

## PROJECT RELATED EXPERIENCE - RISK ASSESSMENT

2016

### **SkyStone, PennWest** **B.C., Canada**

Several different fields: calculation of hazard distances for jet flames, fire balls, distance to LFL/2 for pipelines, wells.

### **SkyStone, Chinook** **B.C., Canada**

Several different fields: calculation of hazard distances for jet flames, fire balls, distance to LFL/2 for pipelines, wells.

2015

### **Ackroyd LLP, ATCO pipeline** **Alberta, Canada**

Critical review assessment of ATCO's proposed natural gas pipeline adjacent to proposed senior's house development. Hazard and risk assessment using ZZArisk.

### **Alberta Energy Regulator, Pembina Pipeline** **Alberta, Canada**

Expert reviewer on behalf of AER of Pembina Pipeline Fox Creek to Edmonton, during hearing and preparation of materials supporting decision report.

### **FirstResponse, ConocoPhillips** **B.C., Canada**

Several different fields: calculation of hazard distances for jet flames, fire balls, distance to LFL/2 for pipelines, wells.

### **FirstResponse, PennWest** **B.C., Canada**

Several different fields: calculation of hazard distances for jet flames, fire balls, distance to LFL/2 for pipelines, wells.

### **FirstResponse, Chinook** **B.C., Canada**

Several different fields: calculation of hazard distances for jet flames, fire balls, distance to LFL/2 for pipelines, wells.

### **Ackroyd LLP, TAMA Power** **Alberta, Canada**

Critical review assessment of TAMA power assessment of proposed power plant and use of anhydrous ammonia. Risk calculations and modelling using ZZArisk.

2014

### **FirstResponse, ConocoPhillips** **B.C., Canada**

Calculation of hazard distances for jet flames, fire balls, distance to LFL/2 for pipelines, wells.

### **Spectra Energy** **Alberta, Canada**

Determine heat radiation and flammability limits for the proposed pipeline to support consultation and involvement processes. Modelling using PHAST and ZZArisk.

### **ConocoPhillips, Risk Tools Development** **Alberta, Canada**

Development of risk analysis tools (programming) for calculating hazard distances for jet flames, fire balls, distance to LFL/2. Modelling using PHAST and ZZArisk.

### **GazMétro Solutions Transport** **Quebec, Canada**

Quantitative risk assessment of a proposed LNG transport comparison to alternative fuels transport including CNG, propane, hydrogen and diesel. Risk of flammability, over pressure explosion, toxicity and fireball. Modelling using PHAST and ZZArisk. In association with Alp & Associates Inc.

2013

### **Natural Gas Pipeline, ENMAX** **Alberta, Canada**

Quantitative risk assessment of natural gas fuel pipeline to Calgary Energy Centre. Flammability, jet fire and fireball risk calculations using ZZArisk model. In association with Alp & Associates Inc

### **Sour Gas Well/Pipeline** **Alberta, Canada**

Sour oil and gas operations associated with Grizzly Resources Ltd Well and Sinopec Daylight Energy Ltd pipeline risk assessment using ZZArisk model Expert testimony at hearing. Concentrations and EPZ distances were calculated using CALPUFF and ERCBH<sub>2</sub>S.

### **GazMétro Solutions Transport** **Cornwall, Canada**

Quantitative risk assessment of a proposed LNG distribution station for Robert Transport in an industrial location. Risk of flammability, over pressure explosion, toxicity and fireball. In association with Alp & Associates Inc.

### **Suncor, Equipment Failure EPZ** **Alberta, Canada**

Emergency response planning zone and dispersion calculations for the Suncor Energy at the base plant near Fort McMurray. Due to equipment failure, sour gas could potentially be emitted during repair. Concentrations and EPZ distances were calculated using CALPUFF and ERCBH<sub>2</sub>S.

2012

### **Shepard Energy Centre, ENMAX** **Calgary, Canada**

Qualitative risk screening assessment and quantitative risk assessment of Shepard Energy Centre (in construction) using natural gas fueled turbine generators, steam turbine generator, aqueous ammonia storage, and hydrogen storage. Dispersion modelling for calculation of ERPG distance, probability of lethality mapping and risk calculations. In association with Alp & Associates Inc.

2011

### **Robert Transport, GazMétro Solutions Transport** **Mississauga, Canada**

Quantitative risk assessment of a proposed LNG distribution station for Robert Transport in an industrial location. Risk of flammability, over

pressure explosion, toxicity and fireball. In association with Alp & Associates Inc.

