NOVA SCOTIA
Environment

# Comment Index

## Highway 104 Twinning Sutherlands River to Antigonish Project

Publication date: January 29, 2019

**Government**

| Number | Source | Date Received |
|---|---|---|
| 1 | Nova Scotia Department of Business | Dec. 18, 2018 |
| 2 | Fisheries and Oceans Canada | Dec. 20, 2018 |
| 3 | Canadian Environmental Assessment Agency | Jan. 7, 2019 |
| 4 | Nova Scotia Environment – Resource Mangement Unit | Jan. 8, 2019 |
| 5 | Nova Scotia Environment – Inspection, Compliance and Enforcement Division | Jan. 11, 2019 |
| 6 | Nova Scotia Department of Agriculture | Jan. 11, 2019 |
| 7 | Nova Scotia Department of Fisheries and Aquaculture | Jan. 11, 2019 |
| 8 | Nova Scotia Office of Aboriginal Affairs | Jan. 14, 2019 |
| 9 | Nova Scotia Environment - Protected Areas and Ecosystems Branch | Jan. 15, 2019 |
| 10 | Health Canada | Jan. 15, 2019 |
| 11 | Environment and Climate Change Canada | Jan. 15, 2019 |
| 12 | Nova Scotia Environment – Water Management Unit | Jan. 15, 2019 |
| 13 | Nova Scotia Environment – Water Management Unit | Jan. 15, 2019 |
| 14 | Nova Scotia Department of Lands and Forestry | Jan. 15, 2019 |
| 15 | Nova Scotia Environment - Environmental Health Program | Jan. 15, 2019 |
| 16 | Nova Scotia Department of Communities, Culture and Heritage | Jan. 15, 2019 |
| 17 | Nova Scotia Environment – Industrial Management Unit | Jan. 15, 2019 |

**Nova Scotia Mi'kmaq**

| Number | Source | Date Received |
|---|---|---|
| 1 | Native Council of Nova Scotia | Dec. 27, 2018 |
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**Public**

| Number | Source | Date Received |
|---|---|---|
| 1 | Anonymous | Dec. 9, 2018 |
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**From:** Mosher, Jake I <Jake.Mosher@novascotia.ca>
**Sent:** Tuesday, December 18, 2018 9:54 AM
**To:** Yeh, Helen X <Helen.Yeh@novascotia.ca>
**Cc:** Glass, Vimy M <Vimy.Glass@novascotia.ca>
**Subject:** RE: Class I Environmental Assessment: Highway 104 Twinning Sutherlands River to Antigonish Project

Hi Helen,

Please find below the comments from Department of Business regarding the Highway 104 Twinning Sutherlands River to Antigonish Project Environmental Assessment Registration:

"The proposed project is not inconsistent with the mandate of the Department of Business."

Best,

Jake

**From:** MacNeil, Jack <Jack.MacNeil@dfo-mpo.gc.ca>
**Sent:** Wednesday, December 19, 2018 4:36 PM
**To:** Yeh, Helen X <Helen.Yeh@novascotia.ca>
**Subject:** [PROBABLE-SPAM] RE: Class I Environmental Assessment: Highway 104 Twinning Sutherlands River to Antigonish Project

Hello Helen,

DFO Fisheries Protection Program has reviewed the EA registration document submitted by NSTIR for Sutherlands River to Antigonish project. It is our understanding that the project area has a total of 127 watercourses. Watercourse alteration activities are anticipated for all 127 watercourses. Based on our initial review, the project will not result in any significant adverse environmental effects. All watercourse crossing impacts can be mitigated through proper design of the crossings, the provision of fish passage and through offsetting measures via a DFO authorization if required.

It is our understanding that prior to initiating construction of watercourse crossings, permitting applications for the construction in watercourses will be submitted to NSE and DFO through our one window process. It is at this time that DFO will conduct an in depth review of the project and work with the proponent to ensure all proper mitigation measures are in place

Thanks,

Jack

Canadian Environmental Assessment Agency | Agence canadienne d'évaluation environnementale

Suite 200
1801 Hollis Street
Halifax, NS B3J 3N4

Bureau 200
1801 rue Hollis
Halifax, NE B3J 3N4

Date: January 7, 2019

To: Helen Yeh, Environmental Assessment Officer

From: Emily Gregus, Environmental Assessment Officer, Canadian Environmental Assessment Agency

Subject: Highway 104 Twinning Sutherlands River to Antigonish Project

The federal environmental assessment process is set out in the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). The *Regulations Designating Physical Activities* (the Regulations) under CEAA 2012 set out a list of physical activities considered to be "designated projects." For designated projects listed in the Regulations where the Canadian Environmental Assessment Agency (the Agency) is the responsible authority, the proponent must provide the Agency with a project description that includes information prescribed by applicable regulations (*Prescribed Information for the Description of a Designated Project Regulations*).

The relevant entries in the Regulations for this type of project are:

> 25. The construction, operation, decommissioning and abandonment of a new:
> c) all-season public highway that requires a total of 50 km or more of new right of way.

Based on the information submitted to the Province of Nova Scotia on the proposed Highway 104 Twinning Sutherlands River to Antigonish Project, it does not appear to be described in the Regulations. Under such circumstances the proponent would not be required to submit a project description to the Agency. However, the proponent is advised to review the Regulations and contact the Agency if, in their view, the Regulations may apply to the proposed project.

