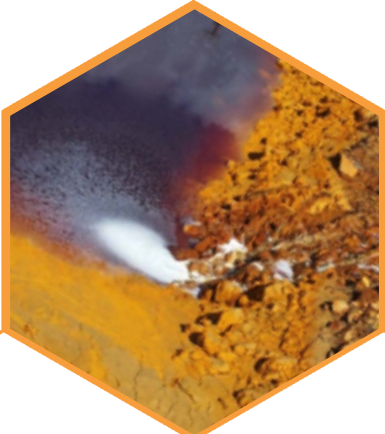


YESAB

Yukon Environmental and
Socio-economic Assessment Board

PROPONENT'S GUIDE



MODEL DOCUMENTATION REPORT

MODEL DOCUMENTATION REPORT: A PROPONENT'S GUIDE

This guide was developed by Richard Guthrie and Vanessa Cuervo for the Yukon Environmental and Socio-economic Assessment Board (YESAB) to provide clarity on considerations for project proposals related to large scale linear infrastructure in Yukon.

Suggested citation:

Guthrie, R.H. & Cuervo, V. 2015. *Geohazards and Risk: A Proponent's Guide to Linear Infrastructure*. Yukon Environmental and Socio-economic Assessment Board, Whitehorse, YT, 47 pp + Appendices.

Please forward any comments or questions you have regarding this document to the YESAB Head Office by email: yesab@yesab.ca or fax: 867-668-6425.

PREFACE

The objective of this document is to provide guidance with respect to information to include in the development of a model documentation report. This guide does not attempt to inform proponents in how to conduct modelling. It is intended to assist proponents in clearly providing justification, transparency, and understanding of any modelling conducted.

Environmental and socio-economic assessments investigate potential effects of a project within the context of existing and future conditions. Modelling is a vital tool for estimating baseline conditions and predicting project effects. This document provides guidance for proponents and their modellers in developing and submitting proper documentation of models in the form of a model documentation report.

A model documentation report has the purpose of describing in sufficient detail any kind of model, whether analytical or numerical, probabilistic or deterministic, submitted as part of a project proposal. The information provided in the model documentation report will assist the Yukon Environmental and Socio-economic Assessment Board (YESAB) in determining the appropriateness of the model and its predictions.

Proponents are encouraged to contact YESAB to discuss information considerations regarding their project proposal prior to submission.

Please contact YESAB by phone: 867-668-6420, email: yesab@yesab.ca or fax: 867-668-6425. For local Designated Office contact information see: www.yesab.ca/contact/.

Yukon Assessment Regulatory Framework

YESAB is an independent arms-length body, responsible for the assessment responsibilities of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) legislation and regulations. Specifically, its role is to administer YESAA.

YESAB's core purpose is to protect the environmental and social integrity of Yukon, while fostering responsible development in the territory that reflects the values of Yukoners and respects the contributions of First Nations.

Establishing a process to assess the environmental and socio-economic effects of developments in Yukon is a requirement under Chapter 12 of the Umbrella Final Agreement and the Yukon First Nations Final Agreements.

YESAA establishes a single assessment process for most projects in Yukon. Under YESAA, the Designated Office or Executive Committee conducts assessments of project proposals and makes recommendations to Decision Body(s). The federal, territorial and/or First Nation Governments, as Decision Bodies for the project, then decide whether to accept, reject or vary the recommendations. The rationale for their decision is issued in a Decision Document. Regulators can issue a permit once a recommendation has been received from YESAB and a Decision Document has been issued.

For more information on YESAB please visit www.yesab.ca.

Proponents are encouraged to check the YESAB website (www.yesab.ca) for any new or additional guidance that may have been generated since this document was produced.

Disclaimer

This document provides guidance and information only. It is not intended to provide legal advice. It does not in any way supersede or modify the *Yukon Environmental and Socio-economic Assessment Act* or Regulations. In the event of any inconsistency between the document and the Act and/or the Regulations, the Act and Regulations prevail. Portions of the Act have been paraphrased in the document and should not be relied upon for legal purposes. The Yukon Environmental and Socio-economic Assessment Board disclaims any liability in respect of anything done in reliance, in whole or in part, on the contents of this document.

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MODEL DOCUMENTATION REPORT

Modelling is used to make predictions about a wide range of topics in both the environmental and socio-economic realms, including air quality, water quality and quantity, wildlife, demographics, community well-being, energy, economy, and climate – to list a few. For example, a proponent might model baseline conditions, project development, or project effects relating to any one of these valued components, in order to demonstrate how they may be affected by various activities.

Models are conceptual descriptions or approximations that describe systems using mathematical equations. However, the majority of interacting systems in the real world are far too complicated to model in their entirety. Hence models are simplifications of these systems containing compromises and assumptions.

