 2005. "Climate-related factors of temperature, sea level, and circulation affect eelgrass in the Pacific Northwest ." Presented by Ronald M. Thom (Invited Speaker) at 18th Biennial Conference of the Estuarine Research Foundation, Norfolk, VA on October 17, 2005. PNNL-SA-46987.

Thom RM, AB Borde, JA Southard, SS Southard, GD Williams, and LF Hibler. 2005. "Climate-related factors of temperature, sea level, and circulation affect eelgrass in the Pacific Northwest ." Presented by Ronald M. Thom (Invited Speaker) at Climate & Fisheries: Impacts, Uncertainty and Responses of Ecosystems and Communities, Victoria, BC, Canada on October 27, 2005. PNNL-SA-46343, Pacific Northwest National Laboratory, Richland, WA.

Thom RM, LK O'Rourke, SL Sargeant, and AB Borde. 2005. "Will Global Warming Impact Eelgrass in the Pacific Northwest?" Presented by Ronald M. Thom (Invited Speaker) at 2005 Puget Sound Georgia Basin Research Conference, Seattle, WA on March 29, 2005.

Pearson WH, MC Miller, KL Sobocinski, GD Williams, GE Johnson, JA Southard, SL Sargeant, GR Ploskey, and JR Skalski. 2004. "Lower Columbia River Stranding Study FY04 Progress." PNNL-SA-4345. Presented by Walter H. Pearson at the 2004 Annual Review of the Anadromous Fish Evaluation Program, Portland, OR on November 18, 2004.

Pearson WH, JR Skalski, MC Miller, KL Sobocinski, GD Williams, GE Johnson, JA Southard, SL Sargeant, and GR Ploskey. 2004. "Lower Columbia River Stranding Study: FY04 Progress Report." PNNL-SA-42891, Pacific Northwest National Laboratory, Richland, WA. [Unpublished]

Pearson WH, KL Sobocinski, MC Miller, GD Williams, GE Johnson, JA Southard, SL Sargeant, GR Ploskey, and JR Skalski. 2004. "Lower Columbia River Stranding Studies." PNNL-SA-43305. Presented by Walter H. Pearson at the 2004 Annual Review of the Anadromous Fish Evaluation Program, Portland, OR on November 18, 2004.

Sargeant SL, LF Hibler, LM Miller, W Hansen, RM Thom, AB Borde, and HL Diefenderfer. 2004. "Putting It All Together: A Shade Model that Predicts Overwater Structure Impacts on Seagrass." PNWD-SA-6326. Presented by Susan L. Sargeant, Lyle F. Hibler, and Lee M. Miller at 2nd National Conference on Coastal and Estuarine Habitat Restoration, Seattle, WA on September 13, 2004.

Thom RM, and SL Sargeant. 2004. "Review of Nearshore Ecosystem Assessment Methods for Nearshore Restoration Planning in Puget Sound." PNWD-SA-6453. Presented by Ronald M. Thom (Invited Speaker) at Pacific Estuarine Research Society 27th Annual Meeting, Port Townsend, WA on May 17, 2004. Also presented at the 2nd National Conference on Coastal and Estuarine Habitat Restoration, September 12-15, 2004, Seattle, Washington.

Diefenderfer HL, SL Sargeant, RM Thom, AB Borde, PF Gayaldo, CA Curtis, BL Court, DM Pierce, and DS Robison. 2003. "Dock Design to Facilitate the Restoration of Eelgrass in Port Townsend Bay, Washington." In Proceedings of the 15th Annual Conference of the Society for Ecological Restoration International, November 19-22, 2003, Austin, Texas. Also presented at the Port Townsend Marine Science Center Eelgrass Forum, Port Townsend, WA, on April 9, 2004. PNWD-SA-6035, Battelle—Pacific Northwest Division, Richland, WA.

Sargeant SL, RM Thom, HL Diefenderfer, AB Borde, and JA Southard. 2003. "Evaluation of Methods to Increase Light under Large Overwater Structures." PNNL-SA-37320. Project funded by the Washington State Department of Transportation; presented at 2003 Georgia Basin/Puget Sound Research Conference, Vancouver, BC, March 31 - April 3, 2003.

Southard JA, SL Sargeant, LK O'Rourke, GD Williams, HL Diefenderfer, and ML Blanton. 2003. "Battelle's Scientific Dive Program." PNWD-SA-5943, Battelle—Pacific Northwest Division, Sequim, Washington.

Southard JA, GD Williams, SL Sargeant, HL Diefenderfer, and ML Blanton. 2003. "Using Advanced Scientific Diving Technologies to Assess the Underwater Environment." PNNL-SA-37344. Presented at 2003 Georgia Basin/Puget Sound Research Conference, Vancouver, BC, March 31 - April 3, 2003.

Thom, RM, GD Williams, AB Borde, JA Southard, and SL Sargeant. 2003. "Overwater Structure Impacts on

Benthic Vegetated Communities in Puget Sound." Presented by Thom, Ronald M (Invited Speaker) at Workshop on Developing a Science-Based Decision Support Tool for Small Dock Management, Phase I: Status of the Science, Boston, MA on January 22, 2003. PNNL-SA-38579, Pacific Northwest National Laboratory, Marine Sciences Laboratory, Sequim, Washington.

Williams GD, RM Thom, JA Southard, SL Sargeant, DK Shreffler, RA Moursund, and MT Stamey. 2003. "Assessing Overwater Structure-Related Predation on Juvenile Salmon: A Field Study and Protocol for Weighing the Evidence." In *Proceedings to the 2003 Georgia Basin/Puget Sound Research Conference*, March 31 - April 3, 2003, Vancouver, BC . PNNL-SA-37954, Pacific Northwest National Laboratory, Richland, Washington.

Sargeant SL, RM Thom, and HL Diefenderfer. 2002. "Evaluation of methods to increase light under large overwater structures: improving salmon habitat functions." Presented by Sue Sargeant at the West Coast Seagrass Colloquium, Newport, OR, November 15-16, 2002. PNNL-SA-37590, Pacific Northwest National Laboratory, Richland, WA; Marine Sciences Laboratory, Sequim, Washington.

Thom, RM, SL Blanton, AB Borde, GD Williams, DL Woodruff, and MH Huesemann. 2002. "Investigations into Wetland Carbon Sequestration as Remediation for Global Warming." PNNL-SA-35183. In *Wetlands and Remediation II – 2001*, proceedings of the Second International Conference on Wetlands & Remediation, September 5-6, 2001, Burlington, Vermont. Eds. KW Nehring and SE Brauning, Chapter 4: Wetlands Ecology and Restoration, pp. 311- 320, Battelle Press, Columbus, Ohio.

Thom, RM, AB Borde, GD Williams, JA Southard, and SL Blanton. 2002. "Adaptive Management to Improve Seagrass Restoration Success." PNWD-SA-5520. Invited presentation at *Watershed 2002*, a specialty conference sponsored by the Water Environment Federation and the Florida Water Environment Association, February 23-27, 2002, Fort Lauderdale, Florida.

Thom RM, GD Williams, AB Borde, JA Southard, SL Sargeant, and J Cordell. 2002. "Eelgrass (Zostera marina L.) Restoration at Clinton Ferry Terminal, Puget Sound." PNWD-SA-5729. Presented by Ronald M. Thom at Pacific Estuarine Research Society (PERS) 25th Annual Meeting, Portland, Oregon, May 3, 2002.

Thom, RM, SL Blanton, DL Woodruff, MH Huesemann, GD Williams, and AB Borde. 2001. "Enhancing Carbon Sequestration in Coastal Vegetated Systems." PNWD-SA-5312. Invited presentation at the Eighteenth Annual International Pittsburgh Coal Conference, Newcastle, New South Wales, Australia, December 4-7, 2001.

Thom, RM, SL Blanton, DL Woodruff, GD Williams, and AB Borde. 2001. "Carbon Sinks in Nearshore Marine Vegetated Ecosystems." PNNL-SA-34668. Invited presentation at the First National Conference on Carbon Sequestration, Washington, D.C., May 14-17, 2001.

Thom, RM, AB Borde, SL Blanton, DL Woodruff, and GD Williams. 2001. "The Influence of Climate Variation and Change on Structure and Processes in Nearshore Vegetated Communities of Puget Sound and other Northwest Estuaries." PNNL-SA-34977. In *Puget Sound Research 2001 Proceedings--The Puget Sound/Georgia Basin Ecosystem: Status, Stressors, and the Road to Recovery.* Bellevue, Washington, February 12-14, 2001.

Thom, RM, AB Borde, GD Williams, JA Southard, SL Blanton, and DL Woodruff. 2001. "Effects of Multiple Stressors on Eelgrass Restoration Projects." PNWD-SA-5434. In *Puget Sound Research 2001 Proceedings--The Puget Sound/Georgia Basin Ecosystem: Status, Stressors, and the Road to Recovery*. Bellevue, Washington, February 12-14, 2001.

Williams, GD, RM Thom, DL Woodruff, MC Miller, RK Kropp, AB Borde, AD Skillman, SL Blanton, J Brennan, and L Blackmore. 2001. "A Comprehensive Assessment of the Central Puget Sound (King County) Nearshore Ecosystem: Historic Changes, Data Gaps, and Pending Threats." PNNL-SA-34562. In *Puget Sound Research 2001* Proceedings--The Puget Sound/Georgia Basin Ecosystem: Status, Stressors, and the Road to Recovery. Bellevue, Washington, February 12-14, 2001.

Blanton, S.L. 1998. Fish Behavior Evaluations in the Forebay of Lower Granite Dam. Presented at the Annual Program Review for the U.S. Army Corps of Engineers Northwest Division Anadromous Fish Evaluation Program (AFEP), Portland, Oregon, October 13-15, 1998.

Blanton, S .L. 1998. Fish Screens On-Line. Presented at the 7th Annual Pacific Northwest Fish Screen Fabrication, Operation, and Maintenance Workshop, Hood River, Oregon, August 25-27, 1998.

Blanton, S.L. 1997. Phase II Screen Evaluations in the Yakima Basin 1997. Presented at the 6th Annual Pacific Northwest Fish Screen Fabrication, Operation, and Maintenance Workshop, Salmon, Idaho, September 9-11, 1997.