The proponent is advised that under section 14 of CEAA 2012, the Minister may, by order, designate a physical activity that is not prescribed by regulations made under paragraph 84(a) if, in the Minister's opinion, either the carrying out of that physical activity may cause adverse environmental effects or public concerns related to those effects may warrant the designation. Should the Agency receive a request for a project to be designated, the Agency would contact the proponent with further information.

The proposed project may be subject to sections 67-72 of CEAA 2012. Section 67 requires that, for any project occurring on federal lands, the federal authority responsible for administering those lands or for exercising any power to enable the

project to proceed must make a determination regarding the significance of environmental effects of the project. The Agency is not involved in this process; it is the responsibility of the federal authority to make and document this determination.

The proponent is encouraged to contact the Agency at (902) 426-0564 if it has additional information that may be relevant to the Agency or if it has any questions or concerns related to the above matters.

Emily Gregus
Environmental Assessment Officer
Canadian Environmental Assessment Agency
Emily.Gregus@canada.ca
902-426-8157

**From:** McKenna, Chuck W <Chuck.McKenna@novascotia.ca>
**Sent:** Tuesday, January 08, 2019 1:29 PM
**To:** Yeh, Helen X <Helen.Yeh@novascotia.ca>
**Subject:** RE: Class I Environmental Assessment: Highway 104 Twinning Sutherlands River to Antigonish Project

Helen,

RMU has no comments.

Chuck

**From:** Bard, Kim A <Kim.Bard@novascotia.ca>
**Sent:** Friday, January 11, 2019 11:18 AM
**To:** Yeh, Helen X <Helen.Yeh@novascotia.ca>
**Subject:** Re: Class I Environmental Assessment: Highway 104 Twinning Sutherlands River to Antigonish Project

Hi Helen

I've reviewed the documents and I have no comments at this time.

Kim

NOVA SCOTIA

**Agriculture**

60 Research Drive
Suite A
Bible Hill, Nova Scotia
B6L 2R2

Date: 2019-01-11

To: Helen Yeh, Environmental Assessment Officer

From: Executive Director, Policy and Corporate Services
Nova Scotia Department of Agriculture

Subject: Class I Environmental Assessment: Highway 104 Twinning Sutherlands River to Antigonish Project

Thank you for the opportunity to review the Environmental Assessment Registration Document for the Highway 104 Twinning Sutherlands River to Antigonish Project.

Based on the location of the proposed project and the project description, there may be impacts to agriculture. The Nova Scotia Department of Agriculture has the following comments:

- It would be beneficial to have more detail on mitigation measures for any potential loss or restriction of access to existing farmland.
- This project will result in the loss of current and future agricultural land (including blueberry, maple, and crop production). To understand the full impact, additional information, including consideration of impacts to future expansion potential, would be useful.
- Although there is an existing highway for most of the project area, this project will result in incremental noise impacts during construction which may impact livestock operations. Mitigation measures for noise reduction in nearby areas would be advantageous.

NOVA SCOTIA

**Fisheries and Aquaculture**

60 Research Drive
Suite A
Bible Hill, Nova Scotia
B6L 2R2

Date: 2019-01-11

To: Helen Yeh, Environmental Assessment Officer

From: Executive Director, Policy and Corporate Services
Nova Scotia Department of Fisheries and Aquaculture

Subject: Class I Environmental Assessment: Highway 104 Twinning Sutherlands River to Antigonish Project

Thank you for the opportunity to review the Environmental Assessment Registration Document for the Highway 104 Twinning Sutherlands River to Antigonish Project.

The Nova Scotia Department of Fisheries and Aquaculture has the following comments:

- The project footprint incorporates a significant number of water courses which provide important habitat to salmonids, particularly speckled trout, brown trout and Atlantic salmon. The Department does not have any concerns with the mitigation measures put forward by the proponent.

- Given that the nearest marine aquaculture lease is 6 km from the project site, the Department does not anticipate any direct interaction or significant impact due to project activities.

- Land-based aquaculture facilities are located in the Barneys River watershed, one of which is downstream from the project site. Project activities that interact with this watercourse should consider this land-based facility; however, the Department does not have any concerns with the mitigation measures proposed by the proponent.

Duke Tower, 5th Floor
5251 Duke St.
PO Box 1617
Halifax, Nova Scotia
Canada B3J 2Y3

NOVA SCOTIA

## Office of Aboriginal Affairs

Date: January 14, 2019

To: Helen Yeh, Environmental Assessment Officer

From: Claire Rillie, Consultation Advisor, NS Office of Aboriginal Affairs

Subject: Class I EA Highway 104 Twinning Sutherlands River to Antigonish Project

NSOAA has no comments or questions on the above-noted Class I EA registration document.

5151 Terminal Rd.
PO Box 442
Halifax, NS
B3J 2P8

Tel: (902) 424-3600
Fax: (902) 424-0503

# MEMORANDUM

**DATE:** **January 15, 2019**

**TO:** **Helen Yeh**

**FROM:** **Peter Labor, Director of Protected Areas and Ecosystems**

**SUBJECT:** **Highway 104 Twinning Sutherlands River to Antigonish Project**

Protected Areas and Ecosystems Branch has reviewed the Environmental Assessment application for the Highway 104 Twinning Sutherlands River to Antigonish Project and offers the following comments for consideration.

## Wetland Comments:

- Impact to wetlands includes loss of habitat as a direct result of construction activities and potential for indirect changes to wetland functions and services because of ongoing use and maintenance. Impacts include changes to hydrology patterns, reduction in water quality, and loss of biodiversity.