In order to evaluate the applicability or usefulness of a model, it is necessary to have a thorough understanding of the system being modeled, including its mechanics, its sources of uncertainty and the assumptions the model incorporates. This understanding requires a discussion of the conceptual construction of and mathematical processes within the model. The selection or design of a model requires consideration and discussion of model limitations, weaknesses and strengths. Data sources also require a similar discussion along with the inclusion of metadata. Discrepancies, data gaps, and other potential sources of error also require discussion to understand the accuracy and usefulness of model inputs and outputs.

Uncertainty always exists; however, a rationale for the use of the data and choice of the model should be provided and the degree of error qualified. As standard practice, any modelling exercise should consider a sensitivity analysis within the expected variability of the input parameters. As with any other input, the process to derive the expected variability of inputs must be clear and justified.

When developing a model as part of a project proposal, consideration should be given to detail the process by which the model was selected, developed, calibrated, verified and utilized. This information should be captured in a model documentation report provided to YESAB. This will assist the assessor in determining the appropriateness of, accuracy of and confidence in the model, its assumptions, and its results. Without this information the model may be of limited or no use to the assessor.

A model documentation report includes the following information:

- Description of the objective and scope of the model.
- Discussion of model selection, alternative models, as well as model applicability, limitations, and key assumptions.
- Description of model conceptualization and modelling approach.
- Summary of input data (e.g. baseline data) including derivation, uncertainty and variability, documentation, limitations, standard metadata and source.
- Summary of model parameters (e.g. dispersion rates of particulate in an air quality model) including derivation, uncertainty, documentation, and source.
- Description of model validation and calibration including (if applicable) history matching, ground truthing, sensitivity analyses, confidence, comparison between synthetic and measured values etc.
- List of references for the model and associated scientific research and review papers.
- Presentation and discussion of model outputs including (if applicable) confidence, alternative scenarios, etc.

Proponents must clearly demonstrate that the proposed model is fully applicable and relevant to the specific circumstance in which it is being applied. A detailed rationale of why the model is appropriate including a description of all caveats in using the model is required. It is recommended that proponents discuss with assessors and regulators the appropriateness of the models being used.

Additional information may be required, depending on the conditions at the site, for example, providing additional studies and/or work plans for the collection of data where model simulations show data deficiencies. These additional subjects should be addressed within the project proposal body of the report.

The expected model documentation report focuses on the model itself, not how the results will be used to inform project design. Likewise, the expected model documentation report should not be intended to link valued environmental or socio-economic values with model results. The main project proposal should address these topics.

STRUCTURE OF MODEL DOCUMENTATION REPORT

The following is a list of parts that should appear (when applicable) within the model documentation report:

- Title Page
- Table of Contents (including a list of figures and tables)
- Introduction
- Objectives
- Model selection
- Software selection
- Model conceptualization and modelling approach
- Model process diagram
- Model assumptions and parameters
- Input data and discussion
- Model calibration and validation
- Sensitivity analysis
- Alternative scenarios
- Results and discussion
- References
- Tables
- Figures
- Appendices

Model Documentation Report Tables

The model documentation report should be accompanied by tables to present data used or produced by the model. The following suggests the structure for tables contained in a model documentation report, including example topics:

- Data information (e.g. borehole depths, rock sample mineralogy, wildlife counts, traffic volumes, demographics, climate variables) including:
 - o Table name
 - o Data identifier (site name, sample label)
 - o Metadata
 - Coordinate data
 - Sampling date and time
 - Sampling methodology
 - Data confidence
 - Data source

- o Data description
 - Material characteristics
 - Results of chemical analyses
 - Population
 - Traffic
 - Climate variables
 - Comparison between source and simulated data
 - Any other data that lends itself to presentation in tabular format

Model Documentation Report Figures

The model documentation report should generally be supported with figures. These figures may present model inputs, outputs or context (e.g. location). Maps and cross sections should include standard elements such as a scale, north arrow, legend, and, if applicable, an overview map. All figures should include sources, references, explanation, and title. When applicable, all figures in a series should be in the same scale, while maps in a series should be of the same extent as well.

Examples of possible figures include:

- Model conceptualization
- Regional map with topography
- Detailed site map
- Geologic cross sections
- Charts
- Photographs
- Map showing the measured parameter's distribution
- Model grid with location of different boundary conditions used in the model
- Maps of simulated results/predictions, e.g. contaminant distribution map(s)

OTHER MODEL DELIVERABLES

In addition to a model documentation report, assessors may require additional access to model information. YESAB accepts that some models may be proprietary; however, model inputs and outputs may be requested to further understand model results, use, applicability, and repeatability. Other items may be requested (such as scripting) in relation to modelling; assessors may need to meet with modellers to further understand models and modeled outputs. As an example, it is possible that a model built in GoldSim may be requested in a limited use form for use in GoldSim Player. Such a request may be made to better understand model dynamics, structure, sensitivity, outputs or inputs.

SUMMARY AND CONCLUSION

Pursuant to section 50 of YESAA, proponents must provide baseline information and project effects characterization. YESAB recognizes that quantitative baseline and effects characterizations are not always available and that modelling may be required to obtain this information.

