



MICHAEL J. KING, R.G., C.E.G., C.HG.

*Gas Storage Engineering
Hydrogeology
Geological Engineering*

Michael King is a Registered Geologist, Certified Engineering Geologist, and Certified Hydrogeologist with over 35 years of experience in the fields of gas storage engineering, drilling technology, hazardous waste management, and geotechnical studies. Mr. King is also considered a leader in ground water hydrogeology involving the development, use, treatment, and protection of ground water based water supply systems in California and Nevada. His experience in gas storage engineering includes gas pressure cycle design, injection and withdraws well design, optimization of field performance, and transient well test analysis.

EDUCATION

1973 BS GEOLOGY, University of Missouri-Rolla
1975 MS GEOLOGICAL ENGINEERING, University of Missouri-Rolla

REGISTRATION/LICENSES

2010 Professional Geology No. G-0347/State of Nebraska
2001 Professional Geologist No. 256/State of Washington
2000 Professional Geologist No. 1008/State of Missouri
1999 Professional Geologist No. M64501/Alberta, Canada
1998 Professional Geologist No. 4387/State of Tennessee
1998 Professional Geologist No. 1133/State of Wisconsin
1995 Certified Hydrogeologist No. 157/State of California
1993 Certified Engineering Geologist No. 1741 / State of California
1992 Registered Geologist No. 5312 / State of California
1992 Registered Geologist No. 759 / State of Idaho

EXPERIENCE

1995- Principal Geological Engineer--The HYDRODYNAMICS Group, Edmonds, WA
1997-1998 Senior Hydrogeologist (Temp.)-Layne GeoSciences, Inc., Mission Woods, KS
1992-1994 Principal Hydrogeologist--AGS, Inc., San Francisco, CA
1988-1992 Vice President--ASE Drilling, Inc., San Carlos, CA
1987-1988 Senior Hydrogeologist--GEO/Resource Consultants, San Francisco, CA
1982-1987 Vice President--Energy Systems & Resources, Inc., Novato, CA
1978-1982 Senior Geologist--URS/John A. Blume Associates, San Francisco, CA
1975-1978 Senior Gas Engineer--Natural Gas Pipeline Company of America, Chicago, IL

PROFESSIONAL ASSOCIATIONS

American Association of Petroleum Geologists
Association of Engineering Geologists
Groundwater Resource Association of California
Navy League of the United States
Society of American Military Engineers
Society of Petroleum Engineers
U.S. Naval Institute

Association of Engineering Geologists (AEG)

- Technical reviewer for the AEG Bulletin.
- 1985 AEG: *Application of Petroleum Engineering to Analysis of Contaminated Groundwater.*

- 1987 Intersociety Energy Conversion Engineering Conference: Panel Chairperson, *Compressed-Air Energy Storage Technology*.

HAZARDOUS WASTE TRAINING

- 1996 Current RCRA and CERCLA 40-hour and 8-hour hazardous management safety training.
- 1995 Groundwater Modeling and Transport: JDB-2D/3D MOC Code
- 1993 Completed course work on the design of vadose zone remediation systems

TECHNICAL REVIEW COMMITTEES

- Electric Power Research Institute, Pittsfield CAES Field Test Program
- Skagit-Hanford Nuclear Power Project License Review
- Yucca Mountain Nuclear Waste Repository Oversight-Inyo and Esmeralda Counties

Gas Storage Engineering

Michael King is involved in natural gas and air storage in aquifer storage structures throughout the United States. He was a gas storage engineer for Natural Gas Pipeline Company (NGPL) for three years; there he was responsible for gas storage operations at 4 natural gas aquifer storage fields in the Midwest. Dr. Donald L. Katz (Father of Natural Gas Storage) tutored Michael in gas storage technology twice a month while at NGPL. Michael designed compressed-air energy storage systems for the Hume Structure in Illinois and the Lodi abandoned gas field in California. He conducted research for EPRI and Southern California Edison for development of compressed-air energy storage. Michael was on the Electric Power Research Institute's Technical Review Committee for compressed-air energy storage. Mr. King was lead scientist for the Norton Air Storage Project utilizing the Norton Mine for high-pressure air storage.

Drilling Technology

Michael King was a former owner and Vice-President of ASE Drilling Company; he supervised the drilling, installation, and testing of over 500 domestic, commercial, and public water supply wells. He was a part owner and operator of mud- and air-rotary, reverse circulation, and auger drill rigs. Michael has managed the drilling of natural gas wells to depths of over 3,500 feet. Michael also managed environmental drilling and sampling projects at a number of sites under Level B environmental protection conditions.