- Several wetlands proposed to be impacted are known to support a variety of Species at Risk, Species of Conservation Concern and plant species of significance to First Nations communities across the study area. The proponent should work closely with Lands and Forestry and First Nations to develop wildlife management plans that should apply to all NSE approvals.

- While several Wetlands of Special Significance are identified to be altered, the proposed Project would meet the requirements of "public necessity" as included in the NS Wetland Conservation Policy.

- Surface water quality/quantity monitoring should be considered in conjunction with routine watercourse monitoring, specific alterations and/or potential changes to flow within the impacted watersheds,

- Groundwater quality/quantity monitoring should be considered in conjunction with routine monitoring of groundwater resource and groundwater dependent ecosystems.

- Prior to any wetland alterations, a Wetland Alteration Approval is required for any wetland directly or indirectly altered by the proposed development and conduct an assessment of wetland function and resulting changes to wetland area/function in association with the approval application.

- Prior to altering any wetlands, the proponent must develop a wetland monitoring plan, which should include the following:
    - How baseline conditions will be documented before construction (and grubbing) begins. This should include indicators of hydrology, water quality parameters and vegetation community.
    - How changes in hydrology of the partially impacted wetlands will be monitored and proposed performance indicators.
    - How changes in the vegetation community of the partially in filled wetlands will be monitored, especially regarding the proportions of wetland specific plants, and invasive species and proposed performance indicators.
    - How changes in water quality of the impacted wetlands will be monitored and proposed performance indicators.

- Prior to any wetland alterations, the proponent must develop a Wetland Compensation Plan. The Wetland Compensation Plan and associated reporting requirements must be developed to establish specific objectives intended to prevent the net loss of wetlands and functions in accordance with the Nova Scotia Wetland Conservation Policy.

## Protected Areas Comments:

- The twinning realignment comes close to two of the three land parcels comprising the pending Barneys River Nature Reserve. Disturbance to those sites should be minimized.

- There is concern about animal movement between Eigg Mountain James River wilderness area and pending Barneys River Nature Reserve. Where the twinning is proposed is where two highland Natural Landscapes are closest together and therefore this area is a natural travel corridor for animals rely on these more remote highland ecosystems, including endangered mainland moose. Human disturbance, particularly at this scale, could be problematic for these animals. The EA document suggests highway underpasses be constructed, but there is concern if those same underpasses are also used by OHVs as scientific literature shows animal avoidance behaviors occur where OHV trails exist. A preferred solution would be to establish separate underpasses to support animal movement. Widening watercourse crossings, as suggested by the EA is a good idea.

## Ecosystem Comments:

- There is concern regarding the karst topography at the eastern end of the proposed project. Karst ecosystems are one of the most endangered ecosystems worldwide because of human development and NS has some of the most well-developed examples. They are often habitat for rare or species of conservation concern. Although, few karst associated rarities were found here, the habitat is still significant, rare and at risk. This ecosystem type is significant enough to warrant some special attention or at least recognition of its loss due to this development. One mitigation option would be to purchase and formally protect an equal area of karst somewhere else.

Health Canada Santé Canada

Environmental Health Program
Regions and Programs Bureau
1505 Barrington Street, Suite 1817
Halifax, NS B3J 3Y6

January 15th, 2019

Helen Yeh
Environmental Assessment Branch
Nova Scotia Environment
1903 Barrington Street
Suite 2085
PO Box 442
Halifax, Nova Scotia, B3J 2P8

Subject: Health Canada's Response – Highway 104 Twinning Sutherlands River to Antigonish Project Environmental Assessment[1]

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Dear Helen:

Thank-you for your e-mail dated November, 30th 2018, requesting Health Canada's review of the above-mentioned Environmental Assessment Registration (EA) document[1] with respect to issues of relevance to human health. Health Canada has reviewed the document and is providing the following information with respect to receptor locations, air quality, noise, and drinking water for your consideration.

**Receptor Location(s):**

**Section 5.8.2 Land Use and Section 8.1.8.1 Land Use –** According to the report, there is an estimated 12 ha of Agricultural lands, 333 ha of forested lands and 286 ha of mineral exploration licences that will be affected within the Project Area. The report does not indicate how much residential land will be affected within the Project Area. The report indicates there is an ongoing private property acquisition program along the Highway 104 right of way (RoW).

**Section 8.1.8.1** notes:

> *Prior to Project development, property acquisition will be required to obtain additional RoW to allow for the execution of the Project….. Residential dwellings within the RAA may experience disruption or degradation, which could include traffic disruptions as a result of construction activities.*

[1] CBCL. 2018. Highway 104 Twinning Sutherlands River to Antigonish Environmental Assessment: Environmental Assessment Registration. Prepared for the Nova Scotia Department of Transportation and Infrastructure Renewal and the Nova Scotia Department of Agriculture, Land Protection. December.



Sent by e-mail to Helen.Yeh@novascotia.ca and ea@novascotia.ca

The registration document does not indicate the proximity of the proposed highway to the nearest permanent human receptors. There is also no discussion about whether there are any particularly sensitive human receptor locations such as schools, daycares, places of worship, sports fields etc. that may be affected by project activities.

- Health Canada recommends the location(s) and proximity of the nearest human receptor locations to the proposed highway ROW be reported and used to evaluate the potential for human health effects associated with project activities, including potential public safety, air quality, noise, and potentially drinking water quality.

## Air Quality

**Section 5.1.1 Air Quality and Section 8.1.1.1 Air Quality – Table 8.4** presents annual air contaminant emissions within proximity of the Project area in 2016. The provincial ambient air quality monitoring stations cited for baseline are located in Halifax, Pictou and Port Hawkesbury.