Poston, T.M. and S.L. Blanton. 1997. Using Ultrasound Technology to Detect Gas Bubbles in Fish. Presented at the 127th American Fisheries Society Annual Meeting, Monterey, California, August 24-28, 1997.

Poston, T.M., S.L. Blanton, and T.J. Carlson. 1996. Non-intrusive Monitoring of Gas Bubble Trauma in Salmonids at PNNL. Presented at the Gas Bubble Disease Review of Research, Northwest Power Planning Council, Bonneville Power Administration, Army Corps of Engineers, Portland, Oregon. November 20-21, 1996.

Blanton, S.L. 1996. Evaluation of WDWF Six-foot Modular Screen Orientation (Angled vs. Perpendicular) and Fish Bypass Efficiency. Presented at the 5th Annual Pacific Northwest Fish Screen Fabrication, Operation, and Maintenance Workshop, Washington Department of Fish and Wildlife Yakima Screens Shop, U.S. Bureau of Reclamation Yakima Field Office - Fish Facilities Branch, Yakima, Washington, August 13-15, 1996.

Mavros, W.V., S.L. Blanton, and J.C. Estes. 1996. Fisheries Education: The Battelle Experience. Presented at the American Fisheries Society Public Outreach Symposium, "How Do We Make Fish as Popular as Dinosaurs?", June 26-29, 1996, Montana State University, Bozeman, Montana.

Technical Reports

2006

Southard SL, J Vavrinec, III, and DL Woodruff. 2006. *Qualitative Observations of Eelgrass Plots Associated with the Hood Canal Bridge Replacement Project – Winter 2006*. PNWD-3657. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, WA.

Thom RM, GD Williams, JD Toft, SL Southard, CW May, GA McMichael, JA Vucelick, JT Newell, and JA Southard. 2006. *Impacts of Ferry Terminals and Ferry Operations on Juvenile Salmon Migrating Along Puget Sound Shorelines: Current Level of Knowledge*. PNWD-3647. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, WA.

Woodruff DL, SL Southard, and JL Southard. 2006. *Second Annual Report: 2005 Pre-Construction Eelgrass Monitoring and Propagation for King County Outfall Mitigation*. PNNL-15678-2. Prepared for King County Department of Natural Resources and Parks by Pacific Northwest National Laboratory, Richland, WA.

2005

Carlson TJ, DL Woodruff, GE Johnson, NP Kohn, GR Ploskey, MA Weiland, JA Southard, and SS Southard. 2005. *Hydroacoustic Monitoring During Pile Driving at the Hood Canal Bridge, September-November 2004*. PNWD-3621. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, Washington.

Johnson GE, ME Hanks, F Khan, CB Cook, J Hedgepeth, RP Mueller, CL Rakowski, MC Richmond, SL Sargeant, JA Serkowski, and JR Skalski. 2005. *Hydroacoustic Evaluation of Juvenile Salmonid Passage at The Dalles Dam in 2004* . PNNL-15180. Prepared for the U.S. Army Corps of Engineers, Portland District by Battelle, Pacific Northwest National Laboratory, Richland, Washington.

Miller MC, SS Southard, and NR Evans. 2005. *Assessment of Potential Impacts to Eelgrass from a Proposed Float and Ramp in Auke Nu Cove, Alaska*. PNWD-3638. Prepared for PND Engineering, Juneau, AK by Battelle,

Pacific Northwest Division, Richland, WA.

Pearson WH, RP Mueller, SS Southard, and CW May. 2005. *Evaluation of Juvenile Salmon Leaping Ability and Behavior at an Experimental Culvert Test Bed* . PNWD-3539. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, Washington.

Pearson WH, MC Richmond, GE Johnson, SL Sargeant, RP Mueller, VI Cullinan, Z Deng, B Dibrani, GR Guensch, CW May, LK O'Rourke, KL Sobocinski, and HM Tritico. 2005. *Protocols for Evaluation of Upstream Passage of Juvenile Salmonids in an Experimental Culvert Test Bed*. PNWD-3525. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, Washington.

Southard SS, LK O'Rourke, and ML Blanton. 2005. *Analysis of Conditions: Potential for Changing Mosquito Population Dynamics at the Willapa Bay Restoration Project Site in Light of West Nile Virus*. PNWD-3520. Prepared for the USDA Natural Resources Conservation Service, Olympia, Washington by Battelle, Pacific Northwest Division, Richland, Washington.

Southard SS, JA Southard, and DL Woodruff. 2005. *Qualitative Observations of Eelgrass Plots Associated with the Hood Canal Bridge Replacement Project – Fall 2005*. PNWD-3616. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, Washington.

Southard SS, DL Woodruff, and JA Southard. 2005. *Light Measurements at the Hood Canal Bridge Replacement Project – Spring 2005*. PNWD-3615. Prepared for the Washington State Department of Transportation by Battelle, Pacific Northwest Division, Richland, WA.

2004

Borde, AB, PJ Balducci, JW Brawley, SL Sargeant, and MJ Scott. 2004. "Annotated Bibliography on Economics as Related to Coastal Habitat Restoration." PNWD-3436-9. Prepared for the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center as part of the Issue-Based Characterization program, by Battelle—Pacific Northwest Division, Richland, WA.

Borde AB, CW May, RM Thom, KF Wellman, LK O'Rourke, TS Peterson, and SL Sargeant. 2004. *The Hydrological, Physical, Chemical, and Biological Connections of Isolated Waters and Wetlands to Non-Isolated Aquatic Ecosystems and the Economic Value and Public Benefits of the Functional Connections.* PNWD-3446, Battelle—Pacific Northwest Division, Richland, WA.

Borde, AB, SL Sargeant, HL Diefenderfer, and RM Thom. 2004. "Assessing Performance of a Coastal Restoration Project." PNWD-3237-4. Prepared for the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center as part of the Issue-Based Characterization program, by Battelle Marine Sciences Laboratory, Sequim, Washington. Available URL: http://www.csc.noaa.gov/coastal/assessment/assessment.htm

Carlson TJ, SL Sargeant, and GE Johnson. 2004. *Plan for Pile-driving Research*. PNWD-3444. Prepared for the Washington State Department of Transportation, Olympia, Washington, by Battelle, Pacific Northwest Division, Richland, Washington.

Pearson WH, JR Skalski, KL Sobocinski, MC Miller, GD Williams, GE Johnson, JA Southard, SL Sargeant, and GR Ploskey. 2004. Study of Stranding of Juvenile Salmon Along the Lower Columbia River: Report on FY 04 Stranding Study Activities . PNNL-14889, Pacific Northwest National Laboratory, Richland, WA. [Unpublished]

Sargeant, SL. 2004. "Risk and Uncertainty in Environmental Restoration Programs." PNWD-3436-5. Prepared for the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (CSC) as part of a website series on coastal habitat restoration, by Battelle Marine Sciences Laboratory, Sequim, Washington.

Sargeant, SL, HL Diefenderfer, RM Thom, and AB Borde. 2004. "Adaptive Management." PNWD-3237-5. Prepared for the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center as part of the

Issue-Based Characterization program, by Battelle Marine Sciences Laboratory, Sequim, Washington. Available URL: http://www.csc.noaa.gov/coastal/management/management.htm

Sargeant, SL, RM Thom, and MC Miller. 2004. *Preliminary Assessment of Potential Impacts to Eelgrass from a Proposed Float and Ramp in Auke Bay, Alaska.* PNWD-3394. Battelle Marine Sciences Laboratory, Sequim, Washington.

Southard JA, GD Williams, SL Sargeant, and DL Woodruff. 2004. "Qualitative Observations of Eelgrass Plots Associated with the Hood Canal Bridge Replacement Project – Late Winter 2004." PNWD-3418. Letter report prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Southard, JA, GD Williams, SL Sargeant, and DL Woodruff. 2004. "Qualitative Observations of Eelgrass Plots Associated with Hood Canal Bridge Replacement Project – Winter 2003/2004." PNWD-3357. Letter Report prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Southard JA, GD Williams, RM Thom, AB Borde, SL Sargeant, DL Woodruff, and NR Evans. 2004. "Habitat Mitigation Monitoring at the Clinton Ferry Terminal, Whidbey Island." PNWD-3439. Letter report prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Thom RM, and SL Sargeant. 2004. "State of the Practice of Nearshore Ecosystem Assessments in Puget Sound: Synthesis and Recommendations from a Workshop." PNWD-3372. Prepared for the U.S. Army Corps of Engineers, Portland District, by Battelle Marine Sciences Laboratory, Sequim, Washington.

Thom, RM, GD Williams, SL Sargeant, MC Miller, and AB Borde. 2004. *Preliminary Monitoring Protocols for the Morro Bay National Estuary Program (MBNEP).* PNWD-3393. Prepared for the Morro Bay National Estuary Program, Morro Bay, California by Battelle Marine Sciences Laboratory, Sequim, Washington.

Thom, RM, SL Sargeant, J, Kearsley, and M. Calvi. 2004. *State of the Practice of Nearshore Ecosystem Assessmentys in Puget Sound: Synthesis and Recommendations from a Workshop*. PNWD-3372. Prepared for the U.S. Army Corps of Engineers, Seattle District, by Battelle Marine Sciences Laboratory, Sequim, Washington.

Williams, GD, SL Sargeant, JA Southard, and DL Woodruff. 2004. "Light Measurements at the Hood Canal Bridge Replacement Project – Late Winter 2004". PNWD-3421. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Woodruff, DL, GD Williams, JA Southard, SL Sargeant, AB Borde, NR Evans, LK O'Rourke, and RM Thom. 2004. *Hood Canal Bridge Replacement and Retrofit Project: Eelgrass Monitoring and Baseline Assessment*. PNWD-3448. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

2003

Borde AB, SL Sargeant, HL Diefenderfer, and RM Thom. 2003. "Assessing Performance of Coastal Restoration Projects." PNWD-3333-3. Prepared for the National Oceanic and Atmospheric Administration by Battelle Marine Sciences Laboratory, Sequim, Washington.

McMichael, GA and SL Sargeant. 2003. *Salmonid Predation Implications of the City of Richland Dock at Lee Boulevard*. PNNL-14400. Prepared for SCM Consultants, Inc., Kennewick, WA.

