



## **Determining noise effects from industrial development on Aboriginal soundscapes: insight into best practices**

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### **Abstract**

Industrial development proposals frequently consider the potential effects of noise on human environments. Emerging practices often include the application of standardized assessment frameworks that focus on the health of those who may be affected. In many cases, specified methods apply pathway analysis and thresholds that presume a set of homogenous values and responses to noise. Aboriginal people in British Columbia, Canada, however, have raised serious concerns that suggest such assessments are substantially inadequate. Whether Aboriginal groups' cultural values are sufficiently integrated into noise standards, and how such values are operationalized, is poorly understood at this time. Using a case study approach, this paper examines the standard methods by which to assess the potential noise from coal mining activities on the land use activities of an Aboriginal group. Analysis demonstrated that noise standards have not implicitly or contextually integrated components from the distinct Aboriginal soundscape. The analysis also demonstrated that current standards fail to adequately scope valued components and predict potential noise effects. This paper suggests a number of steps that may be used as initial best practices to assess the impacts of noise on the Aboriginal soundscape and how to work collaboratively to identify suitable criteria.

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## 1. INTRODUCTION

Impact assessments of industrial projects generally consider the extent to which noise may result in adverse impacts on the values of human environments. In many cases, the approach used to determine potential noise effects includes the application of standardized practices, which, until recently, were implicitly assumed to have encompassed an appropriate set of values. Issues raised by an Aboriginal group in northern British Columbia (BC), Canada, however, suggest that there are substantial inadequacies in the integration of valued components that comprise the Aboriginal soundscape. There is also very little scientific inquiry and discourse with regard to how such assessments may be culturally inclusive when such values are involved. The development of an initial set of best practices for incorporating the cultural-based values of the Aboriginal soundscape into noise effects assessments is thus an essential step for future assessments to be considered credible.

This paper explores noise effects assessments within the context of valued components that are distinct to the traditional land use practices of Aboriginal cultures. Using a case study approach, the paper examines the stationary and transportation sources of noise from the proposed Gething mine located in a culturally important area for the people of West Moberly First Nations (“West Moberly”), an Aboriginal group located in northern BC. The paper begins with an overview of the standards used in BC to determine the potential effects of noise from mining activities. The noise effects assessment undertaken as part of the regulatory process for the Gething mine is reviewed to determine how and to what extent cultural values were considered. Analysis demonstrated that the standards used in BC are likely to produce an inadequate scope and characterization of valued cultural components that reflect the Aboriginal soundscape and, therefore, fail to accurately predict potential noise effects on cultural values. This paper also suggests a number of steps that may be used as initial best practices to assess the impacts of noise on the Aboriginal soundscape.

## 2. STANDARDIZED APPROACHES

Policy guidelines developed by the BC government contain frameworks used by project-proponents to assess potential impacts of noise from industrial-based activities on human environments. Each guideline provides a methodological basis from which either stationary or transportation sources of noise effects are considered (collectively, “BC Guidelines”).

BC’s Oil and Gas Commission developed a guideline for assessing the potential adverse effects of noise from stationary sources on human environments (1). Although the guideline was specifically designed to assess noise effects generated by oil and gas related activities (1), the scope of its application is inclusive in practice (i.e., used by other industries). Its intent is to “address the indoor noise levels for residents near a facility” through the establishment of thresholds for “outdoor noise attenuation of noise through the walls of a dwelling to decrease indoor sound levels so that normal sleep patterns are not disturbed” (1). Data from “neighbouring jurisdictions” were used to establish the “average rural ambient sound level” at night as being approximately 35 dB (1). An additional 5 dB were added as an “allowance to the ambient sound level, plus adjustments intended to more accurately reflect specific aspects of the facility and the environment” (1). Adjustments were based on the assumption that the oil and gas activity is located near (e.g., 30-500m) “heavily travelled roads and/or rail lines” and thus may have an increased ambient level of noise during evening hours (1). Thresholds were set at 40 dB for daytime hours and 50 dB for evening hours in order to achieve the intended purpose (1). For situations that include remote and/or wilderness areas with little to no traffic and the potential absence of industrial activities at night, general direction suggests the assumed baseline may not be representative of site-specific conditions; as such, the collection of primary data to determine the specific ambient level of noise is likely appropriate (1). Further, the established thresholds may need to be “modified to reflect site-specific conditions for seasonal issues” (1). This includes, for example, situations where industrial noise “may affect a winter recreation area where a quiet environment is a key aspect” (1).