### New Standards for $NO_2$ and $SO_2$:

No Federal criteria for $SO_2$ or $NO_2$ were presented in **Table 8.4**. The Canadian Council of Ministers of the Environment (CCME) has recently published updated guideline values for $SO_2$ and $NO_2$, both of which have effective dates of 2020 and 2025 (i.e. the new acceptable values as of 2020 are lower than the current values and the acceptable values as of 2025 are lower than the 2020 values for both substances) (www.ccme.ca/en/resources/air/air/sulphur-dioxide.html and https://www.ccme.ca/en/current_priorities/air/caaqs.html). Depending on the timing of construction, these values may be applicable during the construction phase of the Project.

- In the event that the project construction occurs during 2020 or later, the new Federal $SO_2$ and $NO_2$ standards will apply and should be considered given that they are substantially lower than the current standards.

### Operational Air Quality:

**Section 8.1.1.1** indicates that:

> *There is potential for the proposed Project to adversely impact air quality due to generation of emissions from combustible fuels and dust generated through use of heavy machinery or vehicular traffic. Dust and combustible fuel emissions are anticipated to be short-lived, dissipating within 300 m of the Project area as a result of ambient winds. As such, potential impacts to air quality are anticipated to be temporary.*

No predictive air modelling was undertaken in the EA report for the Project area (within 300 m of the highway). No previous air quality data on the currently twinned section of Highway 104 was presented. Given the potential proximity of the project to nearby residences, it is unclear what impact the project may have on air quality at these nearby residences (or other sensitive receptor locations).

- Consider modelling future ambient air quality at the nearest receptor locations in order to ensure the protection of human health from construction activities and from vehicle emissions during highway operation.
  For a detailed description of Health Canada's guidance for evaluating air quality in EAs, please see the attached (Health Canada, 2017)[2].

## Noise

### Construction Noise

Construction noise is briefly discussed in **Section 8.1.1.2** of the report. The EA does not provide a discussion about acceptable construction noise limits or how these limits will be monitored and/or enforced.

In quiet residential areas, Health Canada suggests that during construction, the long-term average day-night sound level (Ldn) be below 57 adjusted A-weighted decibels (dB(A)) at residences. A Ldn of 57 dB(A) is expected to be the threshold for widespread complaints for construction noise (United States Environmental Protection Agency or USEPA, 1974)[3]. If noise levels at residences are expected to exceed this level, it is suggested that the report include a discussion about proposed mitigative measures.

If a Ldn of 57 dB(A) at receptors cannot be obtained with the use of quieter technology, Health Canada suggests that community consultation be undertaken to determine work schedules and to inform the public of the times and durations of noisy activities (including blasting if applicable).

- In general, Health Canada suggests that impulsive sources (e.g. hammering, pile driving) be avoided at night and in the early morning. Further, Health Canada suggests that noise management and noise monitoring plans, including complaint resolution, as appropriate, be included as part of an Environmental Management Plan.

### Operational Noise:

**Appendix D** identified current ambient noise levels in excess of the Nova Scotia Environment (NSE) noise guidelines[4] (65-55 dB(A)) at all the 12 monitoring stations on the twinned portion of Highway 104. All four un-twinned sections were below the NSE guidelines.

No predictive noise modelling was undertaken for the Project area in the EA report (i.e. within 300 m of the proposed highway) for the operation phase of the project. Given that current noise levels on the twinned section of Highway 104 exceed the NSE noise guidelines at all 12 monitoring stations and that

[2] Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
[3] USEPA. 1974. Office of Noise Abatement and Control. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. www.nonoise.org/library/levels74/levels74.htm
[4] Nova Scotia Environment and Labour (NSE). 2005. Guidelines for Environmental Noise Measurement and Assessment. Available Online: http://www.noise-ordinances.com/wpcontent/uploads/2015/09/EnvironmentalNoiseMeasurement.pdf.

the new section of highway is to be twinned, with a similar volume of traffic expected during the operation phase as the existing twinned portion (i.e. same volume of traffic will travel along both the currently twinned and future twinned sections), it is unclear whether or not noise levels in the newly twinned portion will exceed NSE noise guidelines in the future.

For highway projects, given that improvements may result in increased traffic flow in the future, it is important to evaluate future noise levels based on a future design year. The future design year is the number of years following the commencement of the operation of the road for which the operational sound levels are derived/predicted. Environmental assessments for highways projects in other provinces that have been reviewed by Health Canada have used 10 years or 20 years following operation commencement as their future design year. The reason for using a future design year in the prediction of future operational noise levels is because often noise levels reach a maximum several years following the commencement of the operation of the highway due to changing traffic patterns (more people using the new road) and also due to changes in infrastructure (i.e. additional residential/commercial development) that may result because of the presence of the new road.

- Given that the project involves the operation of a twinned highway in a relatively quiet rural area, the noise levels may increase at any nearby human receptor locations. In order for Health Canada to evaluate the acceptability of future noise levels at nearby human receptors, it is important to model future noise levels using a future design year which would be representative of typical traffic volumes during operation.

For a detailed description of Health Canada's guidance when evaluating noise in Environmental Assessments, see attached (Health Canada, 2017).[5]

**Drinking Water:**

There was no discussion in the report on the potential impacts of the Project on local drinking water supplies. Depending on the type and proximity of nearby potable wells (i.e. dug wells within close proximity to the RoW), the use of road salts on the highway and/or pesticides in the RoW for vegetation control could impact shallow groundwater via runoff and subsequent leaching from soil and surface water.