Pearson WH, GR Guensch, GE Johnson, RP Mueller, MC Richmond, SL Sargeant, and HM Tritico. 2003. *Evaluation of Juvenile Fish Passage through an Experimental Culvert Test Bed: Standard Protocols and Baseline Characterization.* PNNL-14349. Prepared for the Washington State Department of Transportation by Pacific Northwest National Laboratory, Richland, WA.

Sargeant SL, MC Miller, CW May, and RM Thom. 2003. *Shoreline Armoring Research Program: Phase II-Conceptual Model Development for Bank Stabilization in Freshwater Systems.* PNNL-14436. Prepared for the Washington State Department of Transportation by Pacific Northwest National Laboratory, Marine Sciences Laboratory, Sequim, WA.

Southard, JA, GD Williams, RM Thom, AB Borde, SL Sargeant, and J Cordell. 2003. *Habitat Mitigation Monitoring at the Clinton Ferry Terminal, Whidbey Island.* PNWD-3250. Sixth annual report prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

U.S. Nuclear Regulatory Commission (NRC). 2003. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 13, Regarding H.B. Robinson Steam Electric Plant, Unit No. 2*. PNNL-14274 and PNNL-14690, Pacific Northwest National Laboratory, Richland, WA. (contributing author)

Williams GD, RM Thom, DK Shreffler, JA Southard, LK O'Rourke, SL Sargeant, VI Cullinan, RA Moursund, and M Stamey. 2003. *Assessing Overwater Structure-Related Predation Risk on Juvenile Salmon: Field Observations and Recommended Protocols.* PNNL-14435. Prepared for the Washington State Department of Transportation by the Pacific Northwest National Laboratory's Marine Sciences Laboratory, Sequim, WA, in collaboration with Shreffler Environmental, Sequim, WA, and the University of Washington, Seattle, WA.

Woodruff DL, JA Southard, GD Williams, and SL Sargeant. 2003. "Qualitative Observations of Eelgrass Plots Associated with Hood Canal Bridge Replacement Project Fall 2003." PNWD-3346-Sept 2003. Letter Report prepared for the Washington State Department of Transportation by the Battelle Marine Sciences Laboratory, Sequim, Washington.

2002

Borde AB, RM Thom, GD Williams, SL Blanton, and JA Southard. 2002. *Assessment of Light in Eelgrass (Zostera marina) Zones at Clinton Ferry Terminal during Phase II Construction: Baseline Data 2001*. PNWD-3129. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Diefenderfer HL, JA Ward, SL Sargeant, AD Skillman, and VI Cullinan. 2002. *Centredale Manor Channel Catfish (Ictalurus punctatus) Early Life-Stage Exposures with 2,3,7,8-TCDD, PCB 77, PCB 126, and 1,2,4,5,7,8-hexachloroxanthene (HCX).* PNWD-3159. Prepared for the U.S. Army Corps of Engineers, New England District; funded by the U.S. Environmental Protection Agency. Battelle Marine Sciences Laboratory, Sequim, Washington.

Miller, MC, GD Williams, LK O'Rourke, SL Sargeant, and JA Southard. 2002. *Effects of Shoreline Hardening and Shoreline Protection Features on Fish Utilization and Behavior at Washaway Beach, Washington (Final Report).* PNNL-13635-(3). Prepared for the Washington State Department of Transportation by Pacific Northwest National Laboratory, Richland, Washington; Battelle Marine Sciences Laboratory, Sequim, Washington.

Miller, MC, GD Williams, LK O'Rourke, JA Southard, and SL Blanton. 2002. *Effects of Shoreline Hardening and Shoreline Protection Features on Fish Utilization and Behavior, Washaway Beach, Washington (Report 2)*. PNNL-13635-(2). Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington; Pacific Northwest National Laboratory, Richland, Washington.

Sargeant SL, JA Southard, AB Borde, and GD Williams. 2002. *Baseline Survey of Nearshore Habitat Associated with the Sequim Bay Log Transfer Facility.* PNWD-3205. Prepared for the Jamestown S'Klallam Tribe by Battelle Marine Sciences Laboratory, Sequim, Washington.

Sargeant SL, GD Williams, and RM Thom. 2002. *SR 9, Stillaguamish River Bridge to Lake Creek Bridge Culvert Replacement Project and Associated Fish Exclusion.* PNWD-3212. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Thom RM, SL Sargeant, AB Borde, NR Evans, JA Southard, GD Williams, TP McKenzie, and M Wray. 2002. *Eelgrass Habitat Mitigation Plan for Port Townsend Ferry Terminal Slip 2 Transfer Span Replacement Project.* PNWD-3203. Prepared for Washington State Ferries by Battelle Marine Sciences Laboratory, Sequim, Washington; Pacific International Engineering, Edmonds, Washington; and Berger/ABAM, Federal Way, Washington.

Thom RM, GD Williams, AB Borde, JA Southard, SL Sargeant, and J Cordell. 2002. *Habitat Mitigation Monitoring at the Clinton Ferry Terminal, Whidbey Island, Annual Report Number 5.* PNWD-3154. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 6 Regarding Surry Power Station, Units 1 and 2: Final Report.* NUREG-1437, Supplement 6, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 8 Regarding McGuire Nuclear Station, Units 1 and 2: DRAFT Report.* NUREG-1437, Supplement 8, Washington, D.C.

2001

Blanton, SL, RK Karls, and LM Johnson. 2001. *Topsmelt and Echinoderm Bioassay Results in Support of NPDES Permit AK-000039-6: Cook Inlet Pipeline Company, Drift River Terminal.* PNWD-3092. Prepared for Cook Inlet Pipeline Company by Battelle Marine Sciences Laboratory, Sequim, Washington.

Blanton, SL, RM Thom, AB Borde, HL Diefenderfer, and JA Southard. 2001. *Evaluation of Methods to Increase Light Under Ferry Terminals*. PNNL-13714. Prepared for the Washington State Department of Transportation by Pacific Northwest National Laboratory, Richland, Washington; Battelle Marine Sciences Laboratory, Sequim, Washington.

Miller, MC, RM Thom, GD Williams, JA Southard, SL Blanton, and LK O'Rourke. 2001. *Effects of Shoreline Hardening and Shoreline Protection Features on Fish Utilization and Behavior, Washaway Beach, Washington (Report 1).* PNNL-13635-(1). Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington; Pacific Northwest National Laboratory, Richland, Washington.

Southard, JA, GD Williams, RM Thom, SL Blanton, and AB Borde. 2001. *Eelgrass Restoration at West Eagle Harbor. Phase II: Monitoring and Evaluation.* PNWD-3097. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Thom, RM, GD Williams, AB Borde, JA Southard, SL Blanton, and J Cordell. 2001. *Habitat Mitigation Monitoring at the Clinton Ferry Terminal, Whidbey Island.* PNWD-3116. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington, and the University of Washington, Seattle, Washington.

Williams, GD, JA Southard, SL Blanton, and RM Thom RM. 2001. *Findings of Subtidal Dive Resource Surveys: Anchor Cable BN, Hood Canal Bridge.* PNWD-3100. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Williams, GD, JA Southard, SL Blanton, and RM Thom RM. 2001. *Geoduck Dive Resource Surveys: Anchor Cable BN, Hood Canal Bridge.* PNWD-3101. Prepared for the Washington State Department of Transportation by Battelle Marine Sciences Laboratory, Sequim, Washington.

Williams, G. D., R. M. Thom, J. E. Starkes, J. S. Brennan, J. P. Houghton, D. Woodruff, P. L. Striplin, M. Miller, M. Pedersen, A. Skillman, R. Kropp, A. Borde, C. Freeland, K. McArthur, V. Fagerness, S. Blanton, and L. Blackmore. 2001. *Reconnaissance Assessment of the State of the Nearshore Ecosystem: Eastern Shore of Central Puget Sound, Including Vashon and Maury Islands (WRIAs 8 and 9).* Ed., J. S. Brennan. PNNL-14055. Report

prepared for King County Department of Natural Resources, Seattle, Washington. 353 pp. http://dnr.metrokc.gov/wlr/watersheds/puget/nearshore/sonr.htm.

2000

Thom, RM, LD Antrim, AB Borde, SL Blanton, WW Gardiner, DK Shreffler, and J Cordell. 2000. *Habitat Mitigation Monitoring at the Clinton Ferry Terminal, Whidbey Island.* PNWD-3021. Prepared for the Washington State Department of Transportation, Olympia, Washington, by the Battelle Marine Sciences Laboratory, Sequim, Washington, and Fisheries Research Institute, University of Washington, Seattle.

Blanton SL, GA McMichael, and DA Neitzel. 2000 *Washington Phase II Fish Diversion Screen Evaluations in the Yakima River Basin, 1998.* PNNL-13115, Pacific Northwest National Laboratory, Richland, WA.

Blanton SL and JA Ward. 2000. 45-Day Bioaccumulation Test with *Macoma nasuta* and *Nephtys caecoides:* Hylebos Wood Debris Group PSDDA. PNWD-3052. Prepared for Pentec Environmental, Edmonds, Washington.

Borde AB, RM Thom, HL Diefenderfer, and SL Blanton. 2000. *The Links of Isolated Waters and Wetlands to Interstate or Foreign Commerce and to the Objectives of the Clean Water Act – Section I Ecological Functions*. PNWD-3199. Prepared for the US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Oceans and Coastal Protection Division, Washington, DC, by Battelle Duxbury Operations, Duxbury, Massachusetts, and Battelle Marine Sciences Laboratory, Sequim, Washington.

Pinza, MR, SL Blanton, LM Johnson. 2000. *Comparison of the Sensitivities of Acute and Chronic Marine Sediment Toxicity Tests with Leptocheirus Plumulosus Using Sediment Quality Advisory Levels*. PNNL-13216. Prepared for the U.S. Environmental Protection Agency by Pacific Northwest National Laboratory, Richland, Washington; Battelle Marine Sciences Laboratory, Sequim, Washington.

Ward, JA and SL Blanton. 2000. *Amphipod and Bivalve Larvae Bioassay Results: Hylebos Wood Debris Group PSDDA.* PNWD-3043. Prepared for Pentec Environmental, Edmonds, Washington.

