

## EXPERIENCE SUMMARY

Ms. Uhlman is a nationally recognized hydrogeologist specializing in aquifer characterization, water resource management and protection, compliance, and groundwater modeling. Her professional experience includes the management of multi-disciplinary projects involving site characterization, geologic data acquisition and analysis, mine site restoration, aquifer vulnerability assessment, and CERCLA / RCRA compliance. Additionally, Ms. Uhlman has developed innovative field investigatory techniques, generated litigation quality field protocol and standard operating procedures, and provided expert testimony on hydrogeologic issues. Her aquifer characterization experience includes subsurface exploration in many geologic settings, including the arid regions of the Middle East and the Southwestern United States, glacial outwash aquifers, fractured bedrock, karst, and coastal areas susceptible to salt-water intrusion.

## CURRENT: ASSOCIATE RESEARCH SCIENTIST

Bureau of Economic Geology, University of Texas at Austin: research addressing fate and transport of methane in groundwater, impact to drinking water wells by oil/gas development.

## PROJECT EXPERIENCE – WATER RESOURCES

For the *Arizona State Lands Department* and the Arizona State Attorney General, in corporation with the Arizona Geological Survey, managed and implemented the development of numerical simulations (MODFLOW) of groundwater resources in central Arizona to support economic valuation of water for development.

For the *California Energy Commission*, and in support of the Application for Certification of four proposed power plants, evaluated water resources in Colusa, Sacramento, San Joaquin, King, and Alameda Counties. Water resource assessments included California Aqueduct and Bureau of Reclamation contracts, and other surface water suppliers. Alternative water supplies were evaluated to support water supply needs, including providing recycled municipal wastewater from the City of Tracy to support the proposed 5,100 acre-feet/year supply to the Tesla Power Plant in Alameda County, California.

In partnership with the *Arizona Department of Environmental Quality* and *The University of Arizona Water Resources Research Center*, coordinated activities and functions of the Arizona-NEMO (Nonpoint Education for Municipal Officials) program to educate land-use decision-makers to mitigate nonpoint source pollution and protect natural resources. Responsibilities included management of the development of Watershed Based Plans, including AGWA modeling, GIS mapping, and identification of specific water quality and natural resources problems and Best Management Practices (BMPs) to address desired water quality outcomes. Design, development, and implementation of educational outreach activities across the State. [www.ArizonaNEMO.org](http://www.ArizonaNEMO.org)

*Ministry of Agriculture and Water, the Kingdom of Saudi Arabia*. Under a single status *Iqama* Ms. Uhlman supported ground water resource management and agricultural water supply development projects including characterization of ground water recharge by ephemeral flow in washes. Tasks included program design support for the construction of subsurface dams for the retention of seasonal ground water flow towards the expansion of aquifer yield. Ms. Uhlman also managed the geotechnical exploration for the expansion of the Holy Mosque, Medina, a \$900 M construction project.

## EDUCATION

**BS, Hydrology (with Distinction)**, 1974,  
*University of Arizona, Tucson, Arizona*

**M.S. Civil Engineering**, 1975, *Ohio State University, Columbus, Ohio*

**Thesis:** "Water quality and quantity for coal gasification in South East Ohio, a facility siting study"

## REGISTRATIONS

Certified Ground Water Professional, No. 244 (1988-2003) National

Registered or Licensed Geologist Oregon (2002), *Indiana* (1989), *Arizona* (2003), *Texas* (2014).

Registered Engineering Geologist, (1989) National.

## AFFILIATIONS

Appointed, Executive Editor, **Groundwater** February, 2014.

Elected Member, Board of Directors, *Scientists and Engineers Division, National Ground Water Association*, 2010- 2012

Appointed to **Arizona Water Protection Fund Commission** by Governor Janet Napolitano, October 2003 – May 2011.

Association of Ground Water Scientists and Engineers (Division of the National Ground Water Association). Appointed to Editorial Review Board **Ground Water Monitoring & Remediation** 1989 to 2003. Appointed to Assistant Editorial Review Board **Ground Water** 1990, and the Associate Board starting January 2003 - current.

Association of Engineering Geologists: Appointed to Assistant Editorial Review Board **Environmental & Engineering Geoscience** 1992 to current.