- Provide a discussion about the proximity of the nearest potable wells to the Project area;
- If wells may become impacted by chemicals used during any project phase, describe the potential health impacts that may result;
- If wells may become impacted during the project, identify the locations and conduct baseline monitoring for the following parameters including: pH, general chemistry and metals (RCAp plus metals), as well as fecal and total coliform counts (as per NSTIR, 2007)[6]; and
- In the event of public complaints about changes in quality or quantity of drinking water during project operation, conduct an investigation which may include resampling the potentially impacted well(s) and mitigate any identified impacts.

[5] Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

[6] Nova Scotia Department of Transportation and Public Works. 2007. Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways. http://www.gov.ns.ca/tran/enviroservices/EPP100series/Generic%20EPP_July%202007.pdf

For a detailed description of Health Canada's guidance when evaluating drinking water quality in Environmental Assessments, see attached (Health Canada, 2017).[7]

If you have any comments/questions, please contact the undersigned at your convenience.

Sincerely,

Lance Richardson-Prager, BSc., MSc.(A)., JD
Health and Environment Specialist
Health Canada, Atlantic Region
e-mail: lance.richardson-prager@canada.ca

cc: Rick O'Leary, Manager, Environmental Health Program, Health Canada, Atlantic Region

Attachments:

*Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.*

*Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.*

*Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.*

[7] Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Health Canada Santé Canada

*Your health and safety… our priority.* *Votre santé et votre sécurité… notre priorité.*

Guidance for Evaluating
Human Health Impacts
in Environmental Assessment:

# AIR QUALITY

Canada

**Health Canada is the federal department responsible for helping the people of Canada maintain and improve their health.** We assess the safety of drugs and many consumer products, help improve the safety of food, and provide information to Canadians to help them make healthy decisions. We provide health services to First Nations people and to Inuit communities. We work with the provinces to ensure our health care system serves the needs of Canadians.

Également disponible en français sous le titre :
*Conseils pour l'évaluation des impacts sur la santé humaine dans le cadre des évaluations environnementales : Qualité de l'air*

To obtain additional information, please contact:

Health Canada
Address Locator 0900C2
Ottawa, ON  K1A 0K9
Tel.: 613-957-2991
Toll free: 1-866-225-0709
Fax: 613-941-5366
TTY: 1-800-465-7735
Email: publications@hc-sc.gc.ca

This publication can be made available in alternative formats upon request.



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# TABLE OF CONTENTS

This document may be cited as follows:

Health Canada. 2016. *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality*. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Any questions or comments on this document may be directed to:
Environmental Assessment Program, Ottawa, Ontario K1A 0K9
Email: ead@hc-sc.gc.ca

# 1 ACRONYMS

| ACRONYM | MEANING |
|---|---|
| AQMS | Air Quality Management System |
| CWS | Canada-wide Standards |
| CAAQS | Canadian Ambient Air Quality Standards |
| CCME | Canadian Council of Ministers of the Environment |
| CEA | cumulative effects assessment |
| CEAA 2012 | *Canadian Environmental Assessment Act*, 2012 |
| CEPA 1999 | *Canadian Environmental Protection Act*, 1999 |
| CI | continuous improvement |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| COPC(s) | contaminant(s) of potential concern |
| EA | environmental assessment |
| EIS | environmental impact statement |
| HHRA | human health risk sssessment |
| IARC | International Agency for Research on Cancer |
| KCAC | keeping clean areas clean |
| LSA | local study area |
| $\mu g/m^3$ | micrograms per cubic metre |
| µm | micrometres |
| $mg/m^3$ | milligrams per cubic metre |
| MW | molecular weight |
| NAAQOs | National Ambient Air Quality Objectives |
| $NH_3$ | ammonia |
| $N_2O$ | nitrous oxide |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxides |
| PAHs | polycyclic aromatic hydrocarbons (e.g. benzo[a]pyrene) |
| ppb | parts per billion |
| ppm | parts per million |
| $PM_{2.5}$ | particulate matter less than 2.5 µm in diameter |
| $PM_{10}$ | particulate matter less than 10 µm in diameter |
| RA | responsible authority |
| RfC | reference concentration |
| RSA | regional study area |
| $SO_2$ | sulphur dioxide |
| TOR | terms of reference |
| TSP | total suspended particulates |
| VOCs | volatile organic compounds (e.g. benzene, toluene, xylene) |
| US EPA | United States Environmental Protection Agency |
| UFP | ultrafine particles |
| WHO | World Health Organization |

# 2 PURPOSE OF THIS DOCUMENT

This document provides generic guidance on predicting health risks of air quality in federal environmental assessments (EAs) of proposed major resource and infrastructure projects (such as mines, dams, pipelines and other projects). It presents the principles, current practices and basic information Health Canada looks for when it reviews the environmental impact statements (EIS) or other reports submitted by project proponents as part of the EA process.

It was prepared for the benefit of proponents and their consultants and to support an efficient and transparent project review process. The foundational information described here should be supplemented appropriately with additional information relevant to specific projects.

The guidance was also prepared for responsible authorities and stakeholders to the EA process to communicate our normal areas of engagement and our priorities within these areas to help ensure that sufficient evidence is available to support sound decisions. As part of its review, Health Canada may suggest that a responsible authority (RA), review panel or others collect information not specifically described here in order to assess the health effects of specific projects. As the guidance provided here is generic and designed to support EA under multiple jurisdictions, the scope of our review will also necessarily be amended according to specific jurisdictional requirements.