## **Calgary Energy Centre, ENMAX** **Calgary, Canada**

Comparative quantitative risk assessment of changing operations from anhydrous ammonia to aqueous ammonia. Dispersion modelling for calculation of ERPG distance, probability of lethality mapping and risk calculations. In association with Alp & Associates Inc.

### **2010**

## **ERCBrisk Model** **Alberta, Canada**

Co-authoring software for the Alberta Energy Resources Conservation Board for the calculation of sour gas toxicity risk from wells (point sources) and pipeline leaks (linear sources). Building upon the toxicity assessment software ERCBH2S. In association with PSAQM Inc.

### **2003-2009**

## **ERCBH2S Model** **Alberta, Canada**

Co-authoring software for the Alberta Energy Resources Conservation Board for the calculation of sour gas public safety, a model to calculate H2S emergency response planning zone distances for public safety. In association with PSAQM Inc.

## **Parsons Lake, ConocoPhillips/Salmo** **NWT, Canada**

Surface water quality modelling and risk assessment of a historical slumping of drilling fluids contamination and potential release to nearby Parsons Lake.

### **2002 and before**

## **Peer Review** **Nanasivik-Human Health Risk Assessment,** **Alberta, Canada**

The Human Health and Ecological Risk Assessment Nanasivik Mine, (for CanZinco Ltd., by Jacques Whitford Environmental Limited, January, 2003) was reviewed with respect to data quality and methodology. The underground zinc-lead mine was located on the Borden Peninsula on northern Baffin Island. The risk assessment review included recalculation and assessment of the determination of risk based soil remediation concentrations.

## **Human Health Risk Assessment, BlackRock** **Alberta, Canada**

A human health risk assessment was developed to assess the impacts of the SAGD heavy oil project in northeastern Alberta. A multi-media exposure assessment of PAHs and arsenic were developed based on USEPA methods. Potential impacts of phenols and arsenic in the domestic groundwater wells was investigated.

## **Human and Ecological Health Risk Assessment,** **Agrium** **Alberta, Canada**

A human and ecological health risk assessment was developed to assess the impacts of the proposed gypsum stack (settling pond) expansion. A multi-media exposure assessment of fluorides was developed based on

USEPA methods. Impacts due to fluoride and particulate (PM<sub>2.5</sub> and PM<sub>10</sub>) emissions were assessed by incremental risk analysis.

## **Human Health Risk Assessment, Burnco** **Alberta, Canada**

Assessment of human health impacts from a proposed gravel pit operation near Wabamun Lake. Noxious chemicals included fugitive dust, PM<sub>2.5</sub>, metals, silica, PAH from the proposed development, nearby developments and background air quality. Impacts due to particulate (PM<sub>2.5</sub> and PM<sub>10</sub>) emissions were assessed by incremental risk analysis.

## **Human Health Risk Assessment, Lafarge** **Alberta, Canada**

Assessment of human health impacts from a proposed gravel pit operation near Calgary. Noxious chemicals included fugitive dust, PM<sub>2.5</sub>, metals, silica, PAH from the proposed development, nearby developments and background air quality in the Calgary region. Project included expert testimony at an EUB Appeal Board hearing.

## **Toxicity Review, Salmo** **Alberta, Canada**

Literature review of fish toxicity to selected metals.

## **Human Health Risk Assessment, BlackRock** **Alberta, Canada**

Screening level human health risk assessment for BlackRock Ventures Inc. for a SAGD heavy oil project in northeastern Alberta. The assessment examined reasonable maximum exposures to industrial emissions in the Cold Lake area. Literature review and qualitative multipathway exposure for effects of PAHs and acid deposition.

## **Risk Assessment Training** **Alberta, Canada**

A delegation of professors from Chinese universities were trained on the Canadian perspective of environmental issues related to the oil and gas development. An overview of ecological and human health risk assessment issues, practices and modelling methods were presented. (1-d course)

## **City of Calgary Landfill** **Alberta, Canada**

Peer review of a risk assessment prepared for a food industry adjacent to a landfill in Calgary. The risk assessment was reviewed and explained to City officials for their decision to allow the development

## **Goodfish Lake, ToxCon** **Alberta, Canada**

Review and reassessment of gas migration through basement slab and grade slab concrete into above structures. Gas migration resulting from PERC and landfill contamination.

## **Lead Paint Exposure, ToxCon** **Alberta, Canada**

Estimate of human health and wildlife exposure and risk assessment from soils contaminated with lead paint below a historic bridge. The contamination resulted from years of exposure to lead gasoline emissions and chips of paint from sand blasting (cleaning) of the structure.