Appointed to Associate Editorial Board, **Environmental Technology** (1991- 2000).

**ASTM**, Committee D-18, *Soil and Water*, for the development of ground water modeling standards, 1989-1999.

## LITIGATION

**Expert Witness:** Testified on the interrelationship between surface and groundwater, representing the groundwater users in the Adjudication of the San Pedro River, Arizona. Superior Court of Arizona, Maricopa County. 2012

**Expert Witness:** Evidentiary Hearing on impact to water resources in application for power plant certification, California Energy Commission, State of California. 2002.

For the *City of Tucson, Arroyo Chico Multi-Use Project*, evaluated the time of travel of recharge from the Arroyo Chico Wash using isotope sampling, and verified the interrelationship between the shallow, perched ground water and the regional water supply aquifer.

*US EPA Office of Ground Water and Drinking Water, Washington, DC.* Ms. Uhlman was appointed to the committee to provide technical review of studies of Class V injection wells to satisfy a consent decree with the Sierra Club Legal Defense Fund. Study results and review comments were incorporated by the Agency to help determine regulations for specific subclasses of injection wells. Ms. Uhlman's assignment included aquifer recharge wells, spent brine injection wells, in-situ injection wells, aquifer remediation injections wells, and saltwater intrusion barrier injection wells.

*Teton County, Idaho.* Water resource assessment for the communities within the upper Teton River Watershed. Due to the reduction in ground water recharge following implementation of mechanized irrigation and increased development, this study focused on ground water management to meet future valley development. Study included GIS mapping of surface water diversions, water allocation rights, well locations, and hydrogeologic resources.

*Arizona Water Infrastructure Finance Authority.* Ground water resource assessment of the 39-square mile Peoples Valley watershed, Yarnell, Arizona. Study included GIS mapping of geologic and hydrologic features and calculation of recharge in this high-elevation desert area in central Arizona. Geophysical exploration assisted in the determination of aquifer storage capacity. Aquifer characteristics were calculated from well data, and sustainable yield was estimated to support future development.

*Plant 83, General Electric Company, Albuquerque, New Mexico.* Independent design review and QA/QC audit of ground water extraction / injection and water treatment system, including assessment and enhancement of the 3-dimension MODFLOW model used to design the system.

*Goodyear Airport, Goodyear, Arizona.* Ms. Uhlman managed all aspects of the ground water extraction / injection and water treatment system audit and repair at this CERCLA site. Included in the audit was the re-design of extraction wells to enhance recovery, and the application of new MODFLOW modeling to simulate aquifer characteristics that could not be addressed with the existing finite-element model.

*WATER AFRICA '96, Accua, Ghana.* Invited conference speaker and consultation with Kumasi Metropolitan Assembly on aquifer vulnerability indexing to protect ground water supply, including landfill and industrial facility siting.

*Phelps Dodge, Bisbee, Arizona.* Site characterization and identification of best management practices to support an aquifer protection permit at an operating copper mine. Characterization activities included isotope analysis to determine vadose travel time and leaching of acid rock drainage constituents.

*Mina Cerro Nahuatl, HYLISA – Las Encinas, Mexico.* Ms. Uhlman managed the construction of a 3-dimensional MODFLOW ground water flow model to support feasibility assessment and design of a 15 MGD dewatering system of planned open-pit iron mine expansion and development.

*Gallatin National Landfill, Fairview, Illinois.* Lead technical support and task manager for site characterization field program to design, permit, and construct a balefill on reclaimed coal-field strip mine land. Ground water modeling to support design of gradient control system and slurry walls to meet permit requirements.

**Expert Witness:** Testified on behalf of a landfill owner on subsurface DNAPL and dissolved-phase VOC contaminant transport mechanisms before the Environmental Hearing Board, Commonwealth of Pennsylvania, 1990.

**Expert Witness:** Testified on Economic Impact of Landfill Regulations before the Illinois Pollution Control Board, Illinois, 1989.