Health Canada updates guidance documents periodically and, in the interest of continuous improvement, accepts comments and corrections at the following address: ead@hc-sc.gc.ca

Please verify that you are reading the most recent version available by consulting:
**www.canada.ca/en/services/health/publications/healthy-living.html#a2.5**

# 3 INTRODUCTION AND CONTEXT

Health Canada provides expertise to assist RAs, review panels and/or other jurisdictions leading environmental assessments to determine whether there are potential health risks associated with proposed projects and how to prevent, reduce or mitigate them.

Health Canada brings to bear its expertise in health risks associated with air quality, water quality, radiation, noise and country foods when it reviews and provides comments on information submitted by proponents in support of proposed projects. Health Canada also provides guidance to help stakeholders, including responsible authorities, review panels and affected communities, better understand how to conduct health assessments for proposed major resource projects.

This document concerns the assessment of health risks associated with air quality. It contains information on the division of roles and responsibilities for issues related to air quality at various levels of government in Canada; health effects associated with air quality; indicators of these effects; and, steps in Health Canada's preferred approach to assessing air quality-related health effects.

Appendix A contains a checklist that can be used to verify that the main components of an air quality assessment are complete and to show where this information can be found within an EA document.

Appendix B lists online sources of national and provincial air quality standards, data and general information.

Appendix C lists the Canadian Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Objectives (NAAQOs) for various ambient air contaminants, current as of the date of publication of this document. Definitions and equations for converting units are provided at the end of this appendix.

# 4 ROLES AND RESPONSIBILITIES WITH RESPECT TO AIR QUALITY

In Canada, the protection and improvement of ambient air quality is a shared responsibility. The most current and up-to-date criteria and guidelines should be used for any comparisons made in environmental assessments. Health Canada encourages readers to consult with provincial, territorial and municipal authorities, as appropriate, to determine or verify which standards exist for specific regions. Refer to Appendix B for a list of online resources for national and provincial air quality standards, data and general information (current as of the publication date of this guidance document).

The Clean Air Regulatory Agenda is a federal initiative, led by Environment and Climate Change Canada, aimed at improving air quality and protecting human health through reduced emissions of outdoor and indoor air pollutants and greenhouse gases. Health Canada's key role is to provide guidance through health risk assessments and research to ensure risk management actions effectively reduce the health impacts of air pollution. The air quality research, monitoring and modelling activities of Environment and Climate Change Canada and Health Canada aim to quantify priority air pollutants and determine trends, in order to predict air quality in both the near term and long term. The research builds knowledge on atmospheric processes and emissions measurements related to industrial and non-industrial sectors, thereby helping to relate air pollutant emissions to exposure and environmental impacts and in turn, informing the review of environmental assessments (EAs).

## 4.1. HEALTH CANADA

Health Canada's primary role with respect to air pollution is to identify hazards posed to the Canadian population and to collaborate with others, often Environment and Climate Change Canada, to reduce the identified risks. Health Canada's scientists conduct, evaluate and remain current on domestic and international scientific research on the effects of air quality on human health.

Health Canada's review of air quality assessments for EA processes is project-specific. Health Canada's expertise in this context focuses on assessing the risks to human health resulting from exposure to air contaminants—using health-based evaluation tools, guidelines and toxicological reference values. Health Canada reviews the baseline conditions described (i.e. air quality in the existing environment) and the predicted project-related air pollutant concentrations for different assessment scenarios at locations where human receptors may be affected. Health Canada can comment on whether the assessment of effects of air quality on human health undertaken by the proponent was scientifically valid, and may request further information or rationale. Health Canada may make available additional information or knowledge when predicted air quality changes have the potential to affect human health. Health Canada may also comment on the adequacy of mitigation measures proposed to reduce project-related changes and/or health impacts. The responsible authority, review panel or other jurisdiction conducting the assessment will ultimately determine how the information or knowledge provided by Health Canada will be used in the EA process.

Health Canada does not possess the expertise to verify air quality modelling results and assumes that the assessment has used correct, accepted and/or validated methods. Health Canada relies on the expertise of Environment and Climate Change Canada in the areas of emissions, dispersion and atmospheric modelling. Health Canada may also seek Environment and Climate Change Canada's advice on the adequacy of an EA's ambient air quality predictions. If Environment and Climate Change Canada notes errors and/or gaps in the modelling of air quality, revisions may be requested by the responsible authority to address the errors. If the revised results differ from the originally submitted results, Health Canada suggests that the report be resubmitted to Health Canada for review.

Health Canada does not possess expertise on:

- modelling emissions and deposition; and
- assessing or evaluating of the potential effects of odour.

Environment and Climate Change Canada possesses expertise in areas such as emissions modelling and environmental fate and may share information with Health Canada to inform the evaluation of environmental assessments.

## 4.2. PROVINCES AND TERRITORIES

In general, provinces/territories are responsible for controlling pollution emissions, including air pollutants, from industry and business operations. The provinces manage air pollutant emissions through regulations and their approach to granting (or issuing) permits that describe the allowable levels of emissions of various pollutants from a given facility, including emissions from associated mobile sources. Provinces may also adopt ambient air quality standards or objectives (see Appendix B), which are used to inform their processes for issuing pollution emission permits (e.g. using air quality modelling to predict how ambient air quality in a neighbouring community will be impacted by a facility's emissions and how the predicted pollution levels compare to the air quality standard) and other air quality management actions. In 2012, the Canadian Council of Ministers of the Environment (CCME), with the exception of Quebec, agreed to begin implementing the new Air Quality Management System (AQMS), which includes the new ambient air quality standards as a key component. Those conducting assessments are encouraged to seek information as early as possible as to which provincial, territorial and/or municipal legislation and regulations concerning ambient air quality may apply to the project.