Proper modelling can aid in project design and optimization, risk management, and effects characterization; however, without a thorough understanding of the model, its mechanics, and inputs, models are of limited use within either the assessment or regulatory processes in Yukon. Model documentation must include information on model inputs, parameters, and assumptions; it must also provide clear methods and objectives of the model itself.

This document is intended to provide guidance on what information YESAB expects to be included in model documentation reports. Prior to submission, YESAB encourages proponents to discuss proposals, including baseline and effects characterization and any associated modelling, with the appropriate Designated Office or Executive Committee.

For additional information on how to structure and present a model documentation report and further technical details regarding content of the model documentation report please refer to Appendix 1. Please note that the list of references is only exemplary and not considered exhaustive.

FURTHER REFERENCES

The purpose of the following list is to highlight some resources for the presentation and creation of models. The list provides examples and discussions on model documentation – not examples of preferred models or solutions to every scenario – and as such is neither comprehensive nor conclusive. Assessors can help clarify any questions or concerns that may be raised in the listed documents.

Modelling in General

Dilwyn Edwards & Michael Hamson (2001): *Guide to Mathematical Modelling*. 2nd edition. Palgrave Macmillan. ISBN: 9780333794463.

David M. Glover, William J. Jenkins and Scott C. Doney (2005): *Modelling Methods for Marine Science*. Woods Hole Oceanographic Institution:

ftp://ecco2.jpl.nasa.gov/data3/ATN_output/+temp/+seaice/+class/+12.747/frontmatter.pdf

Especially Chapter 9: A Tutorial in Numerical Modelling Techniques:

ftp://ecco2.jpl.nasa.gov/data3/ATN_output/+temp/+seaice/+class/+12.747/chapter09.pdf

Air

Government of British Columbia, B.C. *Air Quality Guidelines for Air Quality Dispersion Modelling in British Columbia*:
http://www.bcairquality.ca/reports/air_disp_model_08.html

Government of British Columbia, *A Primer on the Guidelines for Air Quality Dispersion Modelling in British Columbia*:

http://www.bcairquality.ca/reports/pdfs/aq_disp_model_06_primer.pdf

Especially the 12 steps to good modelling practice, p.7-8, applicable to any modelling.

Government of British Columbia, *Environmental Monitoring, Reporting & Economics (EMRE) - Sampling, Methods and Quality Assurance*:

http://www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html

Water and Air monitoring and reporting, with various links and downloads

Government of Alberta, *Alberta Air Quality Model Guideline*:

<http://environment.gov.ab.ca/info/library/8725.pdf>

Water

YESAB Proponent's Guide: *Water Information Requirements for Quartz Mining Project Proposals*:
http://www.yesab.ca/wp/wp-content/uploads/2014/10/Water-Info-Requirements-Guide_FINAL.pdf

Golder Associates (2011): *Guidance Document on Water and Mass Balance Models for the Mining Industry*. Prepared for Environment Canada and Yukon Government.
http://www.env.gov.yk.ca/publications-maps/documents/mine_water_balance.pdf.

French version and Microsoft Excel copies of Appendix B and C available at <http://www.env.gov.yk.ca/publications-maps/plansreports.php#water>

Government of British Columbia, *Environmental Monitoring, Reporting & Economics (EMRE) - Sampling, Methods and Quality Assurance*:

http://www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html

Water and Air monitoring and reporting, with various links and downloads

Groundwater modelling webpage of Department of Environmental Quality, Michigan, USA. http://www.michigan.gov/deq/0,4561,7-135-3313_21698---,00.html

Various links to model software selection, model calibration, model predictions and performance monitoring, model review etc.

Anderson M. P. and Woessner W. W. (1992): *Applied Groundwater Modelling: Simulation of Flow and Advective Transport*. Academic Press, San Diego.

Riecken, S. (1995): *A Compendium of Water Quality Models*. BC Ministry of Environment and Parks, Environmental Protection Department, Water Quality Branch.

Socio-economic

Statistics Canada, *A User Guide to the Canadian System of National Accounts*, Chapter 3: Input-Output:
<http://www.statcan.gc.ca/nea-cen/pub/guide/chap3-eng.htm>

Government of Yukon Socio-Economic Web Portal:
<http://www.sewp.gov.yk.ca/>

Statistics Canada Web Portal:
<http://www.statcan.gc.ca/start-debut-eng.html>

Data sources for topics such as population and demography, transportation, energy, health, travel and tourism etc.

Wildlife

United States Forest Service, *A Technical Guide for Monitoring Wildlife Habitat*
http://www.fs.fed.us/research/publications/gtr/gtr_wo89/gtr_wo89.pdf

Especially Chapter 5, “Using Habitat Models for Habitat Mapping and Monitoring”

Government of British Columbia, Ministry of Environment, Wildlife Habitat and Species Distribution Modelling.
<http://www.env.gov.bc.ca/fia/whi.htm>