Case studies for rights informed research to protect indigenous use

Timothy Bebeteidoh (MSc Student, RRU)[1]; Mandy Olsgard, MSc[2]; Megan Thompson, PhD[2].

1. Industry Relations Department, Athabasca Chipewyan First Nation (ACFN) Dene Lands and Resource Management (DLRM), Fort Chipewyan, Alberta, Canada.
2. Integrated Toxicology Solution Limited, Alberta, Canada.
   Thompson Aquatic Consulting, Calgary, Alberta, Canada

Introduction

The integration of Western scientific approaches with Indigenous ways of knowing represents a promising frontier for addressing complex environmental and health risk issues especially in the context of Indigenous territories (Wilcox et al., 2023). In Snively (2018), Indigenous knowledge systems refer to the entire spectrum of philosophy, history, heritage, ethics, educational processes and much more rooted in millennia of direct interaction with the land, water, and ecosystem, offering unique insights into environmental sustainability and human well-being. At the same time, Western science provides rigorous methodologies for understanding complex ecological systems and evaluating environmental risks. Embedding these two systems of knowledge in ways that respect and preserve Indigenous peoples' rights, practices and lifestyles can speed up problem-solving through addressing difficult problems (Johnson et al, 2016; Mehltretter et al, 2023). These systems provide us the opportunity to approach the problems from multiple perspectives. This essay describes how the principles of social and environmental science, from anthropology to ecology, are brought in to address conflict with Indigenous knowledge systems during health and environmental impact assessments in the Athabasca Chipewyan First Nation (ACFN) territory.

Embracing Indigenous knowledge systems into science and policy isn't just a matter of connecting systems of knowledge; it's a moral and legal responsibility. The rights of Indigenous peoples to continue traditional food and medicine use are recognized through international agreements such as the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (United Nations, 2007). Furthermore, these rights are enshrined in treaties, such as Treaty 8, which acknowledges the right of Indigenous nations to continue their traditional ways of life on their ancestral lands adhered to by ACFN in 1899. However, despite these legal protections, the inclusion of Indigenous knowledge in environmental management and policy development has been historically sidelined or dismissed by Western scientific frameworks. This gap is increasingly recognized as a significant barrier to achieving sustainable and culturally relevant environmental management.

This paper addresses this gap by presenting a framework that integrates both scientific and Indigenous knowledge to support environmental health risk assessments. By focusing on three case studies from ACFN territory, it illustrates the process and challenges of using both Western science and Indigenous knowledge to develop health and environmental criteria that are informed by both cultural and scientific perspectives. Specifically, the case studies highlight the development of Water and Sediment Quality Criteria and Bush Standards for the protection of Indigenous use in forest and wetland habitats, as well as the creation of a data analytics tool to support the implementation of these criteria and standards.

Case Studies

Case Study 1: Water Quality Criteria for Indigenous Use

The first case study involves the development of water and sediment quality criteria for the protection of Indigenous land use, including hunting, fishing, and gathering practices and referred to as the Water Quality Criteria for Indigenous Use (WQCIU). These criteria are grounded in both Western scientific principles, such as toxicology and limnology, and Indigenous knowledge of water systems, which emphasizes the importance of clean water for the health and well-being of the community. They are informed by a holistic understanding of how plants, animals, humans, and water interact in the ecosystem, and are broader in the protection of indigenous use than existing government guidelines in Canada.

Methodology

An important step in the process of creating the criteria was to assess the current conditions of the Lower Athabasca River waters, which was the initial focus of this work. Scientists assessed existing conditions by calculating normal concentrations or levels for each chemical or constituent by compiling existing data from available monitoring programs, determining normal values, low values, and high values from this data, and repeating the process for each chemical or constituent for each of the high flow, open water and under ice seasons.