BC’s Ministry of Transportation developed a guideline to assess the noise effects (including physiological and psychological) of major transportation projects of the BC government on human settlements (“MoT Guideline”) (2). Potential effects on non-industrial land use values are considered from this perspective. The first is the potential effect on educational facilities, where communications among humans are vital to the

efficacy of the land use and that “intrusive noise within classrooms can interfere with this function by masking or interrupting speech and by distracting the attention of students”; in such cases, the threshold is set at 50 dB (2). The second is a personal residence with a threshold of 55 dB. The third includes the “sensitive land uses” that may comprise or be located within a soundscape (2). Factors that render a land use sensitive “must be considered” when the development is new. Rural areas, for example, often have “very low ambient noise levels” thus making them “particularly sensitive to noise intrusion” (2). The thresholds, which are based on the values of the land use, should be applied generally rather than in a strict sense under this guideline. Noise effects from traffic may occur “below these thresholds”, and as such, the criteria used to assess potential changes to valued components as a result of noise from a project proposal “should not be considered rigid” (2). Further, as the guideline notes, construction materials and the quality and dimensions of windows within dwellings influence the extent to which noise is measurable within a building and therefore likely to elicit negative responses from humans.

### **3. CASE STUDY**

#### **3.1 Gething Mine: Project Profile and Activities**

Geographically situated in the foothills of the Rocky Mountains on the western edge of Canada’s Boreal Forest, the tenure area of the Gething mine is accessible via unpaved roads. Approximately 70 km northeast from the mine site is the municipality of Hudson’s Hope, BC. The initial physical disturbance of the mine site is approximately 33 ha (3). Designed as an underground project, the materials to be mined from the site include an initial 100,000 tonnes of rock and coal reject and approximately 15,000 tonnes of marketable coal (3). The purpose of extracting a bulk sample of coal is to procure contracts, as it enables a potential buyer to test the quality of the resource. Infrastructure that would need to be constructed and maintained at the mine site include the following:

- two underground decline portals;
- stockpiles for waste rock and overburden;
- coal storage piles;
- surface and subsurface conveyors to transport coal;
- drainage and collection ditches;
- new roads and modifications to existing ones;
- buildings for administration, storage, and maintenance;
- diesel generators for power, and;
- sedimentation ponds (3).

While some of the infrastructure constructed during this stage (e.g., diesel-powered generators that would likely be replaced with the construction of a power line should the project advance to full operations) is, to a certain extent, temporary, large-scale components such as the decline portals, bridge augmentations, and roads are more or less permanent. Full mine operations would likely result in additional infrastructure, including a coal wash plant and loadout facility (4).

#### **3.2 “Moose Call”: An Aboriginal Soundscape**

Activities of the Gething mine are proposed to occur within a culturally important area, which is traditionally referred to as “Moose Call” by West Moberly. Wildlife, plants, water, rocks, soils, and various other biotic and abiotic features within Moose Call have maintained the cultural subsistence of the group since antiquity. Oral history preserved by the Elders includes knowledge of ancestors hunting for the woolly mammoth. Archaeological artefacts, too, demonstrates that cultural activities such as camping, hunting, trapping, and other incidental activities (e.g., the manufacturing of tools and other goods) have been taking place for no less than 4,000 years in and around the specific site of the proposed Gething mine and 10,500 years within the First Nations’ respective territory (5,6).

Activities that occur within Moose Call include the hunting of mammals and fowl, fishing for a variety of species, gathering plants for sustenance and medicinal purposes, and the trapping of furbearers (7). The management of such cultural activities has and continues to be done through the traditional seasonal round that, among other things, is based on traditional ecological knowledge (TEK) of the Aboriginal group. In the case of a hunter, for example, the knowledge-system provides guidance on when and where to hunt for a particular species and how to select an animal(s) to be harvested, all of which would be in accordance with the Aboriginal group's worldview.