## SELECTED PUBLICATIONS

Artiola, J. F., and K. Uhlman, G. Hix. 2013. *Arizona Salt*.  
<http://cals.arizona.edu/pubs/water/SWES13>

Uhlman, K., and S. Eden, C. Rock, E. Westfall, T. Sprouse. 2012. *Effluent Dependent Streams of Arizona*.  
<http://cals.arizona.edu/pubs/water/az1562>

Uhlman, K., and D.E. Boellstorff, M. L. McFarland, B. Clayton, J. W. Smith, 2012. *Texas Well Owner Network: Well Owner's Guide to Water Supply*. Texas A&M AgriLife Extension publication B-6257

Artiola, J. F., and K. Uhlman, G. Hix. 2012. *Arizona Wells: Maintaining and Troubleshooting Wells*.  
<http://cals.arizona.edu/pubs/water/az1581>

Uhlman, K., and D.E. Boellstorff, M. L. McFarland, J. W. Smith, 2011. *Facts about Fracking....and your Drinking Water Well*. Texas A&M AgriLife Extension publication Sp-463.

Uhlman, K., and J. Artiola, 2011. *Nitrate Contamination Potential in Arizona Groundwater: Implications for Drinking Water Wells*.  
<http://cals.arizona.edu/pubs/water/az1536>

Uhlman, K., and J. Artiola, 2011. *Arizona Wells: Low Yielding Domestic Water Wells*.  
<http://cals.arizona.edu/pubs/water/az1537>

Uhlman, K., C. Jones, and R. Hill. 2009. *Well Owners Guide to Water Supply in Gila County*. <http://cals.arizona.edu/pubs/water/az1502.pdf>

Uhlman, K., C. Rock, and J. Artiola. 2009. *Arizona Drinking Water Well Contaminants*.  
<http://cals.arizona.edu/pubs/water/az1503>.

Uhlman, K., and J. Artiola. 2009. *Arizona Domestic Water Wells*.  
<http://cals.arizona.edu/pubs/water/az1504>.

Artiola, J., K. Farrell-Poe, and K. Uhlman. 2009. *Water Facts: Home Water Treatment Options*.  
<http://cals.arizona.edu/pubs/water/az1498>.

Artiola, J., and K. Uhlman. 2009. *Arizona Well Owner's Guide to Water Supply*.  
<http://cals.arizona.edu/pubs/water/az1485>.

*Wheaton Industries, Millville, New Jersey.* Directed all aspects of site characterization and ground water flow model and transport modeling at several Wheaton facilities under CERCLA compliance, including Shulton Landfill.

*Anderson Air Force Base, Guam.* Under the United States Air Force Installation Restoration Program, responsible for the technical accuracy of the hydrogeological data interpretation for the RI/FS, landfill characterization, and ground water Operable Unit in a Karst Island setting.

*Land and Lakes Municipal Landfill, Cook County, Illinois.* Directed all aspects of geochemical data analysis and hydrogeological evaluation of landfill monitoring well program.

### PROJECT EXPERIENCE – CERCLA / RCRA REMEDIATION DESIGN

*Eli Lilly Pharmaceuticals, East Lafayette, Indiana.* Managed all aspects of the development of a ground water flow model to assess contaminate transport during the design of the pump and treat operable unit.

*Tutu Well Field Superfund Site, St. Thomas, Virgin Islands.* Lead Technical Support on hydrogeological assessment of DNAPL VOC and waste oil/petroleum product transport and other releases within the water supply aquifer area.

*PPG Coatings and Resins, Columbus, Ohio.* Managed all aspects of the development of ground water flow model to assess ground water remediation of poly-type organic constituents originating from this operating chemical manufacturer under a RCRA Facility Investigation

*Pratt & Whitney, United Technologies, Southington, Connecticut.* Constructed regional 3-dimensional ground water flow model to assess facility impacts to regional water supply aquifer. Retained as expert witness to support client during litigation over alleged property damage due to subsurface transport of industrial chemicals.

For the *Berkeley Open Pit Copper Mine, Butte, Montana*, Ms. Uhlman provided an independent peer-review of the 3-dimensional MODFLOW model to assess remediation options to address acid-rock drainage impacts to the regional water supply aquifer at this CERCLA Superfund Site. Publication and presentation of the project, including at the University of Pennsylvania and at the Department of Geoengineering and Environmental Technologies, University of Cagliari, Italy.