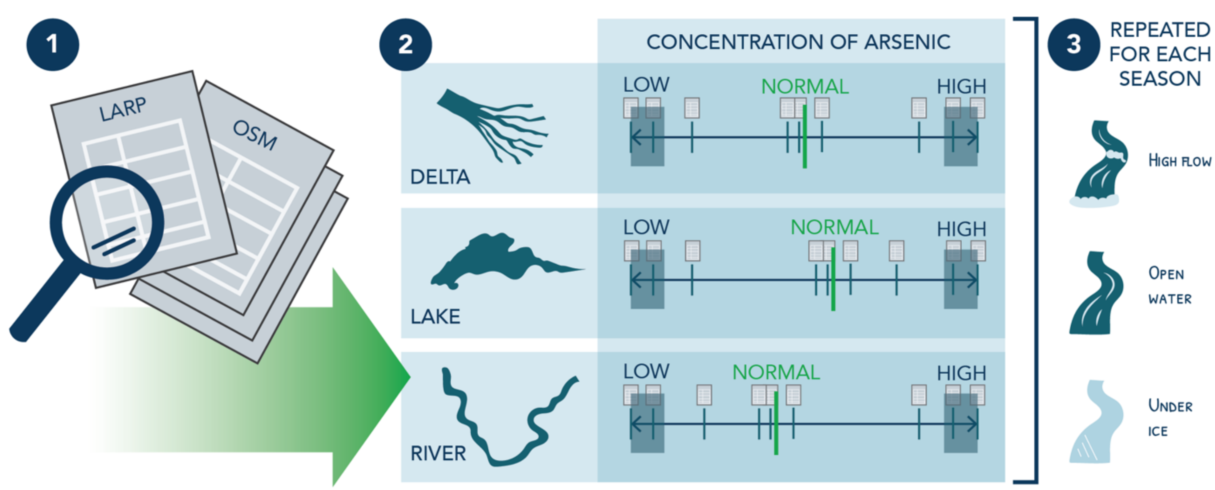

Figure 1: Pictorial representation of process 1

With the support of ACFN members sharing indigenous knowledge, five water use categories were identified for protection which are wildlife health, food and drinking water, medicinal plants, aquatic health, and culture and livelihoods. Relying on both knowledge systems, a conceptual model was developed describing key cultural receptors and exposure pathways for chemical stressors linked to changes that ACFN and other First Nations members have observed over time. Within the conceptual model, ecological and human receptors were identified as co-existing and dependent receptor groups. As such, the study does not segregate these two groups in the evaluation of potential risks from chemical exposure and protection of surface water for Indigenous use. Dozens of chemicals and constituents released by or present on oil sands mine sites were considered in the creation of Water Quality Criteria for Indigenous Use (WQCIU), this represent the maximum amount of each chemical or constituent that can be in the water or sediment while protecting the corresponding most sensitive water use.