## 4.3. AIR QUALITY STANDARDS AND GUIDELINES

The *Canadian Environmental Protection Act*, 1999 (CEPA 1999) is the principal federal legislative tool governing environmental contaminants. It is administered jointly by Environment and Climate Change Canada and Health Canada. CEPA 1999 enables the Minister of the Environment and the Minister of Health to regulate substances and allows the federal government to assess air pollutants and provide targets that can be used in setting goals for reducing health risks from contaminants of potential concern (COPCs). The federal government also has the authority to address air pollution caused by the transboundary flow of air pollutants (e.g. across the Canada-U.S. border) and to identify key air pollutants as toxic substances under CEPA 1999.

Under the auspices of the CCME, Health Canada and Environment and Climate Change Canada have been working with provincial/territorial governments and non-governmental stakeholders on the development of a new AQMS—a comprehensive and national approach to improving air quality in Canada. A key element of the AQMS is new health-based CAAQS, which set the bar for air quality management across the country. In May 2013, the federal government established new CAAQS for fine particulate matter ($PM_{2.5}$) and ozone, using the authority of CEPA (Canada Gazette Part I, May 25, 2013). These new CAAQS, which are to be achieved by 2015 and 2020, are more stringent than the previous Canada-wide Standards (CWS), which they replace.

Like the CWS, the CAAQS are based on the principles of keeping clean areas clean (KCAC) and continuous improvement (CI) (CCME 2000, 2007 and 2012). Provinces and territories will use the CAAQS in air quality management decision-making aimed at improving poor outdoor air quality and maintaining good outdoor air quality. At the time of publication of this guidance document, additional CAAQS for nitrogen dioxide ($NO_2$) and sulphur dioxide ($SO_2$) were under development and will replace the former National Ambient Air Quality Standards (NAAQOs) for these pollutants.

Consult the CCME's website for up-to-date information on the AQMS and CAAQS: **www.ccme.ca**

# 5 COMMON AMBIENT AIR POLLUTANTS

## 5.1. AMBIENT AIR QUALITY AND HEALTH

There is consensus among international and national organizations (e.g. the World Health Organization (WHO), Health Canada, the United States Environmental Protection Agency (US EPA), the European Union and the International Agency for Research on Cancer (IARC)) that air pollution has significant human health impacts. Causal associations have linked poor air quality to respiratory and cardiovascular illnesses, hospitalizations and mortality. The reaction of an individual to air pollutants depends on the type of pollutant to which a person is exposed, the degree of exposure and the individual's health status and genetics. Harmful health outcomes attributable to air pollution can range from respiratory symptoms to premature death—encompassing acute irritation and respiratory problems, the development or worsening of existing respiratory and/or cardiovascular diseases, and cancer. These effects can result in higher medication use, increased visits to doctors or emergency rooms and more hospital admissions. Epidemiological studies that make use of administrative databases that track information such as mortality, hospital admissions and emergency room visits have been used to characterize population risk; these studies are now a common tool in assessing the health implications of air quality changes related to environmental pollutants. Based on such studies, there is a growing awareness that increasing concentrations of air pollutants in many parts of Canada are associated with morbidity (incidence of disease) and mortality (Judek et al., 2004). The WHO's Global Burden of Disease Study recognizes outdoor air pollution in the form of fine particles as one of the top-ten global health risk factors (Lim et al., 2012), while IARC has recently identified air pollution as a whole, as well as component particles ($PM_{2.5}$ and $PM_{10}$), as causes of cancer (2013).

## 5.2. PARTICULATE MATTER

The general term "particulate matter" (PM) can be defined as particles (solid or liquid, or a mixture of both) less than 100 micrometres (µm) in diameter. Particles of 10 µm or less in diameter are referred to as **$PM_{10}$**. Particles of 2.5 µm or less in diameter are referred to as **$PM_{2.5}$** or **fine PM**. Particles intermediate in size (i.e., $PM_{10-2.5}$) are generally known as the coarse fraction of $PM_{10}$. All three size designations ($PM_{10}$, $PM_{10-2.5}$ and $PM_{2.5}$) have been demonstrated to affect various aspects of human health, with the respiratory and cardiovascular systems being the major targets. The fine (smaller) particles pose a greater risk to human health, as they can be inhaled deeply into the lungs, are chemically reactive and have complex characteristics. Despite the overlap between each of these size fractions (i.e. the $PM_{10}$ size fraction includes the $PM_{2.5}$ size fraction), there is also variation in the deposition patterns within the lungs because of differences in the physical and chemical composition, as well as the sources of the particles (WHO 2003). Particulate matter can be primary or secondary in nature; primary particles are emitted directly from a source, while secondary particles arise from the chemical reaction of precursors in the atmosphere.

The WHO *Air Quality Guidelines* (2006) provide exposure-response relationships describing the relationship between ambient PM and various health endpoints. These guidelines do not propose a specific guideline value for PM, as a threshold could not be identified below which no adverse effects on health occur. Recent scientific evidence also indicates that there is no apparent lower threshold for the effects of PM on human health. Scientific evidence shows that fine particles ($PM_{2.5}$) are strongly associated with mortality and other human health endpoints, such as hospitalization for cardio-pulmonary disease (WHO 2003). The new CAAQS for PM also recognize that there is no population health threshold for human health effects; therefore, any increase in exposure will result in an incremental population risk (Environment and Climate Change Canada and Health Canada, 2012; CCME, 2000). In other words, $PM_{10}$ and $PM_{2.5}$ are considered to be non-threshold substances, meaning that health effects may occur at any level of exposure. Health Canada has concluded that the risk associated with fine particles, particularly $PM_{2.5}$, is higher than the health risks associated with coarse PM or total suspended particulates (TSP).

