

MINE WATER BALANCE MODELING: A TOOL FOR MANAGING WATER QUANTITY AND QUALITY AT MINE SITES

Sunday, 14 April 2013 at the JW Marriott Lima Hotel, Peru

Translation into Spanish will be provided

Background

Efficient water use is an increasingly important part of any mine's social and regulatory license to operate. Coupled with this, mining ever lower grades of ore has resulted in increased water use per unit of production. As a result of these pressures, water management now directly affects the ability of the minerals industry to operate worldwide. Mining operations that optimize water use at their mines make an important contribution to efficient mine development and their bottom line. Water balance modeling is an important water management tool that helps mine operators efficiently use their water resources.

Course Overview:

This workshop will focus on water balance studies and water balance modeling as a tool for efficiently managing water volumes and (to a lesser extent) water quality at mines. Presented in a workshop format, the course will answer questions and cover the following topics:

- What is a water balance and why is it important? What can a water balance be used for?
- Defining the water balance objectives
- Selecting water balance methodology and models
- Collecting and evaluating the water balance input data
- Developing and calibrating the model
- Addressing water quality aspects
- Using the water balance for decision making

Case study examples will be presented with the objective of covering a range of site conditions and project challenges. These examples will also illustrate the use of the water balance model for decision making. The workshop will close with **a short model demonstration** to illustrate the intricacies and outcomes of the modeling process.

Participants should bring their water balance issues/challenges; we will choose one issue (more if time permits) during the discussion at the end of the day to discuss / develop a strategy to address the water balance.

Learning Objectives:

Participants will develop the following skills during the course:

- Understanding of mine water balance approaches and methodologies

- Key considerations for mine water balance model selection
- Understanding of the key input data including collection and evaluation of the data
- Lessons learned from past modeling challenges and experience
- Discussion forum to dive into specific site water management challenges and key constraints.

Intended Audience

This short course is targeted at mine operators and participants who:

- Have or anticipate having water management challenges at their site.
- Want to optimize their current water management practices.
- Want to understand how to approach and structure a water balance study.
- Want to understand the current trends and best practices for water balance modeling.
- Are curious about water balance modeling and how to make sure models are calibrated and accurate.

Proposed Program

The proposed program for this short course will run from 8.30am to 5pm

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| 8.30-9.30 | Overview of water in mining – trends driving stricter reporting requirements What is a water balance, why is it important and what could it be used for – Pat Corser |
| 9.30-9.45 | Environmental and regulatory – Carmen Bernedo |
| 9.45-10.30 | Defining the water balance objectives – Melanie Davis |
| 10.30-11.00 | Coffee |
| 11.00-11.45 | Selecting water balance methodology & developing the conceptual model – Zygi Zurakowski |
| 11.45-12.30 | Collecting and evaluating the water balance input data – Melanie Davis & Carmen Bernedo |
| 12.30-13.30 | Lunch |
| 13.30-14.15 | Developing and calibrating the model – Zygi Zurakowski |
| 14.15-15.00 | Mine water treatment case study |
| 15.00-15.30 | Coffee Break |
| 15.30-16.15 | Case Studies |
| 16.15-16.45 | Mine water balance – demonstration model – Zygi Zurakowski |
| 16.45-17.00 | Summary and discussion, course evaluations |

Course Instructor Bios

PATRICK G. CORSER, P.E.

Global Mining Practice Leader

EDUCATION:

MS/MSc, Civil Engineering, Northwestern University, Illinois, USA, 1979

BS/BSc, Civil Engineering, University of Minnesota, USA, 1977

REGISTRATIONS:

Professional Engineer: Montana, Idaho, Alaska, Arizona, California, Colorado, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, Wyoming

SUMMARY:

Pat Corser has more than 30 years of engineering and construction experience working on civil, geotechnical, and environmental projects for mining clients. He has managed mine development and closure projects as well as reclamation plans for numerous mines in North and South America and throughout Europe. His specific areas of technical expertise all involve water: design and construction of containment systems for mine waste disposal (tailing and waste rock facilities) and mine closure and reclamation. As a result, water, water management, water excesses and shortages, water challenges resulting in the need for storage and water quality management are his prime areas of interest.