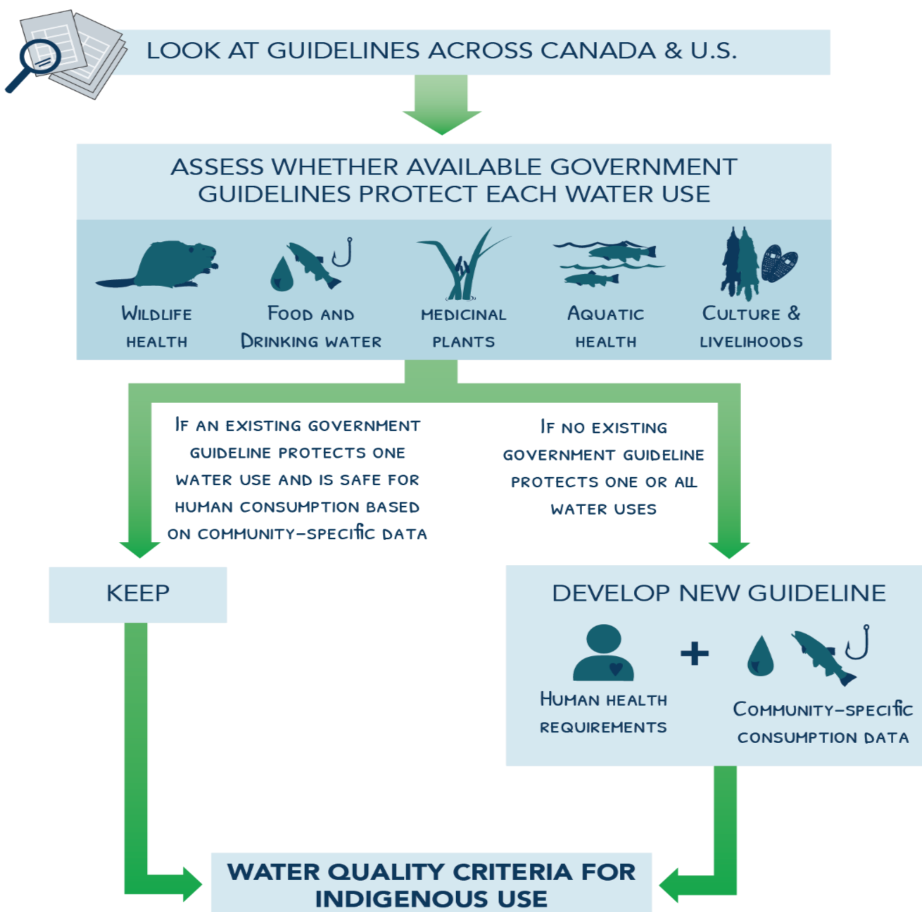

Figure 2: Processed used to create the Water Quality Criteria for Indigenous Use

To develop the multi-media risk model and predict potential risk from exposure to chemicals in surface water and sediment at concentrations equivalent to Alberta (Government of Alberta, 2018) and (Canadian Council of Ministers of the Environment, 2021) the federal guidance on ecological risk (CCME, 2020) was relied upon. In the development of the criteria, when risk to ecological receptors were predicted or a receptor was not considered in derivation of regulatory guidelines, modified or new guidelines were derived using published guidance and community specific exposure data (i.e., consumption rates (g/d)) collected through community surveys for traditional food and medicinal species. Scientists created a table for each chemical for each of the five water uses, adopting the strictest limit to form the final single set of WQCIUs.

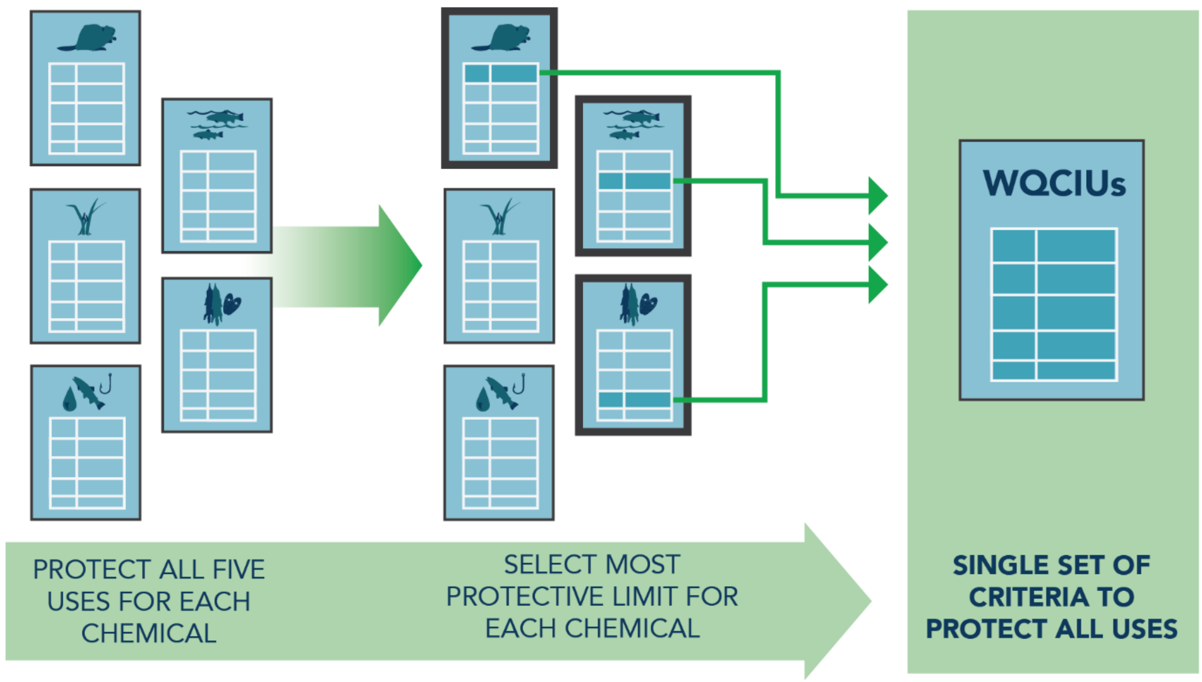

Figure 3: Processes for creating the Water Quality Criteria for Indigenous Use (WQCIUs)

Case 2: Bush Standards: Terrestrial Quality Criteria for Indigenous Use (TQCIU).