## **Cyanide Spill, EuroGold** **Turkey**

Hazardous gas assessment involving the estimation of cyanide spill emission rates to the atmosphere and heavy gas dispersion assessment for a human health risk and consequence analysis for a proposed gold mine.

## **Performance Assessment** **Alberta, Canada**

Project management of the performance assessment of the closure plan for Syncrude. Wildlife, vegetation, forestry, soils and water resources impacts were modelled and predicted through a GIS based framework. A flexible closure planning protocol was developed to co-ordinate and direct closure planning based on company goals and policies and environmental risk.

## **Ecological / Human Health Risk Assessment** **Alberta, Canada**

An on-site, off-site and regional analysis of exposure for an ecological and human health risk assessment. The ecological analysis was performed probabilistically and examined the risks based on observed and predicted concentrations in waterbodies, soils and vegetation. The exposure assessment model included contaminant flows from the on-site landforms, through wetlands, rivers and seepage discharges to the Athabasca River. A river dispersion model was created to predict dilution zones and exposure concentrations for various release configurations. Risks to ecological subpopulation receptors were determined through a probabilistic risk assessment. Risks to humans were assessed based on on-site and off-site impact exposure scenarios.

## **Dust Dispersion Exposure Modelling** **Vancouver, B.C.**

Exposure problem formulation, dust dispersion modelling and expert consulting on the dispersion of dust from a landfill site in the greater Vancouver regional district for a human health risk assessment. U.S. EPA dispersion model techniques were applied and emissions were calculated based on field sampling and emission factor estimates.

## **Dust Dispersion Exposure Modelling** **Eastern Ontario, Canada**

Dust dispersion modelling using fundamentals and the U.S. EPA dispersion models (ISC, SCREEN and FDM) for a human health risk assessment of fugitive dust emissions from the hazardous waste pile of an electro-arc furnace flue dust pile at a steel recycling plant.

## **Decision Analysis** **Voisey Bay, Newfoundland**

Technical direction for the development of a probabilistic decision analysis model to assess the mine development options based on environmental impacts, costs and consequences. Preparation of presentation materials.

## **Preliminary Risk Assessment of Water Discharges** **Northern Ontario, Canada**

Preliminary ecological risk assessment of water discharges of heavy metals for Placer Dome and Environment Canada. The screening level assessment was performed deterministically to determine worst-case risks to ecological receptors.

## **Preliminary Risk Assessment of Seepage Water Discharges** **Alberta, Canada**

Preliminary risk assessment of the seepage water discharges from fine tailings sites was analyzed probabilistically. The exposure model was developed probabilistically using C++ code and examined aquatic biota, fish tissue and osprey as receptor endpoints.

## **End-Cap Lake Water Quality** **Alberta, Canada**

The potential effects on aquatic biota and plant and fish tissue concentrations were determined in a risk assessment framework for Syncrude Canada Ltd. Assisted in the assessment by performing probabilistic fate and exposure model calculations to determine water quality concentrations and plant and fish tissue concentrations.

## **Crab Orchard** **Chicago, USA**

Screening level and later detailed ecological risk assessment on this superfund site following the EPA guidelines. This project involved screening multiple chemical contaminants, multiple sites and multiple receptors. The initial assessment was performed deterministically because of limited data and the large scope of the calculations. A probabilistic assessment of risk was conducted to put problem sites and deterministic risks into perspective.

## **Performance Assessment** **Alberta, Canada**

Performance assessment investigating three land reclamation scenarios using generic landscapes for Syncrude and Suncor. Surface water quality and seepage water was modelled for each of the three landscapes and exposure calculations were performed to assess potential off-site impacts. The assessment was performed probabilistically using steady state seasonal modelling and Monte Carlo time series transient modelling. Code was developed in C++ to do the calculations with greater efficiency and speed than typical spreadsheet assessments.

## **Rossdale Water Intake Health Risk Assessment, ToxCon** **Alberta, Canada**

Probabilistic formulation of a health risk assessment model for contaminant exposure through consumption and use of Edmonton drinking water produced at the Rossdale Water Treatment plant in Edmonton, Alberta. The analysis included a probabilistic pathway analysis of compounds from drinking water to a lifetime averaged human receptor. This analysis was combined with an Alberta Research Council dispersion study to calibrate spill masses, into the stormwater sewer system, that would generate LOAEL/NOAEL level doses and Canadian drinking water chronic guideline concentrations.