Ward, JA and SL Blanton. 2000. *Amphipod Bioassay Results: Hylebos Wood Debris Group PSDDA.* PNWD-3048. Prepared for Pentec Environmental, Edmonds, Washington.

1999

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 2 Regarding the Oconee Nuclear Station, Final Report.* NUREG-1437, Supplement 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 1 Regarding the Calvert Cliffs Nuclear Power Plant, Final Report.* NUREG-1437, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Standard Review Plans for Environmental Reviews For Nuclear Power Plants.* NUREG-1555, Supplement 1, Washington, D.C.

Johnson, R.L., S.M. Anglea, S.L. Blanton, M.A. Simmons, R.A. Moursund, G.E. Johnson, E.A. Kudera, J. Thomas, and J.R. Skalski. 1999. Hydroacoustic Evaluation of Fish Passage and Behavior at Lower Granite Dam in Spring 1998. Final report submitted to Walla Walla District, U.S. Army Corps of Engineers, February 15, 1999.

1998

Blanton, SL, CS Abernethy, and DA Neitzel. 1998. Washington Phase II Fish Diversion Screen Evaluations in the Yakima River Basin, 1997. Report submitted to the Bonneville Power Administration, Portland, Oregon.

1997

Geist, D.R., C.S. Abernethy, and S.L. Blanton. 1997. The Use of Electromyogram Telemetry to Estimate Energy

Expenditure of Adult Fall Chinook Salmon. Pacific Northwest National Laboratory, Richland, Washington.

Johnson, G.E., R.L. Johnson, C.S. Abernethy, S.M. Anglea, S. Blanton, M. Simmons, E.A. Kudera, C.M. Sullivan, and J.R. Skalski. 1997. Fixed-Location Hydroacoustic Evaluation of the Prototype Surface Bypass and Collector, Spill Efficiency, and Fish Guidance Efficiency at Lower Granite Dam in Spring and Summer 1997. Final report submitted to Walla Walla District, U.S. Army Corps of Engineers, January 30, 1998.

Neitzel, D., T.J. Carlson, R. Mueller, W. Mavros, and S. Blanton. 1997. Avoidance Response of Juvenile Hatchery and Wild Chinook Salmon and Rainbow Trout. Prepared for the Bonneville Power Administration, Portland, Oregon.

Poston, T.M., R.A. Pappas, S.L. Blanton, A.A. Diaz, and K.J. Lessor. 1997. Using Ultrasound to Detect Gas Bubbles in Rainbow Trout *(Oncorhynchus mykiss).* PNNL-15545, Pacific Northwest National Laboratory, Richland, Washington.

1996

Neitzel, D.A., S.L. Blanton, C.S. Abernethy, and D.S. Daly. 1996. Movement of Fall Chinook Salmon *Onchorhynchus tshawytscha:* A Comparison of Approach Angles for Fish Bypass in a Modular Rotary Drum Fish Screen. DOE/BP-62611. Prepared for the Department of Energy, Bonneville Power Administration, Portland, Oregon.

1995

U.S. Nuclear Regulatory Commission (NRC). 1995. *Final Environmental Statement related to the operation of Watts Bar Nuclear Plant, Units 1 and 2.* NUREG-0498, Supplement No. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1995. Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2. NUREG-0498, Supplement 1, U.S. Nuclear Regulatory Commission, Washington, D.C.

DARBY C. STAPP Hanford Cultural Resources Laboratory
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EDUCATION

Ph.D. Historical Archaeology--University of Pennsylvania (1990).
M.A. Anthropology--University of Idaho (1985).
B.A. Anthropology/Geology--University of Denver (1977).

SIGNIFICANT PROJECTS

Hanford Cultural Resources Laboratory. Served as director of the cultural resources laboratory created to provide cultural and historical services for the U.S. Department of Energy's Hanford Site. Efforts include managing the mitigation efforts for the Manhattan/Cold War resources, ensuring protection of archaeological sites and traditional use areas, and facilitating involvement of Native Americans and the public.

Nuclear Regulatory Commission. Technical specialist providing support for preparation of environmental impact statements associated with nuclear reactor relicensing and new deployment.

Nuclear Long-Term Stewardship. Selected to serve on the U.S. Department of Energy's Long-Term Stewardship Science and Technology Roadmap Working Group, Idaho National Environmental and Engineering Laboratory. The group advised the Department on tools, analyses, and methodologies needed to ensure long-term protection of human and environmental health over many generations.

Schedule Optimization Study. Conducted assessment of Hanford environmental restoration project using rapid assessment methods to identify opportunities for improving the efficiency of the operation. Included thirty-five interviews, from field technicians, to regulators, to high-level managers. Coordinated multi-agency workshop to evaluate results and recommend solutions.

EMPLOYMENT HISTORY

1998 to Present--Battelle, Pacific Northwest National Laboratory, Senior Scientist.

1994 to 1998--CH2M HILL Hanford, Inc., Cultural Resource Coordinator.

1991 to 1994 -- Battelle, Pacific Northwest National Laboratory, Senior Development Engineer, Waste Systems Department.

1988 to 1991 -- Battelle, Pacific Northwest National Laboratory, Senior Technical Specialist, Communications Department.

1983 to 1987--University of Idaho, Anthropology Research Associate (Project Manager for series of archaeological projects conducted for various agencies).

SELECTED PUBLICATIONS

2006. Protecting Cultural Landscapes. *The Applied Anthropologist*, 26(1). (Ellen Prendergast co-author)

2006. Avoiding Archaeological Disasters. *AWA News* 10(4) 3-4. Association for Washington Archaeology. (Julia Longenecker co-author).

2005. Reinventing Anthropological Writing. *Anthropology Newsletter*. May 2005, p. 7. American Anthropological Association. Washington DC.

2005. "Reclaiming the Ancient One: Addressing the Conflicts Between American Indians and Archaeologists over Protection of Cultural Places," in *Indigenous Peoples and Archaeology: The Politics of Practice,* edited by Claire Smith and H. Martin Wobst. London: Routledge Press. (Julia Longenecker co-author).

2004. "An Anthropological Perspective on Magistrate Jelderks' Kennewick Man Decision." *High Plains Applied Anthropologist*, 23(1):1-16. (Peter Jones co-author)

2004. "Federal Planning and Historic Places: The Section 106 Process (By Thomas F. King, reviewed by Darby C. Stapp)."

2003. Expert Opinion report submitted to the Grievance Committee, Register of Professional Archaeologists, on the Grievance against Gordon Tucker Concerning His Actions at the Semiahmoo Site (45WH17).

2002. *Tribal Cultural Resource Management: The Full Circle to Stewardship* (with Michael Burney). Walnut Creek: Alta Mira Press.

2002. *History of the Plutonium Production Facilities at the Hanford Site Historic District, 1943-1990. To be published by U.S. Department of Energy 2001.* Project Manager and author, "Reactor Operations," "Worker History," and "Research and Development" sections, and assisted in the preparation of the "Waste Management" section of the book. DOE/RL-97-1047.

2002. "The Wanapum" (with Julia Longenecker and Angela Buck), in *Endangered Peoples of the World: North America,* Volume 8. Greenwood Press. High School Reference Book.

2000. "Putting Anthropology to Work," in *Careers in Anthropology: Profiles of Practitioner Anthropologists*, edited by Paula L. Sabloff. PP 5-7. NAPA Bulletin 20. National Association for the Practice of Anthropology.

2000. "Tribes Working with Agencies to Protect Resources." *Cultural Resource Management*, 25(7):41-44. National Park Service.

2000. "The Times, They are A-Changin': Can Archaeologists and Native Americans Change

with the Times?" Society for American Archaeology *Bulletin*, 18(2):18-21 (with J. Longenecker).

2000. "Tribal CRM, Archaeologists, and Action Anthropology." *High Plains Applied Anthropologist*, 20(1). Peer reviewed Journal.

1999. "Learning From the Kennewick Man Controversy." Commentary, *Anthropology News*, 40(6).10-11. American Anthropological Association.

1999. "Reaching Out to the Mid-Columbia in Washington State." Society for American Archaeology *Bulletin*, 17(2):17-18 (with J. Longenecker).

1999. "Operationalizing Anthropology," Invited columnist for "The Real World" column in *Practicing Anthropolgy*, 21(1):50-52.

1998. Editor, Special Issue, "Changing Paradigms in Cultural Resource Management." *Practicing Anthropology* 20(3). Society for Applied Anthropology.

1997. "Documenting a Cold War Nuclear Reactor: Attempting Innovation," *Cultural Resource Management*, Fall 1997. National Park Service.

1997. *The N Reactor Comprehensive Treatment Report - Hanford Site, Volumes 1 to 3*. DOE/RL-96-91, Richland, Washington.

1995. "Reclaiming Hanford." *Federal Archeology*, Vol. 8, No.2: 14-21. Lead author with Thomas E. Marceau and Joy K. Woodruff. National Park Service.

1994. Addressing Solid Waste Problems in the Pacific Northwest: Working Together to Reach Solutions. Proceedings of the Solid Waste Conference. Pacific Northwest National Laboratory. PNL-SA-23528. (Asim Khawaja co-editor).

1993. *Buried Waste Integrated Demonstration Project: Technology Needs for Hanford and Other DOE Sites.* Pacific Northwest National Laboratory. PNL-8328.

1993. "Doing More for Less: Improving Efficiency of Cleanup at Federal Facilities. Lead author with Julie Erickson, James Goodenough, and Thomas Wintczak. In *Proceedings of the Environmental Restoration Conference '1994'*, pp.1301 – 1305. U.S. Department of Energy.

1992. *Schedule Optimization Study. Hanford RI/FS Self Evaluation*. Volume 1. EMO-1080. Environmental Management Operations. Richland, Washington.

1991. "Anthropological Perspectives on Communication Needs in Engineering Projects," in Proceddings of the IEEE Annual Conference. Santa Fe.

1990. "Going Four-Dimensional at a National Laboratory," pp. 88-92 in *Proceedings of the Society for Technical Communication Region 7 Conference.*

1980 – 1987. Miscellaneous archaeology reports.