Moose Call includes a number of historic and contemporary camping sites. Located beside the Gething mine is the site of the *Mah-chipsis-keew* Culture Camp (the "Culture Camp"). Described as an "epicentre" of cultural land use activities, the Culture Camp is a modern-day representation of a land use practice that predates the arrival of Europeans in the territory. It is important to note that the terms "site" and "area" retain spatially distinct but interconnected boundaries. The specific place where members set up and use cultural infrastructure (e.g., wooden frames to dry meat from ungulates, fire pits), tents and tepees, and other camping necessities (i.e., the "Culture Camp site") is different from the land base required to support the cultural activities (e.g., hunting, drumming, gathering plants, and teaching youth) that occur as part of the seasonal round while at camp (i.e., the "Culture Camp area").

Spirituality and connection to the land plays a central role at the Culture Camp. Land upon which the traditions, customs, and practices of the Culture Camp occur forms part of *Klinse-Za* (Twin Sisters), which is a sacred place that supports, guides, and protects current generations while providing a sanctuary for future generations when there is hardship (8). Geographic contextuality is important for this place-based culture, according to the Chief of the Aboriginal group:

"Our Nation must maintain and carry out the activities and practices in this location to enable our Elders and members to pass on their knowledge and teachings from generation to generation and to maintain our cultural and spiritual connection to the land and our ancestors."

Traditions and customs associated with the Sweat Lodge, a well-known spiritual ceremony practiced by many Aboriginal groups in North America, are practiced at the Culture Camp. In broad terms, the ceremony is described "as holistic experiences that improve emotional, physical, cognitive, spiritual well-being" of people that participate (9). Benefits include improvements to the "spiritual and emotional well-being" of participants that "creates a positive change" in a participant's "sense of connection to life" (9). Cultural approaches to maintaining health and well-being are part of "an ancient, intact, complex holistic healthcare system" that Aboriginals practice and "is profound and more deeply rooted and complex than is commonly understood" (10). It is based on the principle of "wholeness and interrelatedness" where everything "is considered to have life, is interconnected, intertwined, and everything affects other things" (10).

Trapping remains an important component of the seasonal round and traditional economy for the Aboriginal group, including a trapline that has existed for thousands of years upon which the mine site is proposed. Preferred species include the American marten, lynx, wolverine, wolf, fisher, beaver, otter, squirrel, and fox (7). Some species are used for multiple purposes. Beaver, for example, is a preferred species that is trapped for its fur, meat, and medicinal purposes, while many remaining parts are often used as bait to trap predatory species. Although trapping activities often focus on furbearers, the TEK upon which the efficacy of the practice is based includes, among other things, small mammals (e.g., voles, mice, rabbits), wildlife trails, and intact riparian zones encased within a mosaic landscape where old-growth coniferous forests transition into other seral stages. During each trapping season (November–March), the trapper who manages the trapline uses those ecosystems in and around the mine site, as well as along the proposed haul route, for transporting coal from the remote area to a railway that is approximately 90 km from mining activities.

### 3.3 Procedures and Results

The noise effects assessment (the "NEA") for the Gething mine considered the potential for surface mining activities from stationary and transportation sources to have adverse impacts on the Culture Camp site. Potential effects from noise or vibrations caused by subsurface mining activities were not included in the scope of the assessment.

Stationary sources included machinery and mechanical processes that operated within the mine site, such as electrical transformers, diesel generators, heavy equipment (e.g., bulldozers, road graders), and water pumps. The majority of these sources were assumed to operate non-stop for the duration of the approved mining activities. Additional mining activities on the mine site (e.g., coal transfer convey, shuttle trucks) were excluded from the NEA based on the assumption that they would not be a “significant noise source” (3). Transportation sources primarily included industrial traffic that would likely cause noise effects offsite as a result of travelling to and from the mine site. The NEA noted that “conservative noise predictions” were used in the analysis to account for the potential impacts on the Culture Camp site as a result of transportation (3).