*Beatrice / Potter [a division of Grace] Electronics, Mississippi.* Ms. Uhlman constructed and calibrated a 3-dimensional MODFLOW ground water model to assess a 13 well extraction system efficiency and to recommend well placement and operation to reduce the risk of impact to a municipal water supply well field at this RCRA Site.

*PPG Chemicals, Barberton, Ohio.* Directed all aspects of investigation and re-sealing of abandoned brine solution mining wells discharging natural gas at this CERCLA/RCRA site. Tasks included ground water assessment and isotope analysis to determine contaminant source at this operating chemical manufacturing facility that manufactured chlorinated hydrocarbons.

*ELF Atochem, Tacoma, Washington.* Supported extensive investigation into the transport and fate of arsenic and volatile organic chemicals to the Hylebos Waterway at this RCRA facility.

### SELECTED PUBLICATIONS

Schwartz, K., and K. Uhlman. 2009. *Arizona Water Map Curriculum Guide* <http://cals.arizona.edu/pubs/water/az1501>

Uhlman, K. 2008. Arizona NEMO: Integrated Watershed Management and Planning. Chapter 8 of **Watershed Management: Concepts and Experiences**. Textbook Edited by S. Menon and P.A. Pillai. Icfai University Press, Hyderabad, India. pp. 162 – 169

Uhlman, K. 2008. *Arsenic in Arizona Ground Water - Source and Transport Characteristics*. <http://cals.arizona.edu/pubs/water/az1453>

Uhlman, K., and R. Hill. 2008. *A Well Owner's Guide to Water Resources of Yavapai County*. <http://cals.arizona.edu/pubs/water/az1451>

McReynolds, K., and S. Pater, K. Uhlman. 2005. Watershed Basics Part 1: Water Resources in *Master Watershed Stewardship Guide*. <http://cals.arizona.edu/pubs/water/az1378>

Uhlman, K. 2005. *Recharge in Desert Regions Around the World*. In: **Wiley Encyclopedia of Water - Ground Water Volume**. Edited by J. Lehr and J. Keeley,

Uhlman, K. and D.P. Guertin, S.N. Miller. 2004. *Storm II: Looking for NEMO*. **Water and Wastewater Products**, pp. 52-55.

Uhlman, K., and D. Burgard, 2001. *Land Application for Natural Wastewater Treatment*. In: **Environmental Protection**, Vol. 12, No. 8. pp 28 – 30.

Uhlman, K., and W. Pendexter, 1999. Characterization of the Complex Flow Geometry of DNAPLs in the Subsurface. In: **Hazardous and Industrial Waste** edited by: Nikolaos Nikolaidis, C. Erkey, and B. Smets. CRC Press. pp. 335-343.

Uhlman, K., and G. Helland, M. Varljen, 1998. *Conceptual and MODFLOW Model Applications to Predict Ground Water Discharge to Industrialized Coastal Waterways*. Conference Proceedings, Abstract, Association of Engineering Geologists.

Uhlman, K., and W. Barner, 1998. Contaminant Transport Mechanisms in Karst Terrains. In: **Hydrology in the Humid Tropic Environment**. International Association of Hydrological Sciences (IAHS) Press Publication No. 253. pp. 327-335.

Clark, A., O. Leite, G. Steusse, K. Uhlman, D. Vance, and R. Heuchkeroth, *Remediation Technologies Resource Guide*. **Environmental Technology**, Vol. 6 Issue 7. 1997, pp. 86-101 and Vol. 7, Issue 6, 1998, pp. 83-102

*Reilly Tar and Chemical Industries, Indianapolis, Indiana.* Managed all aspects of the design and construction of a ground water extraction/gradient control system under both RCRA and CERCLA compliance, at this 120-acre DNAPL coal tar refinery and operating chemical manufacturing facility.

*Brush Wellman, Inc., Elmore, Ohio.* Directed all aspects of RCRA site characterization to evaluate deep industrial water supply well contamination by Tetrachloroethylene (PCE) and Trichloroethylene (TCE) and assess impact to the site soils and water due to recent release of PCE from an aboveground tank storage area.

*Tutu Well Field Superfund Site, St. Thomas, Virgin Islands.* Lead Technical Support on hydrogeological assessment of DNAPL VOC and waste oil/petroleum product transport and other releases within the water supply aquifer area.

