

Demonstrated Expertise in Pit Lake Management, Environmental Chemistry and Modeling – Curriculum Vitae for Jerry Vandenberg

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ABSTRACT

Developing industrial projects poses risks to surface water bodies and their connected ecological systems. At all stages of project development, from initial site investigations to approvals to operations and closure, environmental models can be employed to predict the risk to the environment. More importantly, models can be used to derive and test mitigation strategies to avoid or minimize the risk. When applying models, it is critical that stakeholders understand the model's assumptions, findings, limitations and uncertainty.

A special case where models are often misunderstood is pit lakes. Pit lakes are formed at the cessation of open-pit mining when the void is filled with water and other materials. In the past decade, many case studies have been published from which lessons can be derived about how to avoid the failures of the past and create beneficial uses in existing and future pit lakes. In some cases, this may require the use of numerical models, whereas in other cases, especially where applicable analog pit lakes have been created, best practices and lessons learned can guide the development of the pit lake toward beneficial end uses.

This document describes case studies of relevant projects undertaken by Jerry Vandenberg over the past two decades and serves as his curriculum vitae.

Keywords: *water quality modelling; mine pit lakes; fate and transport models; expert witness; best practices; sustainable development; beneficial end uses; mine water management*

Introduction

Vandenberg Water Science, Ltd. was formed as a consulting firm that specializes in three core areas:

1. Pit Lake Management
2. Review of Environmental Models
3. Expert Witness Services

Jerry Vandenberg is the sole proprietor of VWS; his demonstrated expertise is highlighted below.

Background

Jerry Vandenberg is registered as a Professional Chemist in Alberta and B.C. He holds an M.Sc. (Environmental Chemistry) and B.Sc. (Environmental Science, Chemistry Major) from the University of Calgary and a Water Quality Technology diploma from Okanagan University College.

Jerry was a Principal Environmental Chemist at Golder from 2004 to 2019. Between 1998 and 2004, he held positions as a water treatment and environmental technologist. He worked for environmental departments in municipal, provincial and federal government agencies between 1996 and 2019.

From 2019 to 2022 he was a sessional lecturer at the University of British Columbia, Okanagan. He developed and taught the following courses: EESC 101 Intro to Environmental

Science; BIOL 307 Limnology; EESC 315 Environmental Impact Assessment; EESC 398 Technical Communications; EESC 335 Environmental Field Techniques (stream and lake sampling). His lectures can be viewed on his [YouTube Lecture Channel](#).

He now divides his time consulting and as a paid-on-call fire fighter as a Lieutenant with [Joe Rich Fire Rescue](#).

Methods

Jerry has developed and applied methods for water quality monitoring and modelling that have become industry best practices (Vandenberg et al. 2016) and university course material (Vandenberg et al. 2005). Projects related to water quality monitoring and modelling, pit lake management and expert witness services are provided in Table 1.

Jerry has taught these methods to internal staff, external courses for Indigenous Communities and Environment Canada model reviewers and at pre-conference workshops (Vandenberg 2011). Courses and workshops developed and delivered include:

- Aquatics Monitoring Protocols and Interpretation
- Best Practices for Mine Water Modelling
- Water Quality, Hydrodynamic & Dispersion Modelling
- Visual Basic for Applications
- Mental Health and Wellness in the Workplace

Table 1. Summary of Experience

Expertise	Services	Projects applied to
Model developer	Sediment diagenesis model (<i>Vandenberg et al. 2015; Prakash et al. 2015</i>)	Alberta oil sands pit lakes
	Oil sands pit lake model (<i>Mackenzie 2006; Lauzon et al. 2009</i>)	Alberta oil sands pit lakes
	Oil sands reclamation wetlands model (<i>Vandenberg and MacKenzie 2006</i>)	Regional oil sands reclamation research
	Cooling pond mass balance and geochemical model	Capital Power Genesee
Modeller or Reviewer	Pit lake hydrodynamic and water quality models	All Alberta oil sands mines; all NWT diamond mines; Burnco McNab; Greater Phoenix; Eagle Mine
	Multiple linked models including site-wide water quality, receiving environment dispersion and far-field (<i>Lauzon et al. 2011; Vandenberg et al. 2015; Zawadzki et al. 2017</i>)	Mines: Mount Polley; Amaruq; Wolverine; Constanca; Gahcho Kué; Jackpine; Frontier; Kearl; Muskeg River
	Aerial deposition model (<i>Dayyani et al. 2016</i>)	Alberta oil sands mines
	Sediment-water partitioning model	Alberta oil sands mines
	Tailings storage facility spill model	Nickel Plate Mine; Alberta oil sands mines
	Lake hydrodynamic and water quality model (<i>Snow et al. 2014</i>)	Snap Lake, NWT; Lac de Gras, NWT; Bootjack Lake, BC
	Cooling pond thermal model	TransAlta Sundance
	Hydroelectric reservoir and river model	Site C Dam
	CORMIX dispersion modelling	Meadowbank Mine
	Water Quality Monitoring	Automated instrumentation (<i>Vandenberg 2008</i>)
Forensic monitoring		Calgary Zoo; Shorncliffe Lake; Abbotsford; Lussier Hot Springs
Routine monitoring		Teck Beaverdell Mine; Okanagan Lake; Kearl Lake
Spill monitoring		Nickel Plate Mine
Mine Water Management Plans	Trigger Response Plans, Adaptive Management Plans, Quality Assurance Plans, Mine Water Management Plans, Effluent Discharge and Plume Delineation Plans	Highland Valley Copper Mine, Mount Polley Mine, Red Chris Mine, NexGen Rook 1 Mine, Ekati Diamond Mine
Pit Lake Management	Beneficial use of pit lake for water treatment (<i>Moger et al. 2017; Vandenberg and Litke 2017</i>)	Mount Polley Mine
	Third-party review of model	Rio Tinto, Australia; Atlantic Gold
	Determine optimal use of pit lakes for mine waste disposal	NWT diamond mines; Alberta oil sands mines
	Develop guidance documents, roadmaps, global reviews and expert workshops for pit lake development (<i>McCullough et al. 2018; Vandenberg et al. 2014; Vandenberg 2016</i>)	Alberta oil sands mines
	Physical limnology of pit lakes for passive selenium treatment	BC coal mines
Expert Witness	Reservoir primary productivity modelling	BC Hydro Site C Dam
	Water quality and aquatic health components and pit lakes	Teck Frontier Oil Sands Mine
	Water quality component of EIA and pit lakes	Total Joslyn North Mine
	Water quality component of EIA and pit lakes	Shell Jackpine Mine Expansion
	Hydrodynamic and water quality model	De Beers Snap Lake Mine
	Water quality component of EIA and pit lakes	De Beers Gahcho Kué Mine
	Pit lake and water quality expert	Lafarge Phelan Pit
	Pit lake and water quality model review	Diavik Diamond Mine
Provide expert opinion on evidence	Multiple cases, under privilege, for law firms	

Results

Jerry has applied the best available scientific information to approximately 40 large-scale industrial projects to minimize environmental disturbance, balance cost with environmental performance, obtain the necessary permits and approvals, safely operate and close facilities. Many of these projects were multi-year endeavors with rounds of review by government, stakeholders and third-party experts.

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