The NEA did not include the collection of baseline data (i.e., the historical reference point) to determine ambient sound levels in relation to the setting of the relevant cultural values. Instead, the assessment assumed that the “acoustical environment” of such locations was “consistent with [the] Canadian remote or rural acoustical environment”, which is “40 dB or less” (3). Criteria used to assess stationary sources were derived from the OGC Guideline, which included the following: (1) whether there are human receptors within the project boundary or within 1.5 km of its boundary; and (2) thresholds of 50 dB for daytime and 40 dB for night-time. The assessment noted the Culture Camp site as the nearest human receptor, with a distance of 1.3 km from the mine (3); however, there was no qualitative description or geographic analysis included in the assessment that demonstrated the presence (or absence) of Aboriginal-based valued components and proximity to sources of noise. Transportation criteria from the MoT Guideline included a “24-hour equivalent sound level ( $L_{eq}$ , 24 hour)” as a basis, the assumption that noise may physiologically “impact residential areas” by exceeding the threshold and/or by a considerable increase in noise from the ambient “community sound level” (3).

Results of the NEA modelling exercise projected a noise level of 39 dB at the Culture Camp site (1.3 km away) and 37 dB at a distance of 1.5 km (3). Effects from stationary sources were predicted to be of “moderate magnitude, local in extent (within the guideline setback of 1.5 km or less), and occur short to medium term” (3). Similar results were found for the potential effects from transportation sources of noise. Because the assumed baseline was less than the 55 dB threshold noted in the MoT Guideline, the assessment noted that the mining activities associated with the transportation sources “do not alter the existing acoustical environment” (3). As such, the predicted effects for transportation sources were considered “low magnitude, local in extent (within 40 m or less from the road ways), and occur short to medium-term duration” (3). In both cases, the analysis concluded that the “effects on the acoustical environment” are “reversible” and thus “are predicted to be not significant” (3).

#### **4. DISCUSSION**

The NEA provided insight into the standards for assessing noise effects in BC and how these are applied to industry-generated anthropophony from stationary and transportation sources. Analysis of the methods and results demonstrated that there are a number of issues to consider for the assessment of impacts to cultural-based valued components of Aboriginal groups. An implicit assumption of the NEA was that the BC Guidelines are applicable for mining activities and that each standard has adequately accounted for the valued components of Aboriginal cultures and thus is a credible approach. Substantial modifications, if any at all, do not appear to have been made to the standard to account for the potential adverse noise effects of mining activities on an Aboriginal group.

While the NEA identified the Culture Camp site as a valued component, the assessment failed to identify cultural land use activities other than to describe the camp’s general location in reference to the mine site and the road that would be used for transporting equipment, personal, and hauling coal. Cultural activities that occur at the site were not itemized, delineated, or characterized for an evaluation of the distinct qualities that may have been potentially impacted. Not only were the spatial boundaries of the site not specified, but the cultural values of traditions, customs, and practices that occur within the boundaries of the site were also, by extension, assigned the same ambiguous spatial boundary as well. Temporal boundaries of these values were also not determined. Further, the NEA did not take notice of the fundamental purposes and objectives of the Culture Camp: harvesting and gathering material sustenance and medicines, teaching and building TEK, connecting to the land and history, spiritual practices, and other traditions, customs, and practices of the mode of life that supports and sustains cultural subsistence. Nearly all of these cultural-based values occur within the

Culture Camp area, including the mine site. From both an ecological and safety perspective, the supposition that modern-day hunting practices of large ungulates (e.g., moose) would occur inside the boundaries of the Culture Camp site is not a plausible assumption. Lands and natural resources that surround the site of a Culture Camp were noted by the Aboriginal group as being as much a part of the experience as the valued components within its boundaries. When viewed collectively, the valued components of the TEK form the basis of the Aboriginal soundscape. This, however, was not considered in the NEA. BC Guidelines are not designed to adequately integrate recent science on soundscapes, let alone that distinct soundscapes based on the values of Aboriginal cultures may be present.

During the impact assessment process, the substitution of one valued component for another to function as a surrogate has generally been seen as an acceptable practice in select cases, but only when needed. The prerequisite, however, is that a surrogate mirror the plurality, if not all, of the necessary characteristics and conditions of the valued component it is proposed to represent. Replacing the substantial cultural values of an Aboriginal group with the “acoustical environment”, as was done in NEA, is unlikely to satisfy the methodological requirements for a credible analysis of potential adverse effects. Changes to the characteristics of the variables associated with the acoustical environment are insufficient, as correlations between the characteristics of each value and the acoustical environment are unlikely.