The second case study involves establishing Bush standards that apply ethnobotany and traditional ecological wisdom to the conservation of plant and animal species central to Indigenous culture. Lacking any assurance that tailings waste would support abundant, biodiverse and healthy plant, invertebrate and wildlife communities that are healthy and safe for ACFN members who eat these traditional species for a variety of food, medicine and spiritual uses, ACFN went on to develop an indigenous system of remediation and reclamation that ensures provincial and federal regulations are followed with consistency.

Through the definition of terrestrial criteria for indigenous use (TCIUs), based on how ACFN members relate and depend on the biophysical features of the boreal forest, risk-tolerance, environmental health, and safe eating of traditional foods, this research sought remediation and reclamation criteria that allow for the sustainable and healthy use of reclaimed mine sites for Indigenous use. These criteria are designed to be used to assess tailings treatment systems, mine wastes, and co-mixed reclamation soils designed to be placed in reclamation areas.

Methodology

The following describes the methodology employed to develop the Bush Standards related to remediation and reclamation:

Indigenous Terrestrial Use Conceptual Model which required developing a conceptual model describing the linkages between the soil and community uses including the routes by which chemicals move through the environment into plants and wildlife and its impact on human health and the ability for ACFN members to safely and confidently exercise their treaty rights. Parameters were screened with available criteria (Health Canada (FSCAP), 2021), applications used to identify bioaccumulative substances were adopted by CEPA SOR (2022). Indigenous knowledge receptors were identified and exposure pathways through Health Canada (2021).

The risk model was developed based on federal risk assessment guidance (CCME, 2021; Health Canada, 2021) as well as guidance from the US EPA (2005: 1999) describing the interactions between the abiotic and biological components of food webs and the fate transport of chemical substances between soil, invertebrates, plants, wildlife, and humans through body burden and exposure dose calculations.

A total of 219 surveys was completed by engaging ACFN adults and youths. Survey included 51% female and 49% male members. The survey design and implementation consisted of four key elements, namely:

- Identify and prioritize receptors,
- Survey design,
- Planning and preparation; and
- Pilot and implementation.

The next methodology was exposure and toxicity assessment. Quantifying the exposure and uptake of COPCs in measuring receptors was the exposure assessment component of this study. Estimated Daily Intakes (EDIs), or the assumed daily consumption of a substance, were calculated as mg/kg body weight (BW)/day, taking into account the consumption of soil and food items for humans and prey for wildlife (USEPA, 1999b, 2005a).

USEPA (1999a) provided the Toxicity Reference Values (TRVs), which describe the concentration below which detrimental effects from exposure to particular substances are unlikely to occur in wildlife species. These TRVs were supplemented by peer-reviewed journal articles or screening benchmark reports from Oak Ridge National Laboratory (Efroymson et al., 1997; Efroymson et al., 1997; Sample et al., 1996).

Potential risks to wildlife receptors from exposure to substances at soil guideline concentrations through ingestion of environmental media was assessed, while potential risk to higher trophic level receptors were assessed using methods prescribed by the (CCME, 2021; Health Canada (FSCAP), 2021) United States Environmental Protection Act (US EPA, 1993) and the US EPA

Office of Solid Waste (US EPA OSW, 1999, 2005). Finally, a multi-jurisdictional scan of available soil quality guidelines published by regulatory agencies and the development of a guideline database was completed. Guidelines published by Alberta Environment and Parks (AEP), the Canadian Council of Ministers of the Environment (CCME), and the United States Environmental Protection Agency (USEPA) were selected for the jurisdictional scan and database development. The most stringent guideline published was screened through the community-specific risk model.

Case Study 3: Fort Chipewyan Treatment Plant Data Analytic Tool

The third case study was the deployment of a data analytics system to apply the water criteria Lake Athbasca and drinking water samples from Fort Chipewyan. This application compares the concentrations of chemicals and constituents in the water to the Water Quality Criteria for Indigenous Use (WQCIUs) individually but adds the step of assessing the cumulative risk for each human health endpoint for all chemicals or constituents combined. This more comprehensive and realistic cumulative exposure assessment is completed within the application, and risk levels that exceed the hazard quotient are flagged for the user. In addition, the data are tested statistically for trends over time, so that an increasing concentration or value can be flagged before it exceeds a criterion.