RECENT PRESENTATIONS

2003. An Anthropological Perspective on the State of Environmental Justice. Society for Applied Anthropology Annual Meeting.

2002. Roles of Anthropology in Nuclear Waste Disposition Policy Making. Environmental Justice Policy Workshop, University of Georgia.

2002. Addressing the Conflicts Among American Indians and Archaeologists over Protection of Cultural Places: Cultural Resource Stewardship vs. Archaeological Research. Ethics and Archaeology Conference, University of Pennsylvania.

2002. Preserving, Protecting and Interpreting a Large Twentieth Century Farming Landscape at the Hanford Reach National Monument. Presented at the Society for Historical Archaeology Annual Conference. Mobile, Alabama.

2000. "Tribes and Archaeologists: Keeping the Relationship Growing." Session Organizer and facilitator. Northwest Anthropological Conference. Spokane, WA.

1996. Developing Technology in the Nuclear Weapons Complex – Reflections on American Approaches to Developing Anthropology. American Anthropological Association Annual Meeting. San Francisco.

SPECIAL RECOGNITION

2003. Recipient of the 2003 Washington State Historic Preservation Officer's Award for *Outstanding Achievement in Portraying Historic Preservation in the Media*.

1997. Award for Outstanding Volunteer Service to Our Community (United Way of Benton-Franklin Counties.

1996. Award of Merit, John Wagoner, Hanford Site Manager, for Participation in Hanford Historic Building Task Force.

1994. Selected by U.S. Environmental Protection Agency and Washington State Department of Ecology to serve as an alternate to the Hanford Advisory Board, representing non-union employees of Pacific Northwest Laboratory and the Hanford Environmental Health Foundation.

PROFESSIONAL AFFILIATIONS

Registered Professional Archaeologist. Member of American Anthropological Association, National Association for the Practice of Anthropology, Society of American Archaeology, Society for Applied Anthropology (Fellow), Society for High Plains Applied Anthropology, Society for Historical Archaeology.

Correspondence Editor, *Journal of Northwest Anthropology*. South Fork Press. Moscow, Idaho.

Contributing Editor, *The Applied Anthropologist*. High Plains Society for Applied Anthropology.

Committee Head, American Indian Committee, Society for Applied Anthropology.

1997. Elected to Governing Board, National Association for the Practice of Anthropology, a division of the American Anthropological Association, 2 year-term, ended November 1999.

GREGORY A. STOETZEL, Environmental, Safety and Health Principal Engineer
Safety and Health Department
Battelle, Pacific Northwest National Laboratory

Education

B.S.	Science, Penn State University	1973
M.S.	Bionucleonics, Purdue University	1976

Experience

Mr. Stoetzel joined Battelle in 1976, and has over thirty years of work experience in the operational health physics, emergency preparedness, and environmental assessment areas. Details of his work experience are presented below:

- Operational Health Physics. Mr. Stoetzel has extensive experience in writing technical basis guidance documents to support Federal health physics regulations. He was the primary technical contributor to the Department of Energy (DOE) Implementation Guides on workplace air monitoring and on sealed radioactive source accountability and control. He was a technical contributor to the DOE Radiological Control Manual, the Hanford Site Radiological Control Manual, and to several DOE Good Practices Manuals covering topics such as ALARA and operation of uranium and plutonium facilities. He was also a contributor to the workplace air monitoring guidance developed by the Nuclear Regulatory Commission (NRC) to support implementation of 10 CFR Part 20.

  Mr. Stoetzel has provided health physics support to DOE contractors and programs in the following areas: writing radiation protection manuals and radiological protection portions of safety analysis reports; evaluating facility conceptual design reports for adequacy of shielding, radiation detection instrumentation, and ALARA considerations; and performing occupational dose assessments for inclusion in environmental assessments and environmental impact statements.

  Mr. Stoetzel has performed qualitative air flow studies (i.e., smoke testing) at over 12 nuclear facilities as a means of evaluating the adequacy of workplace air sampler and monitor locations.

  Mr. Stoetzel has provided health physics support to several Department of Army projects. Specific work has included determination of the best survey methods and instrumentation for performing release surveys on depleted uranium contaminated components, and the evaluation of component decontamination methods to ensure worker safety.

  Currently, Mr. Stoetzel is assigned to Battelle's Safety and Health Department. Responsibilities include 1) conducting compliance inspections of nuclear facilities against requirements in 10 CFR Part 835 and the DOE Radiological Control Manual

(RCM), 2) writing health physics procedures to support implementation of 10 CFR Part 835 and the RCM, 3) providing technical support to Battelle's air sampling/monitoring program and area dosimeter program, and 4) developing technical methods for uncontrolled release of work areas and materials and equipment from radiological control.

- Emergency Preparedness. Mr. Stoetzel was a contributor for approximately fourteen years to a Battelle program that provided technical assistance to the Nuclear Regulatory Commission (NRC) in the area of emergency preparedness at commercial nuclear power plants. He was a team member on about 20 onsite appraisals and inspections of reactor emergency preparedness programs and an observer on over 50 exercises. Other activities related to this project included performing technical reviews of exercise scenarios, emergency plans, and emergency procedures. Mr. Stoetzel was also a technical contributor and coordinator on two special studies for the NRC, one that reviewed emergency offsite dose projection methods at commercial nuclear power plants and one that developed emergency environmental sampling and analysis guidance for radioactive material facilities.

  Mr. Stoetzel has provided emergency preparedness support to Department of Energy (DOE) Headquarters and DOE Richland Operations Office (DOE RL). This support has included 1) development of radiological and nonradiological field data for emergency preparedness exercises, 2) conduct of emergency preparedness appraisals of individual DOE facilities, 3) an evaluation of the applicability of the revised protective action guidelines developed by the Environmental Protection Agency to DOE sites, and 4) upgrading emergency environmental monitoring activities on the Hanford site. Mr. Stoetzel is currently part of the DOE-RL emergency response team filling the position of radiological field team coordinator.

- Environmental Assessments. For the past five years, Mr. Stoetzel has been a contributor to the environmental impact statements developed by the NRC for license renewal of nuclear plants and for early site permits. He has supported development of the radiological health impact and fuel cycle impact sections. He has worked on environmental impact statements for three license renewal applications and two early site permit applications.

Professional Certifications

Certified Health Physicist (November 1996 by American Board of Health Physics)

LANCE W. VAIL

Senior Research Engineer II
Environmental Technology Division
Battelle, Pacific Northwest Division
Pacific Northwest National Laboratory

Since joining Battelle in 1981, Mr. Vail has been involved in projects covering a diverse set of water related issues. His professional experience includes basic and applied research, and regulatory compliance assessments. His areas of expertise cover a broad spectrum of areas related to water resources.

RESEARCH INTERESTS

Water resource management
Multiple objective tradeoff analysis in water resources
Uncertainty analysis in water resources
Advanced hydrologic process modeling
Impacts of climate on water resources
Neural networks, fuzzy logic, and genetic algorithms applied to water resource issues
Linking simulation models with optimization methods to water resource problems
Linkage of physical and biological models in fisheries management

EDUCATION

B.S.	Humboldt State University, environmental resources engineering	1979
M.S.	Montana State University, civil engineering	1982

PROFESSIONAL AFFILIATIONS

American Geophysical Union
American Society of Civil Engineers
American Water Resources Association

CURRENT PROJECTS

Hydrologic Site Safety Reviews for Early Site Permits. Principal Investigator and Project Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This project provides an independent assessment of the hydrologic suitability of the proposed sites. Assessments include a broad range of considerations such as flooding, low water conditions, ice impacts, seiches, storm surge, and tsunamis.

Water-related Environmental Reviews for Early Site Permits. Task Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This task provides an independent assessment of the proposed sites' environmental suitability. Assessments include a broad range of considerations such as water-use conflicts and changes in water quality.

Snohomish Basin Characterization. Technical Contribution. Advanced distributed watershed models were applied to provide the Tulalip Tribes of Western Washington state with a thorough understanding of the impacts of logging, development, and climate on the Snohomish River Basin.

Acid Rain TMDL. Principal Investigator and Technical Project Manager. The objective of this work assignment for Region II of the U.S. Environmental Protection Agency is to develop a preliminary assessment approach for TMDLs for pH impaired waters listed on the New York State Section 303(d) list. The intent is to enhance and further develop TMDL program capabilities by providing expertise in both acid deposition and TMDL development. The development of such an assessment approach requires that available models and data resources be reviewed. Systems engineering methods will be used in developing a conceptual model to ensure that the relationships

between models and data are fully understood. The assessment approach will be tested on one or more representative watersheds to be determined in close coordination with EPA, NYSDEC and Battelle.

Environmental Impact of License Renewal of Commercial Nuclear Power Plants. Contributor. Mr. Vail assesses the water use, water quality, and hydrologic impacts of license renewal for the Nuclear Regulatory Commission's NEPA process. He has performed this function for the following commercial nuclear plants: Calvert Cliffs, Oconee, Arkansas Nuclear One, and Hatch., McGuire, Catawba, North Anna, Robinson, Ginna, and St. Lucie.

PAST PROJECTS

- ***Chehalis Basin Characterization.*** Principal Investigator and Project Manager. Advanced numerical modeling, and GIS methods were applied to assist the Corps of Engineers in characterizing the Chehalis Basin in Western Washington State. The Chehalis Basin is subject to frequent flooding. The native populations of anadramous fish have been stressed to adverse changes in habitat resulting from development and logging.

- ***Generic Environmental Impact Statement (GEIS) for Decommissioning Commercial Nuclear Power Plants.*** Contributor. Mr. Vail provided expertise in the development of a GEIS for decommissioning of nuclear plants. He provided expertise on water use, water quality, and hydrologic impacts for the Nuclear Regulatory Commission.

- ***Impact of Climate on the Lower Yakima Basin***. Principal Investigator and Project Manager. The objective of this three-year EPA STAR Grant Project was to develop and demonstrate an integrated assessment of the impact of climate variability and climate change on a diverse set of interests in the Lower Yakima Valley in Central Washington State. Interests considered included: surface and groundwater supply, surface and groundwater quality, air quality, public health, farm and regional economics, and fisheries. The project considered the effectiveness of changes in land management (crop selection) and water management (reservoir operation) in adapting to an uncertain future climate. A diverse set of models was linked with an optimization procedure to ensure that the tradeoffs between various resource management objectives were clearly articulated.

