Principal Hydrogeologist

Expertise	Mining Hydrogeology, Water Quality, Dewatering, Depressurization
Education	Ph.D. (Civil Engineering), 1992 University of Colorado, Boulder, USA
	M.S. (Hydraulics and Fluid Mechanics), 1986 HeHai University, Nanjing, P.R. China
	B.S. (Hydraulic Engineering and Water Resources), 1983 HeHai University, Nanjing, P.R. China
Registration	Registered Professional Engineer, Colorado
Professional Affiliations	Member: International Mine Water Association
Certifications	MSHA (Mine Safety and Health Administration)

Professional Experience

2008 – Present	ITASCA Denver, Lakewood, Colorado Principal Hydrogeologist, General Manager (2014 to 2023)
2001 – 2008	Hydrologic Consultants, Inc., Lakewood, 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., Lakewood, 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 over 30 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, Newmont, Antamina, Antapacaay, 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 for 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. Dr. Liu has provided high-level reviews within ITASCA and for clients worldwide.

Due Diligence Review and Qualified Person: Dr. Liu directed and conducted hydrogeologic assessments and investigations to support bankable studies at mines worldwide. He worked for a funding company as its expert hydrogeology reviewer for ongoing as well as potential projects. He has been a qualified person in the field of hydrogeology for feasibility studies and 43-101 reports for various projects worldwide.

Geochemistry: Dr. Liu directed and participated in geochemical and water-quality investigation of open-pit mines and underground mines worldwide. 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 identify 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, he 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. He 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.