### PROJECT EXPERIENCE – GROUND WATER

*East Bay Municipal Utility District Penn Mine Site, Oakland, CA.* Site characterization and expert reports prepared in anticipation of litigation regarding acid rock drainage transport concerns at the abandoned Penn Mine Site. Dye trace studies and isotope analysis assisted in determination of ARD transport in fractured rock and in completing water balance studies. Retained as the expert witness addressing the highly acidic water containing toxic concentrations of heavy metals (Pb, Cu) discharging to the municipal water supply reservoir serving the City of Oakland.

For *Basic American Foods* in Eastern Washington, Ms. Uhlman constructed a 3-dimensional ground water flow model to support the land application of food process / wastewater for irrigation. Reductions in nitrate loads were achieved by strategic irrigation well field operation to capture nitrate plumes, crop management, and recycling of reclaimed water for irrigation.

For *several Colorado Developers*, Ms. Uhlman served as project manager to determine water resource availability to meet development and design criteria under Colorado Senate Bill 213 addressing ground water rights appropriations.

*Texaco/Star Enterprise Bulk Storage Petroleum Storage Facility, Fairfax, Virginia.* Supported extensive investigation into the transport and fate of petroleum spill, presented technical findings of independent audit of remediation system efficiency in public meetings.

For *Canadian Occidental Petroleum Ltd., British Columbia, Canada* Ms. Uhlman constructed a 3-dimensional MODFLOW ground water model to predict mercury flux to Howe Sound. In addition to the risk assessment, the model was used to select and design soil and ground water remediation options. Significant tidal fluctuations of 15 to 17 feet were important to contaminant transport mechanisms and were simulated in the model.

*Expert Report:* DNAPL Manufactured Coal Gas Tar transport mechanisms and distribution and discharge to the Hudson River, City of Newburgh, New York.

*Expert Reports:* Prepared in anticipation of litigation on natural attenuation of chlorinated hydrocarbons at the Woodlawn Landfill Superfund Site, Maryland. Cost allocation review of pump and treat remediation design and alternative attenuation option, deposition by opposing counsel.

### SELECTED PUBLICATIONS

Sipe, D., M. Wilczewski, and K. Uhlman, 1996. *Application of Computer Modeling to the Environmental Remediation of the Berkeley Open Pit, Butte Cooper Mine, Montana.* Chapter 77 of **Application of Computers and Operations Research in the Mineral Industry**, Society for Mining, Metallurgy, and Exploration, Inc.

Uhlman, K., and W. Barner, 1996. *Contaminant Transport Mechanisms in Karst Terrains.* Conference Proceedings, Kingston, Jamaica.

Sipe, D., M. Wilczewski, and K. Uhlman, 1996. *Computer Model Application to Remediation of the Berkeley Open Pit, Butte Copper Mine, Montana.* Conference Proceedings and presentation, SWEMP: Cagliari, Italy.

Uhlman, K., 1995. *An Aquifer Vulnerability Indexing Approach to Provide Water Resource Protection.* Conference Proceedings and presentation, WATER AFRICA '96, Accra, Ghana. July 1996.

Uhlman, K., *The Application of Digital Models to Subsurface Remediation Design.* Conference Proceedings, GSA Annual Meeting, New Orleans, Louisiana.

Uhlman, K., and D.L. Rhode, 1995. *An Aquifer Vulnerability Indexing Approach to Address Ground Water Protection Under Colorado Senate Bill SB89-181.* Conference Proceeding, 1995 Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operations, Colorado School of Mines, Denver, Colorado.

Uhlman, K., 1995. *Communicating Digital Model Applications and Limitations to a Compliance Audience,* Conference Proceedings, **ASTM** Symposium on Subsurface Fluid-Flow (Ground Water) Modeling, Denver, Colorado.

Uhlman, K., 1995. *Strategies to Estimate Pump & Treat Cleanup Schedules.* **The National Environmental Journal**, Vol. 5, Issue 1.

Uhlman, K., and McCracken, D., 1994. *Abandoned Brine Solution Mining Wells at a RCRA Facility: Compliance Concerns.* Conference proceeding, Eastern Regional Ground Water Issues, NGWA - Burlington, Vermont.