Baseline data were not collected as part of the NEA, including data of the presence and occurrence of sounds that are within the soundscape. Instead, the NEA relied on the assumed baseline as directed by the OGC Guideline. Importantly, the setting described in the OGC Guideline does not represent the characteristics of the soundscape where mining activities would interact with the cultural values of the Aboriginal group. There were no heavily used roads or oil and gas infrastructure that would contribute to an increase in the ambient sound level, as the land base was largely a wilderness area with intermittent activities in the region.

Impact assessments frequently rely on predetermined thresholds when assessing whether a project proposal may adversely change the conditions of a valued component, as was the case in the NEA. While the practice is acceptable in many cases, reliance on a threshold approach when a valued component is derived from the culture of an Aboriginal group is likely unacceptable. The application of an externally generated threshold carries with it several assumptions that remain largely untested with regard to Aboriginal cultures. Most notable is whether the science upon which a threshold has been developed may be generalized. Different scales and diversity of non-aboriginal land uses within the respective territories of such groups are likely to result in different experiences and challenges, specifically in relation to cumulative effects to valued components. There is also the *sui generis* nature of each Aboriginal group and their TEK. Neither the NEA nor the BC Guidelines have accounted for these characteristics of the Aboriginal soundscape with regard to the standardized thresholds.

Using a threshold of 40 dB or 50 dB may be appropriate in some settings, but its application to circumstances that involve cultural values of an Aboriginal group (as opposed to certain valued components relating to human health) raises serious concerns. Research on noise that involves humans in their residences (e.g., houses, apartment buildings) in urban and/or rural settings is not directly comparable to the traditional activities of Aboriginal groups, such as at the Culture Camp, where people are teaching songs, stories, and knowledge, and sleep in tents and/or tepees. This is not to say that some of the research is not applicable to Aboriginal peoples in general, but rather that there are significant differences with regard to cultural-based valued components of Aboriginal groups and the values of those that are located in the built environment. Research that examined responses to noise from the general public in wilderness areas (e.g., parks) is analogous to some extent. However, the correlation is likely cosmetic in comparison to substantial traditions, customs, and practices of Aboriginal cultures that are intertwined with the natural environment and are, in the case of West Moberly, linked to approximately 4,000 years of continued use and occupancy. The Aboriginal group refers to this as “bush life”; they actively seek such an environmental setting, as it was when their ancestors were there. From this perspective, as described by a participant, a likely threshold would reflect “nothing but wind in the trees”, which has been quantified via other research studies as approximately 20 dB (11).

If the purpose of the NEA was to determine whether the noise generated by the stationary and transportation sources of anthrophony would result in adverse effects to valued components of the Aboriginal group, then the conclusions (e.g., “effects... are predicted to be not significant” and that “a high degree of confidence in the prediction”) cannot be considered credible, as the scope, baseline, and analysis of potential

effects in the NEA were inadequate. A spiritual ceremony, specifically the Sweat Lodge, as well as other spiritual practices such as drumming, singing, and connections with the land and ancestors are key to the Culture Camp. Traditions and customs such as these are irreconcilable with the noise effects from mining activities in close proximity, and as such, would not be able to occur for the duration of the industrial development in the area and likely for a period of time afterwards. From a temporal perspective, this would mean that all spiritual activities associated with the Culture Camp would need to stop. This would also mean that traditional health practices, healing, cultural identity, social relationships, and teaching, among other things, would also stop. When asked about the conclusion of the NEA in relation to his culture, the Chief of the Aboriginal group provided a succinct analogy:

“Would it be acceptable to stop all services and traditions that occur at the Vatican for three years or so? I don’t think Christians would like that. I’m sure that would really upset them and a lot of other people; rightfully so. So, I ask you this: why do people think it is acceptable to make us stop our spiritual practices where we do them? It’s the same thing. The only difference is that the land, trees, water, animals, that’s our Vatican, and that camp is where we do some of our spiritual ceremonies. They are just as important to us as the Vatican is to Christians and others. We can’t move them just like they can’t move the Vatican.”

