ITASCA Denver, Inc.
An Itasca International Company

Houmao Liu

Principal Hydrogeologist/General Manager

Expertise	Mining Hydrogeology and Numerical Modeling
Education	Ph.D. (Civil Engineering), 1992 University of Colorado, Boulder, USA M.S. (Hydraulics and Fluid Mechanics), 1986 HeHai University, P.R. China B.S. (Hydraulic Engineering and Water Resources), 1983
Registrations	Registered Professional Engineer (Colorado)
Professional Affiliations	Member: International Mine Water Association
Certifications	MSHA (Mining Safety and Health Administration), First Aid, WHMIS (Workplace Hazardous Materials Information System), SUN Microsystems Certified Java II Programmer

Professional Experience

2008 – Present	*Itasca Denver, Inc., (formerly Hydrologic Consultants, Inc.), Lakewood, Colorado* *Principal Hydrogeologist, General Manager (2014 to present)*
2001 – 2008	*Hydrologic Consultants, Inc. of Colorado* *Senior Engineer/Technical Manager*
2000 – 2001	*Matchlogic, Inc., Westminster, Colorado* *Advanced Software Engineer*
1999 – 2000	*Geoanalysis, Inc., Denver, Colorado* *Associate Engineer/Geochemist*
1992 – 1999	*Hydrologic Consultants, Inc. of Colorado* *Senior Project Engineer/Geochemist*
1990 – 1992	*University of Colorado, Boulder, Colorado* *Research and Teaching Assistant*
1988 – 1990	*University of Arizona, Tucson, Arizona* *Research and Teaching Assistant*
1986 – 1988	*HeHai University, Nanjing, P. R. China* *Assistant Professor*

Project Experience

Mining Hydrogeology: Dr. Liu has more than 25 years of project experience in mining hydrogeology, geochemistry, and groundwater flow modeling. He has worked on and directed numerous mining hydrogeology projects in southern Africa, South America, Turkey, North America, Russia, and East Asia. He has also been the Principal-in-Charge of Itasca's hydrogeologic projects for key mining companies such as Alrosa, De Beers, Cameco, Anglo American, Debswana, Doe Run, Freeport McMoRan, Rio Tinto, Goldcorp and Codelco. These projects include mine dewatering, slope depressurization, water management of surface and underground mines, environmental impacts, and mine water quality. In addition, Dr. Liu has extensive experience in the code development of *MINEDW* as well as more than 25 years of groundwater flow modeling experience using other commercial codes such as *MODFLOW, MT3D*, and *FEFLOW*. He has taught mining hydrogeology short courses at the Society of Mining, Metallurgy & Exploration (SME), Cameco, Anglo American, Debswana, and the American Rock Mechanics Association (ARMA). He also provides expert opinions for regulatory hearings and due diligence reviews. In addition to his project experience, Dr. Liu participated extensively in the early development of the engine portion of *REBOP*. He also taught the hydrogeologic section of several caving short courses that Itasca has offered in the past few years.

Due Diligence Review: Dr. Liu Directed and conducted hydrogeologic assessments and investigations to support bankable studies at mines worldwide. Worked for a funding company as its expert groundwater reviewer for ongoing as well as potential projects.

Geochemistry: Dr. Liu Investigated and predicted geochemical conditions of open pit mines in Nevada, an underground mine in Indonesia, and a diamond mine in Canada. Experience includes developing numerical codes and using commercial software to predict the potential of acid mine drainage, simulate the kinetic reactions and transport of multi-chemical species and implement geochemical models, and identifying dewatering targets with geochemical fingerprinting approaches.

Research and Software Development

Dr. Liu has extensive experience in the code development and design of *MINEDW*, the three-dimensional groundwater flow code developed by Itasca. As a certified Java programmer, has several years of working experience in developing middleware to interact with databases.

Dr. Liu developed the Rapid Emulator based on *PFC3D (REBOP)* using Java and an object-oriented approach. The final version of *REBOP* will be a user-friendly package for simulating the flow of rocks into multiple interacting drawpoints of block cave mining. Developed distributed-web-advertisement software using Java and COBRA technologies. Experience includes database design and application (both Oracle and SQL), development of server-side and middleware applications, and mapping of relational database with Java objects using Toplink.