Hazardous Waste Management

Michael King performed over 30 environmental investigations in the past 7 years. These studies have ranged from level I environmental site assessments for the Sacramento light-rail transportation corridor to the remediation of free-phase petroleum hydrocarbons from leaking underground storage tanks. Michael has been the project manager for major environmental projects, such as a 17 site investigation along the I-105 Interstate in Los Angeles. He recently completed a study of contaminate transport to dewatering facilities at the San Francisco International Airport; this involved complex numerical ground water modeling and transport analysis.

Ground Water Hydrogeology

Michael King has conducted over 16 watershed resource studies in the past 5 years. He has conducted studies for the Ground Water Master Plan for the San Francisco Water Department, which involved ground-water source analysis, exploratory drilling, pump testing, and development of a wellhead protection program. He also conducted water supply studies for four coastal communities in support of applications for ground-water supplies to the California Coastal Commission, the California Utilities Commission, and various county Environmental Health Departments. Numerical modeling of aquifer systems was used as a planning tool for a number of these studies.

Applied Ground Water Research

Michael King was involved in applied research for the evaluation of aquifer pumping test techniques and innovative watershed analysis. He presented a number of papers on the application of petroleum technology to aquifer pump test analysis. He is currently a technical editor for the AEG Bulletin. He was a member of the technical review team for the Skagit-Hanford nuclear power plant responsible for evaluating numerical ground water models of the Tri-Cities area. He currently provides technical oversight to Inyo and Esmeralda Counties for the Yucca Mountain Nuclear Waste Repository project. This involves the review of contaminant transport models of southern Nevada.

Geotechnical Studies

Michael King conducted geotechnical engineering studies of various critical facilities. These studies have included seismic design studies of 1) Diablo Canyon Nuclear Power Plant; 2) N, K, and L Reactors at the Savannah River Plant; and 3) Purex Plutonium Treatment Plant at Hanford, Washington. He has also conducted geotechnical and seismic studies for nuclear waste storage tunnels at the Nevada Test Site, and for the Sunol Water Treatment Plant on the Calaveras Fault in California.

PUBLICATIONS

King, M.J., McGill, M.J., 2009, Compressed Air Energy Storage, Encyclopedia of Energy Engineering, Taylor & Francis Group, New York, New York.

Bredehoeft, J. and M. King, 2009, *The potential for contaminant transport through the Carbonate Aquifer beneath Yucca Mountain*: Hydrogeology Journal, November.

Bredehoeft, J., C. Fredrick, and M. King, 2008, *Groundwater flow through the Funeral Mountains, Death Valley National Park, California*: Flow and Transport Processes, Proceedings International High-Level Radioactive Waste Meeting, American Nuclear Society, Las Vegas, NV, Sept 7-11, 2008, p. 5-13.

King, M.J., Bredehoeft, J.D. 1999, *The New Federal Food and Drug Administration Spring Regulations: A Unified Approach to Compliance*, Water Technology Journal, April.

King, M.J., Bredehoeft, J.D., 1997, *San Francisco Zoo Wells Versus San Francisco Ground Water Master Plan - A Case For Modeling*, Proceedings, American Water Resources Association Annual Conference, Long Beach, CA, (Pending October 21)

Bredehoeft, J.D., King, M.J, Tangborn, W., 1995, *An Evaluation of the Hydrology at Yucca Mountain: The Lower Carbonate Aquifer and The Amargosa River*, Oversight Committee for the Yucca Mountain High Level Nuclear Waste Repository, Inyo County, California, and Esmeralda County, Nevada.

King, M.J., Bredehoeft, J.D., Tangborn, W., 1995, *Ground Water Resource Development: A Comparison of Three Methods of Analysis*, Bulletin of the Association of Engineering Geologists, Pending.

King, M.J., 1987, *Compressed-Air Energy Storage System Technology: Pittsfield, Illinois Test Experience*, Proceedings, 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, PA.

King, M.J., and Scholl, R.E., 1981, *Analysis of Low-Rise Building Damage*, U.S. Department of Energy, Nevada Operations Office.

King, M.J., 1981, *Compressed-Air Energy Storage (CAES) Market, Criteria, Economics*, Bulletin, Technical Note, Association of Engineering Geologists, Vol. 18, No. 4.

King, M.J., and Skeji, R.E., 1980, *Energy Storage in Aquifers*, Proceedings, Rockstore 80 Conference, Sweden.

King, M.J., 1979, *Compressed-Air Energy Storage (CAES), Hume, Illinois*, Proceedings, Sixth Annual UMR-DNR Conference on Energy, Rolla, MO.

King, M.J., 1978, "Engineering Resource Unit Approach to Engineering Land-Use Planning," Bulletin, Association of Engineering Geologists, Vol. 15, No. 3.

Thesis: King, M.J., 1973, "Engineering Land-Use Planning, Harry S Truman Dam Site Area, Missouri," U.S. Army Corps of Engineers.