Based on the potential changes to the cultural values at the Culture Camp, it is difficult to see how the noise effects would be considered “not significant” if the assessment included an appropriate scope with sufficient baseline data. It is unlikely that adverse effects to cultural values in general, and particularly those relating to spirituality, are “reversible” in such circumstances. Placing cultural identity on hold is not possible because it requires an individual, and in this situation a culture, to cease the traditions, customs, and practices that define their existence.

Regulators of the BC government accepted the NEA. There was no technical evaluation of the methods, analysis, and conclusions insofar as the public or West Moberly were made aware. Under the BC Guidelines there are no obligations to do such a review. The acquiescence of assessments without examining credibility is not likely to generate social acceptability, especially when circumstances include land use activities that involve individuals who will likely experience adverse effects. The efficacy of the standardization of noise effects assessments is unlikely to be maximized with the removal or lack of inclusion of regulator oversight, which includes a technical review. Incorporation of a technical review process into the standards would assist with the evaluation and thus ensure transparency while at the same time eliminating ad hoc approaches.

Based on the legal responsibility to include Aboriginal groups in impact assessment processes and protect their cultures from unreasonable adverse effects, the lack of inclusion is cause for concern. Many of the issues relating to the scope and baseline could have been addressed through the involvement of the Aboriginal group, and the results of the analysis could easily be provided for review, and when required, modification. Presentation of results would likely go a long way in terms of acceptance, especially to determine whether the monitoring efforts are suitable and mitigation measures are likely to be effective.

## **5. SUGGESTIONS FOR A PATH FORWARD**

Standardization of noise effects assessment in BC have not accounted for the cultural-based valued components that are unique to Aboriginal groups. Further implementation of the BC Guidelines is unlikely to adequately incorporate such values into the assessment process, as a number of procedural and substantive issues need to be reconsidered, modernized, and perhaps removed in some cases. Routine recommendations in similar circumstances are to work collaboratively, provide adequate resources, identify the values and soundscape, and engage as much as possible, all of which are appropriate – but, inevitably, insufficient on their own. Conventional best practices should be an assumed starting point rather than viewed as an improvement to the status quo. Initial steps to move forward with an Aboriginal group would likely take into account the following:

- Develop an understanding of the traditional ecological knowledge and *sui generis* nature of Aboriginal groups that could potentially be affected;
- Begin with a cumulative perspective, both in terms of the past, present, and future impacts that have changed the cultural-based valued components that comprise an Aboriginal soundscape as well as other changes and/or influences to TEK;
- Reconsider the scientific terms, meanings, and ways of identifying and thinking about information with an Aboriginal group, where there is mutual learning and understanding;
- Review the generalizability (external validity) of extant scientific knowledge in the context of the Aboriginal soundscape; and,
- Partner with the Aboriginal group in the design, methods, analysis, and follow-up.

More and more, the participation of humans in impact assessments has been scaled down in nearly all aspects of the process when the role, particularly in situations where adverse cumulative effects require considerable monitoring and management, should instead be strategically modified. Noise effects assessments and additional efforts to standardize the practices would be best served to examine the efficacy of participation rather than moving towards expert-driven approaches.

## 6. CONCLUSIONS

Incorporation of Aboriginal cultures into land use planning and the management of natural resources have become a foundational requirement in Canada. Subsistence of these cultures is largely based on the preservation of ecosystems within their respective territories. The maintenance of cultural connections to the land, which has as much to do with the locations that relate to histories, stories, ancestors, and spirituality as it does with the natural systems and processes that exist within these environments, is also integral. The way the land sounds is only one, albeit important, element of their TEK that supports such relationships, as these cultures are interwoven with their surroundings.

Sounds that conflict with the balances and functions within the TEK of an Aboriginal group could, as the case study demonstrated, have significant consequences. Noise was shown to interfere with the application of traditional knowledge, the practicing of spiritual ceremonies and beliefs, harvesting flora and fauna, and connection and connectivity with the land. Furthermore, the level and type of noise required to cause such responses is considerably less than the thresholds that have been included within the standards used to assess potential impacts. An accurate account of the potential impacts from industrial-based sounds on Aboriginal values is possible, but a considerable shift must occur in order for a scientifically and culturally appropriate approach to emerge.



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