- ***Use of NOAA's Seasonal Climate Forecast for Water Resource Management***. Task Manager of Reservoir Optimization Task. The objective of this NOAA funded project was to show the potential value of improved climate forecasts in managing surface water reservoirs for multiple objectives. Using a pareto genetic algorithm, the reservoir operating rules were optimized to define the tradeoff curves for hydropower, flood control, and instream flow requirements in the Tennessee River basin. Changes in forecast reliability result in changes to these tradeoffs and thereby express the value of such improved forecasts.

- ***Accelerated Climate Prediction Initiative.*** Task Manager of Water Resources and Habitat Task. This project will provided a limited, systematic assessment of the potential effects of anthropogenic climate change over the next half-century on water resources in the western United States. This objective was accomplished by "downscaling" the results of global-scale simulations to the spatial and temporal resolution needed to drive impact assessment models. Downscaling is particularly important for the West, where topography is a dominant climate driver. An important aspect of the hydrology of almost all western rivers is water management. Other than a few headwater streams, the hydrology of most rivers in the west is strongly affected by water use, and artificial storage. Water management models were used to study the effect of reservoir operations and understand the implications of climate variability and change on the water resources of the west.

- ***Linking Physical and Biological Models***. Principal Investigator and Project Manager. The objective of this three-year Laboratory Directed Research and Development project was to develop and demonstrate an integrated natural resource analysis framework. This framework: dramatically improves the ability to integrate physical and biological models, thereby encouraging the utilization of advanced process models; allows utilization of large, sparse, and distributed data sets (including model output); communicates high-level tradeoffs and their respective uncertainties; and assesses, communicates, and minimizes scales issues.

During the first year a significant obstacle to successful linking of physical and biological models was identified to be the fundamental structural differences between such models. The pervasive vagueness of rules and the multivaluedness associated with temporal/spatial upscaling, suggested an approach using "fuzzy methods." The second year of this project utilized a variety of fuzzy methods including: fuzzy arithmetic, fuzzy logic, fuzzy clustering, and adaptive neural fuzzy inference systems (ANFIS). A series of rules and a database from the Multispecies Framework Process were employed to test the various fuzzy methods. These rules and data are used to define aquatic habitat diversity in the Pacific Northwest. A tool called FuzzyHab was developed to estimate habitat diversity from a set of categorical statements about the environment. Each of these categorical statements is vaguely defined. Estimates for each categorical statement are derived from physical process models.

- ***Integrated Natural Resource Data System.*** Contributor. This project is to demonstrate INRDS. INRDS is an advanced, web-based environmental information system that will promote public understanding of natural resource management issues and assist planners and decision makers in accessing the most relevant information and analytical tools and evaluating the tradeoffs of alternate actions. http://inrds.pnl.gov

- ***Early Warning of El Niño Southern Oscillation (ENSO) Events for Regional Agriculture.*** Task Manager of Reservoir Optimization Task. This project is investigating the current predictability of interannual variability in climate conditions in the Pacific Northwest to determine whether and how early warning and seasonal climate forecasts by the Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration (NOAA) forecasts can be used to reduce the vulnerability of irrigated agriculture to low water-availability conditions. The study is funded by a grant from the economics and Human Dimensions Program of the NOAA Office of Global Programs. The Economics and Human Dimensions program aims to improve our understanding of how social and economic systems are currently influenced by fluctuations in short-term climate (seasons to years), and how human behavior can be (or why it may not be) affected based on information about variability in the climate system. http://elrino-northwest.labworks.org

- ***Impact of Reservoir Operating Strategies on Resident Fish*** - Mr. Vail has employed several models to assess the impact on resident fish species of a variety of reservoir operating strategies. This study was undertaken as part of the Columbia Basin System Operation Review process. Mr. Vail helped define the values and value measures of the Resident Fish Work Group.

- ***Multiobjective Optimization*** - Mr. Vail was the project manager of an effort to assess the multiobjective optimization needs of Bonneville Power Administration. Objectives included: hydropower, resident fish, anadramous fish, irrigation, flood control, wildlife, and navigation. Mr. Vail developed definitions of the canonical mathematical form of each of these objectives. The resulting multiobjective statement will be used to define the required optimization tools.

- ***Integrated Environmental Monitoring Initiative*** - Mr. Vail was a co-principal investigator for the Integrated Environmental Monitoring Initiative. The objective of this initiative was to develop and demonstrate a comprehensive interdisciplinary methodology targeted to improve the effectiveness of environmental monitoring and restoration activities. This objective required comprehensive integration of monitoring regimes, analytical practices, design methodologies, and compliance needs.

- ***Coupled Simulation/Optimization of Ground Water Remediation*** - Mr. Vail developed a computer code that coupled a ground water flow model with an optimization procedure. The code was able to provide estimates of the pumping/injection rates that would mitigate or remove a plume at minimal cost.

- ***Simulation of Watershed Hydrologic Responses to Alternative Climates*** - Mr. Vail was the principal investigator of a project studying the impacts of global climate change on the hydrologic response of a watershed. The results of hydrologic simulations using distributed snowmelt and soil moisture accounting algorithms were graphically compared via video displays of daily simulated snow water equivalent, soil moisture, and runoff for the American River, Washington, which drains 204 square kilometers of the east slopes of the Cascade Mountains, Washington. Snow water equivalents and snowmelt were simulated using a simplified distributed temperature-index model augmented with seasonally estimated net solar radiation. A classification scheme was used to partition the empirical cumulative probability distributions

of precipitation (rain plus melt) and a topographic index over the basin into groups of near-equal membership. Topographically-based soil moisture capacities were assumed for each class and were estimated via automated calibration methods using historical data. The simulated soil moisture and snow water accumulations for each class were geographically mapped for visualization. Tests of the effect of alternative, warmer climates on snow accumulation, the seasonal distribution of soil moisture, and runoff were conducted by adjusting historical (daily) temperature and precipitation and repeating the analysis.

- ***Pacific Northwest Climate Change Case Study - Water Resource Impacts*** - Mr. Vail was investigating the effects of global climate change on water resources of the Pacific Northwest. Spatially distributed snowmelt, soil moisture, and runoff models have been combined with a graphics visualization package to understand the changes in snowpack, soil moisture, and evapotranspiration over time. A weather classification scheme has been developed which estimates point precipitation as a function of large-scale atmospheric variables. This allows the synthesis of point precipitation given large-scale meteorological information as might be produced by GCM simulations. Orographic effects also have a significant role in defining climate at the watershed scale. Efforts underway to develop a scientific basis to extend the sparse meteorological measurements available for any watershed in order to estimate the spatial distribution of precipitation, temperature, and wind speed within the watershed. A reservoir network model for the Columbia River Basin has been aggregated to fourteen nodes. This network model will be driven by a collection of index watersheds. A daily hydroclimatological data set has been developed to aid in the selection of index watersheds.

- ***Acid Rain Watershed Modeling Project*** - Mr. Vail directed the hydrologic part of a study to evaluate and apply several coupled hydrology/geochemical codes that were developed to model the impact of acid rain on surface water chemistry. The project involved extensive behavior and sensitivity analyses of three coupled geochemical/hydrological simulation codes.

- ***Incineration at Sea*** - The objective of this project was to assess the impact of incinerating toxic waste at sea on the aquatic environment. Mr. Vail developed a model on an IBM-PC to estimate the concentration of contaminant in the ocean.

- ***Aquifer Thermal Energy Storage*** - The objective of this project was to develop and apply computer codes that would simulate the trade-offs between different management policies of an Aquifer Thermal Energy Storage system. Mr. Vail independently developed, validated, and applied several computer codes for this purpose.

- ***Flow and Fractured Media*** - The objective of this study is to develop a state-of-the-art predictive capability for flow and transport in saturated fractured media. Mr. Vail was responsible for implementing, modifying, and testing a computer code that models steady flow in permeable media with discrete fractures. Mr. Vail has also developed a computer code that models steady flow through fractures in an impermeable rock mass. The fractures can either be specified or generated via Monte Carlo Methods. This code was applied in an investigation of the potential impact of a nuclear meltdown on groundwater.

- ***Modeling Flow With Certainty in Hydraulic Parameters*** - The objective of this study is to develop a methodology to analyze the uncertainty in predicting piezometric surfaces caused by uncertainty in groundwater flow parameters. Mr. Vail developed a computer code that couples perturbation and finite-element techniques to estimate the mean and variance of the piezometric surface.

- ***Stripa Mine Hydrogeologic Characterization*** - The objective of this study was to perform three-dimensional simulations with the CFEST code for ground water flow at the Stripa Mine in Sweden. Mr. Vail was the Battelle project manager of this effort.

PUBLICATIONS

Coleman A, LW Vail, and A Savery. 2005. "Landscape Classification for Assessment of Impacts of Landuse and Climate on Water Resources." Presented by Andre M Coleman (Invited Speaker) at 25th Annual Environmental Systems Research Institute International User Conference, San Diego, CA on July 25, 2005. PNWD-SA-7118.

Prasad R, LW Vail, CB Cook, and G Bagchi. 2005. "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America." Presented by Rajiv Prasad (Invited Speaker) at IAEA-India External Flooding Hazards Workshop , Kalpakkan, Tamil Nadu on August 29, 2005. PNNL-SA-46005.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch**.** 2005. "Benefits and Costs of Options to Mitigate the Uncertain Effects of Climate Change on Irrigated Agriculture in the Yakima Basin. What Matters? What Doesn't?" Presented by Michael J. Scott (Invited Speaker) at 39th Annual Pacific Northwest Regional Economic Conference, Bellingham, WA on May 20, 2005. PNWD-SA-6980.

Scott MJ, LW Vail, and R Prasad. 2005. "Managing Water for Irrigated Agriculture Under Extended Climate-Related Drought." Presented by Micahel J. Scott at American Water Resources Association 2005 Annual.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch. 2005. "Benefits and Costs of Options to Mitigate the Uncertain Effects of Climate Change on Irrigated Agriculture in the Yakima Basin. What Matters? What Doesn't?" Presented by Michael J. Scott (Invited Speaker) at Pacific Northwest Regional Economic Conference, Bellingham, WA on May 20, 2005. PNWD-SA-6902.