Uhlman, K., *Ground Water Dating Locates VOC Source.* **Environmental Protection**, Vol. 3, No. 9, November 1992, pp. 56-62.

Uhlman, K., *Tritium Age Dating and The Search for DNAPLs.* Conference Proceedings Association of Engineering Geologists, Long Beach, California. October 1992.

*Expert Reports:* Prepared in anticipation of litigation on Natural Resource Damages (NRD) to the sole-source water supply aquifer of St. Thomas, Virgin Islands.

*Expert Report:* Incorporated into litigation addressing sole-source water supply aquifer, St. Croix, Virgin Islands. Fact witness deposition by opposing counsel.

*Expert Report:* To support litigation addressing damage to sensitive coral reefs due to release of drilling fluids during horizontal drilling to install communication cable, St. Croix, Virgin Islands.

*Expert Reports:* To support litigation addressing insurance recovery for CERCLA liability at eleven private industrial manufacturing sites.

*Expert Report/Affidavit:* To support litigation addressing the adjudication of the San Pedro River, Arizona.

*Love Canal, Niagara Falls, New York.* Served as task manager for the site characterization of the Love Canal by the New York Attorney General's Bureau of Environmental Protection.

*The History Channel: 'Life After People'* a new series looking at the fate of the built environment over time. Interview with Kristine Uhlman, RG. The episode "investigates how long it might take for groundwater levels and desert rivers to recover with people no longer diverting them.... and will specifically look at Phoenix, an oasis created with, and maintained by, ever increasing amounts of water." Watch online: [http://www.history.com/minisites/life\\_after\\_people](http://www.history.com/minisites/life_after_people) Season 1, Episode 5: "The Invaders". News article: <http://uanews.org/node/25647> May 14, 2009

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## SELECTED PUBLICATIONS

Uhlman, K., *The Search for DNAPLs: An Analytical Approach to Distinguish Between Long-or-Short-Term Pump-and-Treat Options*. Proceedings Hazardous Materials and Environmental Management Conference New Jersey, June 1992, pp. 183-190.

Uhlman, K., *The Geochemistry of Boron in a Landfill Monitoring Program*. **Ground Water Monitoring Review**, Vol. XI, No. 4, Fall 1991, pp. 139-143.

Uhlman, K., and Portman, M., *Ground Water Modeling Without Fear*, **Civil Engineering**, Vol. 61, No. 9, September 1991, p. 64.

Uhlman, K., and Portman, M., *Predicting the Efficiency of a Ground Water Remediation Extraction Program Using MODFLOW*. Conference Proceedings and presentation, AEG 34<sup>th</sup> Annual Meeting, September 1991.

Shields, D.C., and Uhlman, K., *Volatile Organic Compound (VOC) Transport in the Subsurface, a Case Study*. Conference Proceedings, Hazardous Material Control Research Institute, Boston Massachusetts, July 1991.

Uhlman, K., and Portman, M., *Modeling the Impact of Point of Compliance of Timing of Ground Water Corrective Action*. Conference Proceedings, Association of Ground Water Scientists and Engineers Outdoor Action Conference on Aquifer Restoration, May 1991.

Uhlman, K., *Lust Busting, Inventory and Ranking of Leaking Underground Storage Tank Incidents in Illinois*. NWWA Ground Water Management and Wellhead Protection Conference, February 1990; also presented at December 1989 ASCE – Chicago, Illinois Section luncheon.

Uhlman, K., *Hydrogeology Comes to the Surface*. **Civil Engineering**, Vol. 59, No. 4, April 1989, pp. 60-62.

Uhlman, K., *A Ground Water Modeling Effort to Simulate the Results of an Aquifer Restoration Scheme*. Proceeding of the ASCE 15<sup>th</sup> Annual specialty Conference on Critical Water Issues and Computer Applications, June 1988.

Rebholz (Uhlman), K., *Refinements to the Digital Model at Dayton, Ohio*. U.S. Geological Survey Water Resources Draft Open File Report, Columbus, Ohio, August 1977.

Whitlach, E.E., and Rebholz (Uhlman), K., *Coal Gasification in Southeastern Ohio: Water Supply and Demand – report No. 489XS*. State of Ohio Water Resources Center, Ohio State University, September 1975 Thesis to defend Masters of Engineering Degree Program.