These case studies highlight both the pitfalls and triumphs of incorporating Indigenous knowledge into environmental and health risk assessment systems. The fundamental issue is the philosophical difference between Indigenous wisdom and Western science. Indigenous knowledge tends to be holistic, relational and experiential, while Western science tends to be reductionist and phenomenological. Converging these two views requires a close scrutiny of the cultural and epistemological norms that underpin each knowledge system. But the success of such integration also depends on providing a space for Indigenous people to take an active role in research, and to make their voices and perspectives relevant and important to decisions.

Outcome

The best-known product of these case studies is the ACFN Water Policy, tu bet'a ts'ena (With Water We Live), which articulates the community's intense connection to water and how it helps to keep the environment and people healthy. This policy is an example of how Indigenous knowledge can be embedded into scientific research and accessed to produce policy that embraces Indigenous rights and desires. The ACFN Water Policy outlines water management principles with respect to Indigenous health, ecological integrity and Treaty rights and sets the stage for Nation-to-Nation treaty negotiations, engagement and communication with industry and government agencies.

Incorporating Indigenous knowledge into environmental management has important implications for ecosystem health and resilience. Indigenous peoples know that soil, water and people are inextricably connected. In that sense, their ancient knowledge systems have important implications for ecosystem resilience over the long-term and the links between environment and human wellbeing. When coupled with Western science, we could develop more holistic and culturally responsive models for environmental governance that put ecology and community above all else.

Finally, this paper aims to show how integrating social and environmental sciences with Indigenous knowledge can yield better, more culturally sensitive health and environmental risk assessments. In ACFN territory, such integration enables the formulation of policies that balance environmental protection with Indigenous lifestyles and Treaty obligations. According to the outcomes from these case studies, a joint action — an approach that takes account of scientific rigor and Indigenous knowledge — will be necessary to develop environmental policies that are just, sustainable and respectful of Indigenous rights.

References

CCME. (2021). ECOLOGICAL RISK ASSESSMENT GUIDANCE DOCUMENT.

CEPA SOR. (2022). Persistence and Bioaccumulation Regulations. http://laws-lois.justice.gc.caPubliéparleministredelaJusticeàl’adressesuivante:http://lois-laws.justice.gc.ca

Efroymson, R. A., Will, M. E., & Suter, G. W. (1997). Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision.

Efroymson, R. A., Will, M. E., Suter, G. W., & Wooten, I. A. C. (1997). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision.

Health Canada. (2021). FEDERAL CONTAMINATED SITE RISK ASSESSMENT IN CANADA: Toxicological Reference Values (TRVs) VERSION 3.0.

Health Canada (FSCAP). (2021). FEDERAL CONTAMINATED SITE RISK ASSESSMENT IN CANADA: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 3.0.

Johnson, J. T., Howitt, R., Cajete, G., Berkes, F., Louis, R. P., & Kliskey, A. (2016). Weaving Indigenous and sustainability sciences to diversify our methods. *Sustainability Science*, *11*, 1-11. https://doi.org/10.1007/s11625-015-0349-x

Mehltretter, S., Longboat, S., Luby, B., & Bradford, A. (2023). Indigenous and Western knowledge: Bringing diverse understandings of water together in practice. *Global Commission on the Economics of Water*.

Sample, B. E., Opresko, D. M., & Suter, G. W. II. (1996). Toxicological Benchmarks for Wildlife: 1996 Revision. https://www.esd.ornl.gov/programs/ecorisk/documents/tm86r3.pdf

Snively, G. (2018). –Braiding Indigenous Science with Western Science. *Knowing Home: Braiding Indigenous Science with Western Science, Book 2*.

United Nations. (2007). *United Nations Declaration on the Rights of Indigenous Peoples*. United Nations. Retrieved from https://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf

USEPA. (1999a). APPENDIX E TOXICITY REFERENCE VALUES Screening Level Ecological Risk Assessment Protocol.

USEPA. (1999b). Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume One.

USEPA. (2005a). Ecological Soil Screening Level Guidance.

USEPA. (2005b). Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

USEPA. (2005c). Guidance for Developing Ecological Soil Screening Levels.

Wilcox, A. A., Provencher, J. F., Henri, D. A., Alexander, S. M., Taylor, J. J., Cooke, S. J., ... & Johnson, L. R. (2023). Braiding Indigenous knowledge systems and Western-based sciences in the Alberta oil sands region: A systematic review. *Facets*, *8*(1), 1-32. https://doi.org/10.1139/facets-2022-0052