Vail LW**.** 2005. "Adaptive Management of Water Resources in the Puget Sound." Presented by Lance W. Vail (Invited Speaker) at Puget Sound Georgia Basin Research Conference, Seattle, WA on March 29, 2005. PNNL-SA-44581.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch. 2005. "Adapting Irrigated Agriculture to Climate Variability and Change." Presented by Michael J. Scott (Invited Speaker) at 2005 Annual Meeting, American Association for the Advancement of Science , Washington, DC on February 20, 2005. PNWD-SA-6848.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch. 2005. "Adapting Irrigated Agriculture to Climate Variability and Change." Presented by Michael J. Scott (Invited Speaker) at 2005 American Association for the Advancement of Science Annual Meeting, Washington, DC on February 20, 2005. PNWD-SA-6743.

Scott MJ, LW Vail, and R Prasad. 2005. "Managing Water for Irrigated Agriculture Under Extended Climate-Related Drought." Presented by Michael J. Scott (Invited Speaker) at American Water Resources Association 2005 Annual Conference, Seattle, WA on November 8, 2005. PNNL-SA-47342.

Scott MJ, LW Vail, CO Stockle, and A Kemanian. 2005. "Impacts of Water Availability on Washington Agriculture in a Changing Climate." Presented by Michael J. Scott (Invited Speaker) at 2005 Fall Climate Change Conference, Seattle, WA on October 27, 2005. PNNL-SA-47128.

Meza EP, and LW Vail. 2005. Real-time Harvesting of Distributed Environmental Data for Improved Management of Complex Distributed Water and Power Management Systems . PNNL-15333, Pacific Northwest National Laboratory, Richland, WA.

Prasad R, LW Vail, CB Cook, and G Bagchi**.** 2005. "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America". In Proceedings of International Workshop on External Flooding Hazards at Nuclear Power Plant Sites (tentative; title yet to be finalized by IAEA). PNNL-SA-46268, Pacific Northwest National Laboratory, Richland, WA.

Coleman A, LW Vail, and A Savery. 2005. "Landscape Classification for Assessment of Impacts of Landuse and Climate on Water Resources." PNWD-SA-7118, Battelle—Pacific Northwest Division, Richland, WA.

Prasad R, LW Vail, CB Cook, and G Bagchi. 2005. "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America." PNNL-SA-46005, Pacific Northwest National Laboratory, Richland, WA.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch**.** 2005. "Benefits and Costs of Options to Mitigate the Uncertain Effects of Climate Change on Irrigated Agriculture in the Yakima Basin. What Matters? What Doesn't?" PNWD-SA-6902, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch. 2005. "Benefits and Costs of Options to Mitigate the Uncertain Effects of Climate Change on Irrigated Agriculture in the Yakima Basin. What Matters? What Doesn't?" PNWD-SA-6980, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, and R Prasad**.** 2005. "Managing Water for Irrigated Agriculture Under Extended Climate-Related Drought." PNWD-SA-6946, Battelle—Pacific Northwest Division, Richland, WA.

Vail LW. 2005. "Adaptive Management of Water Resources in the Puget Sound." PNNL-SA-44581, Pacific Northwest National Laboratory, Richland, WA.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch. 2005. "Adapting Irrigated Agriculture to Climate Variability and Change." PNWD-SA-6848, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, CO Stockle, and A Kemanian**.** 2005. "Climate Change and Adaptation in Irrigated Case Study of the Yakima River ." American Association for the Advancement of Science, Portland, OR.

Cook, CB, LW Vail, and DL Ward. 2005. "North Anna Early Site Permit Water Budget Model (LakeWBT) for Lake Anna". PNNL-14944, Pacific Northwest National Laboratory, Richland, WA.

Pennell WT, LR Leung, MS Wigmosta, and LW Vail. 2004. "Prospects for Adapting to Near-Term Climate Change: The Yakima River Example ." Presented by William T. Pennell (Invited Speaker) at American Water Resource Association's annual state conference, Seattle, WA on October 28, 2004. PNNL-SA-43189.

Scott MJ, JA Jaksch, and LW Vail. 2004. "Water Exchanges: Tools to Beat Climate Variability." Journal of the American Water Resources Association 40(1):15-31.

Scott MJ, LW Vail, R Prasad, and JA Jaksch. 2004. "Can WE Use Long-Lead Climate Forecasts to Operate the Pacific Northwest Rivers Better?" PNWD-SA-6512, Battelle – Pacific Northwest Division, Richland, WA.

RL Skaggs, LW Vail, and SA Shankle. 2003. "Operationalizing Adaptive Management for Water Supply Planning: Sustaining Mexico City's Water Supply." In Urban Water Supply Infrastructure Management Handbook. J. Wiley. New York, NY.

Burke JS, GR Danielson, DA Schulz, and LW Vail. 2002. " Parallel computing for automated model calibration." vol. XVIII, pp. 424-429. The 6th World Multiconference on Systemics, Cybernetics, and Informatics (SCI 2002), Orlando, FL.

Scott MJ, LW Vail, and A Kemanian. 2002. "Integrated Impact of Climate Warming on Yakima Valley Water Demand and Availability." PNWD-SA-5613, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, JA Jaksch, CO Stockle, and A Kamenian. 2002. "Early Warning of ENSO Events For Regional Agriculture." PNWD-SA-5834, Battelle—Pacific Northwest Division, Richland, WA.

Skaggs R, and LW Vail. 2002. "Adaptive Management Platform: Approach and Application." PNNL-SA-36755, Pacific Northwest National Laboratory, Richland, WA.

Vail LW. 2002. "Adaptive Management in Nooksak River, Wa Flow Selection." PNNL-SA-36605, Pacific Northwest National Laboratory, Richland, WA.

Vail LW, and R Skaggs. 2002. "Adaptive Management Platform for Natural Resources in the Columbia River Basin." PNNL-13875, Pacific Northwest National Laboratory, Richland, WA.

Vail LW, and R Skaggs. 2002. "Integrated Process Modeling to Assess Performance of Salmon Recovery Strategies." PNNL-13903, Pacific Northwest National Laboratory, Richland, WA

Vail LW, MS Wigmosta, R Prasad, and CK Knudson. 2002. "Accelerated Climate Prediction Initiative." PNNL-SA-36759, Pacific Northwest National Laboratory, Richland, WA.

Ramsdell JV, K Rhoads, CA Brandt, LW Vail, PR Nickens, PL Hendrickson, DA Neitzel, and EE Hickey. 2001. "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 3 Regarding Arkansas Nuclear One, Unit 1." PNNL-13473, Pacific Northwest National Laboratory, Richland, WA.

Scott MJ, LW Vail, and CK Knudson. 2001. "El Nino and the Yakima Valley." PNWD-SA-5597, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, JA Jaksch, and LW Vail. 2001. "Water Exchanges: Tools to Beat Climate Variability." PNWD-SA-5425, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, A Kemanian, and CO Stockle. 2001. "Integrated Impact of Climate Warming on Irrigated Crop Production." PNWD-SA-5468, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, JA Jaksch, CO Stockle, and A Kemanian. 2001. "Integrated Impact of Climate Warming on Irrigated Crop Production." PNWD-SA-5596, Battelle—Pacific Northwest Division, Richland, WA

Skaggs R, LW Mays, and LW Vail. 2001. "Application of Enhanced Annealing to Ground Water Remediation Design." Journal of the American Water Resources Association 37(4):867-875

Skaggs R, LW Mays, and LW Vail. 2001. "Simulated Annealing With Memory and Directional Search for Ground Water Remediation Design." Journal of the American Water Resources Association 37(4):853-866.

Vail LW, EA Jenne, HL Diefenderfer, WR Barchet, and LF Hibler. 2001. "Assessment of pH-Impaired Lakes for TMDL Development in New York State." PNWD-SA-5234, Battelle—Pacific Northwest Division, Richland, WA.

Vail LW, HL Diefenderfer, CK Knudson, and JD Carroll. 2001. "Assessment of pH-Impaired Lakes for TMDL Development in New York State." PNNL-SA-35658, Pacific Northwest National Laboratory, Richland, WA.

Vail LW. 2001. "Application of Fuzzy Logic in Estimating Impact of Water and Land use Practices on Aquatic Habitat Diversity ." PNNL-SA-34213, Pacific Northwest National Laboratory, Richland, WA

Vail LW. 2001. "Drought 2001 Water Management Implications for the Yakima River Basin." PNWD-SA-5326, Battelle—Pacific Northwest Division, Richland, WA.

Vail LW, JA Jaksch, and CO Stockle. 2001. "Regional Climate Forecasts and Water Markets in Irrigated Agriculture." PNWD-SA-5375, Battelle—Pacific Northwest Division, Richland, WA.

Vail LW, MS Wigmosta, and R Prasad. 2001. "Impact of Climate on Aquatic Habitat in the Yakima River." PNNL-SA-35194, Pacific Northwest National Laboratory, Richland, WA.

Vail LW. 2001. "Adapting to Climate Change in the Yakima Basin." PNWD-SA-5488, Battelle—Pacific Northwest Division, Richland, WA.

Vail LW. 2001. "Impact of Climate on the Lower Yakima Basin." PNWD-SA-5489, Battelle—Pacific Northwest Division, Richland, WA

Kincaid CT, MP Bergeron, CR Cole, MD Freshley, VG Johnson, DI Kaplan, R Serne, GP Streile, DL Strenge, PD Thorne, LW Vail, GA Whyatt, and SK Wurstner. 2000. "Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site, Southeast Washington." In Environmental Toxicology and Risk Assessment: Recent Achievements in Environmental Fate and Transport Vol. 9; STP 1381, ed. Fred T. Price, Kevin V Brix, and Nancy K. Lane, pp. 104 - 117. Am. Soc. For Testing and Materials, West Conshohocken, PA

Scott MJ, LW Vail, JA Jaksch, KK Anderson, and CO Stockle. 2000. "Climate Forecasts and Water for Regional Irrigated Agriculture ." PNWD-SA-5050, Battelle—Pacific Northwest Division, Richland, WA.

