

Paul D. Thorne
Statement of Professional Qualifications

Senior Research Scientist with the Environmental Systems Group, Earth Systems Science Department, Pacific Northwest National Laboratory, Richland, WA.

Education:

M.S. Degree, Hydrology/Hydrogeology, University of Arizona, 1983.

B.S. Degree, Chemistry/Mathematics, University of Utah, 1977.

Qualifications:

Mr. Thorne has over 35 years of experience in hydrogeology. His current work focuses on understanding and modeling hydrogeologic systems and analyzing fluid flow in the subsurface. He also has considerable experience in testing wells up to 1000 m deep to determine aquifer flow and storage properties. He has built numerous geologic models that support numerical modeling of fluid flow, contaminant transport, and seismic hazards modeling. Mr. Thorne has also contributed to development of innovative aquifer testing techniques. He has developed hydrogeologic models used to predict DNAPL migration at superfund sites and has experience addressing uncertainty in conceptual models of groundwater flow and contaminant transport. Mr. Thorne has supported the U.S. NRC on issues related to groundwater protection at radioactive waste sites and to determine environmental impacts of planned nuclear power plants.

Employment History and Selected Projects:

August 1990 to Present — Pacific Northwest National Laboratory, Richland, WA.

Mr. Thorne currently works on site characterization, well testing, and modeling related to investigations of fluid flow in the subsurface. He is helping to plan tests for hydrogeologic characterization of a proposed 5,000 m deep borehole. He worked on building a groundwater flow model of the area encompassing the damaged Fukushima Daiichi Nuclear Plant. Mr. Thorne is also participating in research on underground sequestration of CO₂ and has performed reservoir flow tests at four different field sites. He has developed three-dimensional models used for predicting movement of CO₂ and groundwater contaminant plumes. His work includes defining aquifer structure, quantifying aquifer flow properties, and identifying sources and magnitude of groundwater recharge and discharge..

September 1988 to August 1990 — Solexperts A.G., Schwertzenbach, Switzerland.

Mr. Thorne worked for a small Swiss firm specializing in geotechnical instrumentation and consulting. He contributed to investigations of potential disposal sites for radioactive waste in Switzerland. He worked on planning and design of an aquifer test program for a medium-level radioactive waste disposal site and was in charge of quality control for the testing of an 1100-meter deep borehole. He also developed tracer test methods and equipment for hydraulic characterization of an underground "ventilation test" site at the Grimsel underground laboratory, and developed a strategy for measuring the inflow of water and natural gas to an exploratory tunnel. He managed a project to determine the potential for

natural gas inflow at a tunneling site.

January 1986 to August 1988 — Rockwell/Westinghouse Hanford Company, Richland, WA.

Mr. Thorne continued to work on aquifer testing of deep boreholes and other hydrogeologic investigations for the Basalt Waste Isolation Project (BWIP). Responsibilities included designing and conducting hydraulic tests in boreholes up to 1000-meters in depth. He also supervised the installation of multiple-level piezometer systems in deep boreholes.

September 1981 to August 1986 — Pacific Northwest National Laboratory, Richland, WA.

Mr. Thorne worked on the Basalt Waste Isolation Project (BWIP) groundwater investigations with responsibility for aquifer testing in deep boreholes. He also conducted groundwater investigations and remediation projects four hazardous waste sites at four different U. S. Military bases. This work included design and installation of monitoring well networks, aquifer testing, groundwater sampling, and analysis and interpretation of data.

Technical Specialties:

- Testing and analysis of fluid flow in geologic formations
- Modeling of aquifers and subsurface flow
- Characterization and remediation of groundwater contamination
- Modeling of subsurface geologic structure for seismic hazard modeling
- Scientific Programming (Computers)

Selected Publications:

Frankel, A, PD Thorne, and AC Rohay. 2014. "Three-Dimensional Ground-Motion Simulations of Earthquakes for the Hanford Area, Washington." U.S. Geological Survey Open-File Report 2013-1289.

Vermeul VR, A Bonneville, ME Kelley, RD Mackley, CE Strickland, PD Thorne, and MD Williams. 2014. FutureGen 2.0 – CO2 Pipeline and Storage Project Testing and Monitoring Plan . PNWD-4428, Battelle—Pacific Northwest Division, Richland, WA.

Spane FA, EC Sullivan, PD Thorne, and ME Kelley. 2013. "Integration of Selected Wireline Logs, Core Analysis, and Hydrologic Testing Results for Detailed Reservoir Permeability Characterization: Results for the FutureGen Pilot Borehole." 12th Annual Carbon Capture Utilization & Sequestration Conference. PNWD-SA-10115.