As Practice Leader for MWH's Global Natural Resource Sector, Mr. Corser is involved in conceptual, basic, and detailed engineering as well as senior project review for MWH's services to the mining industry which includes environmental baseline and permitting studies, mine water supply and water resource management, civil infrastructure, environmental monitoring, waste product handling, mine closure/reclamation and remediation. Mr. Corser is based in MWH's Colorado operations.

MELANIE DAVIS, P.E.

Supervising Geotechnical Engineer & Lead Water Balance Modeler

EDUCATION:

MS Civil Engineering, Colorado State University, Colorado

BS Civil Engineering, Drexel University, Pennsylvania

REGISTRATIONS: Professional (Civil) Engineer - Colorado, Maine, Utah, Washington, Wyoming

SUMMARY:

Ms. Davis has over 14 years of experience in geotechnical and geo-environmental engineering for mine design, reclamation and remediation. In her role as the water balance lead, she will be responsible for all water balance activities. Her areas of expertise include project management, cover and liner design, tailings facility design, site-wide water balance modeling, slope stability analyses, seepage analyses, expansive soil evaluations, settlement/consolidation analyses, hydrologic analyses, unsaturated flow modeling, and other general aspects of geotechnical and geo-environmental engineering. Her water balance experience includes serving as Project Manager for permitting a TSF at a uranium mill site in

Garfield County, Utah where she was responsible for co-design of facility and management of site-wide water balance using the program GoldSimDesign. She also served as the Project Engineer/Project Manager for a seepage analysis and site-wide water balance for mining operations in Globe-Miami, Arizona. More recently, she served as the lead Water Balance Modeler to assess makeup water requirements for the Pitarrilla Mine. Finally she served as the Lead Geotechnical Engineer at the Marlin Mine where her work included a detailed site-wide water balance using GoldSim, as well as ongoing site engineering and construction coordination for tailings (slurry) storage facility. In 2013 she was honored by the American Council of Engineering Companies as an Outstanding Woman Engineer.

ZYGI ZURAKOWSKI

Geotechnical Engineer & Water Balance Modeler

EDUCATION:

M.S. in Civil Engineering, University of Colorado at Boulder

B.S. in Civil Engineering (magna cum laude), University of Colorado at Boulder

B.Sc. in Geology and Physics, University of Otago, New Zealand

SUMMARY:

Mr. Zurakowski is a geotechnical engineer with more than 6 years of experience in the mining industry. He is experienced with the various mining components and processes and has worked at mine sites in USA, Canada, Chile, Honduras, Mexico, and New Zealand. Mr. Zurakowski uses deterministic, probabilistic and risk type analyses to help evaluate environmental impacts and support mine and management strategic planning.

CARMEN E. BERNEDO, P.E.

Principal Hydraulic Engineer

EDUCATION:

M.S., Civil Engineering, Colorado State University, 2002

B.S., Civil Engineering, Pontificia Universidad Católica del Perú, 1995

REGISTRATION:

Professional Civil Engineer: Arizona, 2005

Professional Civil Engineer: Peru, 1997

SUMMARY:

Ms. Bernedo is a Principal Engineer with 17 years of specialized experience in hydraulics, hydrology, river restoration, remediation and environmental studies. She is an expert user of many existing standard hydrologic and hydraulic computer programs and has been responsible for numerous hydrologic and hydraulic studies in the US and South America including water supply and reservoir sizing assessments. Her hydrologic and hydraulic analysis experience also includes reservoir and channel flood routing, hydraulic structures and dam design, freeboard analysis and erosion protection design and sediment transport analysis. She has completed and supervised diversion structure; water containment and associated facilities engineering; surface water management plans; site wide water balances; gathered baseline information; monitored and evaluated hydrological and water quality data



for Baseline Studies, Environmental Impact Assessments (EIS), and Risk Assessments. She implemented and managed site wide hydrological studies for large industrial site developments and operating locations and trained environmental personnel to operate industrial surface water monitoring programs. She has served as a Hydrologic/Hydraulic Technical Leader in several projects the U.S., Peru, and Africa. In 2012 she was honored by the American Council of Engineering Companies as an Outstanding Woman Engineer.