Scott MJ, LW Vail, JA Jaksch, and KK Anderson. 2000. "Considerations for Management of Irrigation Water with Climate Variability ." PNWD-SA-5069, Battelle—Pacific Northwest Division, Richland, WA.

Rosenberg NJ, DJ Epstein, D Wang, LW Vail, R Srinivasan, and JG Arnold. 1999. "Possible Impacts of Global Warming on Hydrology of the Ogallala Aquifer Region." Climatic Change 42(4):677-692.

Bergeron MP, CR Cole, MD Freshley, NL Hassig, DI Kaplan, CT Kincaid, R Serne, GP Streile, DL Strenge, PD Thorne, LW Vail, GA Whyatt, and SK Wurstner. 1998. "Composite Analysis for Low-Level Waste Disposal in the 200-Area Plateau of the Hanford Site." PNNL-11800, Pacific Northwest National Laboratory, Richland, WA.

Geist, D, LW Vail, and DJ Epstein. 1996. "Analysis of Potential Impacts to Resident Fish From Columbia River System Operation Alternatives." Environmental Management 20 (2) :275-288.

Jenne, EA., SE Faulk, LW Vail, JP Zipperer, M. I. McKinley. 1994. "H_20TREAT Version 2.0 User's Manual: An Aid for Evaluating Water Treatment Requirements for Aquifer Thermal Energy Storage." In Proceedings of International Symposium on Aquifer Thermal Energy Storage. November 14-15, 1994, The University of Alabama, Tucaloosa.

Leung L, MS Wigmosta, SJ Ghan, JL Epstein, and LW Vail. 1996. "Application of a Subgrid Orographic Precipitation/Surface Hydrology Scheme to a Mountain Watershed." Journal of Geophysical Research 101:12,803-12,817

Leung L, MS Wigmosta, SJ Ghan, and LW Vail. 1994. "Regional Modeling of Climate-Hydrology Interactions." No clearance number available, Pacific Northwest National Laboratory, Richland, WA.

Vail, LW, and EA Jenne. 1994. "Optimizing the Design and Operation of Aquifer Thermal Energy Storage Systems." In Proceedings of International Symposium on Aquifer Thermal Energy Storage. November 14-15, 1994, The University of Alabama, Tucaloosa.

Brown, DR, KK Humphreys, and LW Vail. 1993. "Carbon Dioxide Control Costs for Gasification Combined-Cycle Plants in United States." PNL-SA-22634, Pacific Northwest Laboratory, Richland, Washington.

Scott, MJ, RD Sands, LW Vail, JC Chatters, DA Neitzel, and SA Shankle. 1993. "Effects of Climate Change on Pacific Northwest Water-Related Resources: Summary of Preliminary Findings." PNL-8987, Pacific Northwest Laboratory, Richland, Washington.

Vail, LW, EA Jenne, JP Zipperer, MI McKinley. 1993. "H_2O-TREAT User's Manual: An Aid for Evaluating Water Treatment Requirements for Aquifer Thermal Energy Storage Systems." PNL-8504, Pacific Northwest Laboratory, Richland, Washington.

Wigmosta, MS., DP Lettenmaier, and LW Vail. 1993. "A Distributed Hydrology-Vegetation Model for Mountainous Catchments." In Proceedings of Workshop on Distributed Hydrologic Modeling. July 1992, Venice Italy. International Association of Hydrologic Science. PNL-SA-23540, Pacific Northwest Laboratory, Richland, Washington.

Geist, DR, LW Vail, and D Daley. 1992. "Screening Analysis of Columbia River System Operation Alternatives for the Resident Fish Work Group." PNL-SA-10687, Pacific Northwest Laboratory, Richland, Washington.

Lettenmaier, DP, KL Brettman, and LW Vail, SB Yabusaki, and MJ Scott. 1992. "Sensitivity of Pacific Northwest Water Resources to Global Warming." Northwest Environmental Journal, 8:265-283. University of Washington, Seattle, Washington.

Vail, LW, EA Jenne, and LE Eary. 1992. "H_2O-TREAT: An Aid for Evaluating Water Treatment Requirements for Aquifer Thermal Energy Storage." Presented at the IECEC Conference. August 3-4, 1992, San Diego, California.

Vail, LW, MS Wigmosta, and DP Lettenmaier. 1992. "Influence of Vegetation, Topography, and Climate on Hydrologic Processes in a Mountainous Catchment." PNL-SA-20673A, Pacific Northwest Laboratory, Richland, Washington.

Wigmosta, MS, LW Vail, DP Lettenmaier. 1992. "Simulations of Distributed Lard Surface Fluxes and Runoff from a Mountainous Drainage Basin." Presented at the 1992 Fall Meeting of America Geophysical Union, San Francisco, California.

Eary, LE, EA Jenne, LW Vail, and DC Girvin. 1991. "Recovery of the Highly Acidified Clearwater Lake Watershed, Ontario, Canada, Simulated with ILWAS Model." Applied Geochmistry. 6:613-634.

Yabusaki, SB, LW Vail, and DP Lettenmaier. "Impact of Global Climate Change on the Water Resources of the Pacific Northwest." Presented at Hydrology Days 1991. Fort Collins, Colorado.

Lettenmaier, DP, KL Brettman, and LW Vail. 1990. "Robustness of a Multiple-Use Reservoir to Seasonal Runoff Shifts Associated with Climate Change." PNL-SA-18266, Pacific Northwest Laboratory, Richland, Washington.

Vail, LW, DP Lettenmaier, and SB Yabusaki. 1990. "Simulations of Hydrologic Response of Mountainous Catchment to Alternative Climate." Presented at Fall American Geophysical Union Conference, San Francisco, California. PNL-SA-18582, Pacific Northwest Laboratory, Richland, Washington.

Eary, LE, EA Jenne, LW Vail and DC Girvin. 1989. "Numerical Models for Predicting Watershed Acidification." Archives of Environmental Contamination and Toxicology.
18:29-53.

Vail, LW. 1989. "ATES/Heat Pump Simulations Performed with the ATESSS Code." In Proceedings of the Third Workshop on Solar-Assisted Heat Pumps with Ground-Coupled Storage. January 16-18, 1988, Gothenborg, Sweden.

Vail, LW. 1989. "Status of Numerical Models for ATES." In U.S. Department of Energy Thermal Energy Storage Research Activities Review, 1989 Proceedings. March 15-17, 1989, New Orleans, Louisiana. CONF-89-0351.

Jenne, EA, LF Eary, LW Vail, DC Girvin, MJ Monsour, LF Hibler, TB Miley, and A Liebetrau. 1988. "An Interim Report on Evaluation and Analysis of Dynamic Watershed Acidification Models (Magic II, ETD, and ILWAS)." Prepared for the U.S. Environmental Protection Agency, Washington, D.C.

Kannberg, LD, and LW Vail. 1988. "Stratigraphy Effects on Energy Recovery for Aquifer Thermal Energy Storage." STES Newsletter 10:3. International Council for Thermal Energy Storage, Public Works Canada, Ottawa Canada.

Dauble, DD, RM. Ecker, LW Vail, and DA Neitzel. 1987. "Downstream Extent of the N. Reactor Plume." PNL-6310, Pacific Northwest Laboratory, Richland, Washington.

Dauble, DD, LW Vail, and DA Neitzel. 1987. "Evaluation of the Potential for Fish Passage through the N. Reactor and Hanford Generating Project Discharges." PNL-6309, Pacific Northwest Laboratory, Richland, Washington.

Droppo, JG, LW Vail, and RM Ecker. 1987. "Final Report on INSEA User's Manual, Environmental Performance Model of Incineration-At-Sea Operations." Prepared for the U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

Gale, JR, Macleod, J Whelan, CR Cole, and LW Vail. 1987. "Hydrogeological Characterization of the Stripa Site." SKB-87-15, Swedish Nuclear Fuel and Waste Management, Stockholm, Sweden.

Shafer, JM, and LW Vail. 1987. "Screening Method for Contaminant Plume Control." Journal of Water Resource Management and Planning Division, American Society of Civil Engineers 113:3, May 1987.

Droppo, JG, LW Vail, CJ English, and RM Ecker. 1986. "Technical Support for the Ocean Incineration Regulation Model, Part 1 - Review and Recommendations, Part 2 - Revised Model." Prepared for the U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

Cole, CR, LW Vail, GM Petrie, and RL Skaggs. 1985. "Ground Water Modeling on Small Computers: Past, Present, and Future," BN-SA-2074. In Proceedings of ASCE Hydraulics Division Conference. August 13-16, 1985, Orlando, Florida.

Onishi, Y, RM Ecker, DS Trent, SB Yabusaki, and LW Vail. 1985. "Oceanographic Modeling of Beaufort Sea in Relation to the Proposed Lisborne Development." Volumes I and II. Prepared for ARCO Alaska, Inc. by Battelle, Pacific Northwest Laboratories, Richland, Washington.

Vail, LW, LD Kannberg, and CT Kincaid. 1985. "A Computer Code for Analyzing the Performance of Aquifer Thermal Energy Storage Systems." In Proceedings of International Conference on Energy Storage for Building Heating and Cooling. September 22-27, 1985, Toronto, Ontario, Canada. PNL-SA-12870, Pacific Northwest Laboratory, Richland, Washington.

Kincaid, CT, LW Vail, and JL Devary. 1983. "Stochastic Ground Water Flow Analysis - FY81 Status Report." PNL-4025, Pacific Northwest Laboratory, Richland, Washington.

Vail, LW, and CT Kincaid. 1983. "A Simple Areal Flow Model: A Screening Tool for Managing Aquifer Thermal Energy Storage Systems." In Proceedings of International Conference on Subsurface Heat Storage. June 6-8, 1983, Stockholm, Sweden. PNL-SA-11126, Pacific Northwest Laboratory, Richland, Washington.

Vail, LW, and CT Kincaid. 1983. "Numerical Model for Analysis of Multiple Well ATES Systems." In Proceedings of the DOE Physical and Chemical Energy Storage Annual Contractors' Review Meeting. September 12-14, 1983, Arlington, Virginia. CONF-830974.