Thorne PD, MA Chamness, CL Davidson, JA Horner, BP McGrail, SP Reidel, and FA Spane. 2012. "Feasibility of Storing Surplus Wind Energy in Deep Geologic Formations in the Pacific Northwest." AGU Science Policy Conference 2012, Washington D.C., DC. PNWL-SA-86185.

Thorne PD, and FA Spane. 2011. "Hydrogeologic Characterization of a CO2 Injection Pilot Borehole Within the Columbia River Basalts." GSA Rocky Mountain/Corilleran Joint Section Meeting, Logan, UT. PNWD-SA-9302.

- Bjornstad BN, PD Thorne, BA Williams, GV Last, GS Thomas, MD Thompson, JL Ludwig, and DC Lanigan. 2010. Hydrogeologic Model for the Gable Gap Area, Hanford Site . PNNL-19702, Pacific Northwest National Laboratory, Richland, WA.
- Serne RJ, BN Bjornstad, JM Keller, PD Thorne, DC Lanigan, JN Christensen, and GS Thomas. 2010. Conceptual Models for Migration of Key Groundwater Contaminants Through the Vadose Zone and Into the Upper Unconfined Aquifer Below the B-Complex . PNNL-19277, Pacific Northwest National Laboratory, Richland, WA.
- Thorne PD. 2008. Solid Earth Model of the 100-K Area at the Hanford Site, Washington . PNNL-17557, Pacific Northwest National Laboratory, Richland, WA.
- Thorne PD. 2007. Summary of Hydrogeology and Evaluation of Existing Groundwater Monitoring Wells for Outfalls 002 and 003 at the Columbia Generating Station . PNWD-3845, Battelle—Pacific Northwest Division, Richland, WA.
- Oostrom M, MJ Truex, PD Thorne, and TW Wietsma. 2007. "Three-Dimensional Multifluid Flow and Transport at the Brooklawn Site near Baton Rouge, LA: A Case Study." *Soil & Sediment Contamination* 16(2):109-141.
- Thorne PD, MP Bergeron, MD Williams, and VL Freedman. 2006. Groundwater Data Package for Hanford Assessments . PNNL-14753 Rev. 1, Pacific Northwest National Laboratory, Richland, WA.
- Thorne, PD. 2005. "Groundwater Modeling" in Hanford Site Groundwater Monitoring for Fiscal Year 2004: Hartman, M. J., L. F. Morasch and W. D. Webber (eds.), PNNL-15070, Pacific Northwest National Laboratory, Richland, Washington.
- Vermeul VR, MP Bergeron, PE Dresel, EJ Freeman, RE Peterson, and PD Thorne. 2005. Evaluation of the Fate and Transport of Tritium Contaminated Groundwater from the 618-11 Burial Ground. PNNL-15293, Pacific Northwest National Laboratory, Richland, WA.
- Murray CJ, Y Chien, and PD Thorne. 2004. A Geostatistical Analysis of Historical Field Data on Tritium, Technetium-99, Iodine-129, and Uranium . PNNL-14618 , Rev. 0, Pacific Northwest National Laboratory, Richland, WA.
- Neitzel DA, et al. 2004. Hanford Site National Environmental Policy Act (NEPA) Characterization Report . PNNL-6415 Rev. 16, Pacific Northwest National Laboratory, Richland, WA.
- Spane, FA, PD Thorne and LC Swanson. 1996. "Applicability of Slug Interference Tests for Hydraulic Characterization of Unconfined Aquifers: (2) Field Test Examples," *Groundwater*, 34(5), 925-933.
- Thorne, PD, MA Chamness and SK Wurstner. 1995. "A Three-Dimensional Conceptual Model of Groundwater Flow at the Hanford Site," 1st Symposium on the Hydrogeology of Washington State, Washington State Department of Ecology, Olympia, Washington.
- Thorne, PD. 1994. Sitewide Remedial Investigation Report for Eielson Air Force Base, Alaska. Prepared for the U.S. Air Force by Pacific Northwest Laboratory, Richland, Washington.
- Hoehn, E, Th Fierz, and P Thorne. 1990. Hydrogeological Characterisation of the Migration Experimental Area at the Grimsel Test Site, PSI Bericht 60, Paul Scherrer Institute, Villigen, Switzerland.

Thorne, PD, and FA Spane. 1985. "A Comparison of Under-Pressure and Over-Pressure Pulse Tests Conducted in Low-Permeability Basalt Horizons at the Hanford Site, Washington State," Proc. 17th International Congress, International Assoc. of Hydrogeologists, Tucson, Arizona, Jan. 7-12, 1985.