**Ultrafine particles (UFPs)** refer to very small, usually reactive particles with a diameter smaller than 0.1 µm that achieve widespread deposition within the respiratory tract. Therefore, by definition, $PM_{2.5}$ (and $PM_{10}$) includes ultrafine particles (UFPs). The results of recent studies on UFPs are not entirely consistent, and the scientific literature in this field continues to evolve. Therefore, Health Canada does not currently make specific conclusions on the potential health effects of UFPs. Rather, Health Canada encourages the inclusion of an assessment of $PM_{2.5}$ and a discussion of the predicted levels in relation to human health in all air quality assessments.

## 5.3. SECONDARY POLLUTANTS

Secondary pollutants such as ground-level ozone and secondary $PM_{2.5}$ are formed in the atmosphere through the reaction of gaseous precursors; in the case of ozone, the presence of sunlight is required for these reactions to occur. Project-related emissions may contribute to secondary pollutants formation. Including predicted concentrations of secondary pollutants from project-related emissions in an air quality assessment provides a more comprehensive estimate of project-related effects; a qualitative discussion of precursors and secondary pollutant formation (especially ozone and secondary $PM_{2.5}$) is helpful in the absence of a quantitative assessment. Secondary pollutants may be important elements of an air quality assessment, especially when the secondary pollutant precursors (e.g. nitrogen oxides ($NO_x$), ammonia ($NH_3$), sulphur dioxide ($SO_2$), volatile organic compounds (VOCs)) are emitted from project activities. PM and ozone precursor pollutants need to be managed—both in terms of mitigating their own associated health risks and with regard to their contribution to the formation of secondary pollutants. As examples, ground-level ozone is formed from reactions involving $NO_x$ and VOCs, and $PM_{2.5}$ is formed from complex reactions involving $NO_x$ and VOCs and $SO_2$, as well as other substances. Ground-level ozone is a constituent of photochemical smog and is linked to serious health impacts, including chronic bronchitis, asthma, increased medical and hospital visits, and premature deaths (Environment and Climate Change Canada and Health Canada, 2012; WHO, 2003). Ozone, along with PM, should be treated as having no safe level; that is, on a population basis, there is no threshold below which no adverse effects on health may occur (Environment and Climate Change Canada and Health Canada, 2012).

## 5.4. OTHER AMBIENT AIR POLLUTANTS

The use of equipment such as engines and generators, as well as other industrial processes, may lead to increased levels of PM and fuel combustion by-products (e.g. PM, $NO_x$, $SO_2$, carbon monoxide (CO), polycyclic aromatic hydrocarbons (PAHs), VOCs, metals). $NO_x$ can impair lung function and irritate the respiratory system and are especially problematic for people who already suffer from asthma, bronchitis or other respiratory disease. Similarly, $SO_2$ at relatively high levels of exposure can cause breathing problems in people with asthma, and there is some evidence that exposure to elevated levels may increase hospital admissions and premature deaths. Exposure to CO may increase hospital admissions for cardiac diseases and, at high levels, CO exposure can cause mortality.

PAHs are relatively non-volatile compounds of low solubility in water. These compounds are mostly adsorbed to particulate matter, on which they are transported. Some PAHs are known to be carcinogenic (e.g. benzo[a]pyrene) (Government of Canada, 1994), as are some volatile organic compounds (VOCs), such as acetaldehyde, formaldehyde, benzene and 1,3-butadiene.

Road transportation (including fuel combustion, tire friction on road pavement and brake usage) is a source of many air pollutants. Equipment used in large development projects can be a significant source of diesel engine exhaust, which is a mix of gases and particles, including criteria air pollutants and air toxics that may damage the lungs and potentially cause cancer. In addition to PM and fuel combustion by-products, traffic-related pollutants include 1,3-butadiene, benzene, formaldehyde, acetaldehyde and acrolein.

Additional air pollutants of concern include hydrogen sulphide ($H_2S$), toxic metals (e.g. cadmium, lead, mercury, manganese, arsenic and nickel), polychlorinated biphenyls (PCBs), dioxins and other persistent organic compounds.

# 6 CONDUCTING AN AIR QUALITY ASSESSMENT FOR AN ENVIRONMENTAL ASSESSMENT

Section 6 provides general information about the assessment of project-related changes in ambient air quality in EAs and the potential impacts of these changes on human health. In general, an assessment begins by characterizing the project study area and identifying the people who may be impacted by changes to the environment due to the project. This includes considering the manner of exposure (e.g. inhalation). Next, the possible COPCs are identified and characterized. The existing environment is described, and the emissions and COPCs generated from the project activities are predicted using scenarios and modelling software. The predicted COPC concentrations should be analyzed in relation to appropriate air quality standards (e.g. CAAQS). After estimating the changes in air quality, the assessment should examine and consider the risks to human health due to these changes. Mitigation measures may be recommended to reduce the potential changes to air quality. Measuring COPC levels during the project may assist with implementing or modifying mitigation measures.

## 6.1. DEFINE SPATIAL AND TEMPORAL BOUNDARIES

"Regardless of whether direct measurement or environmental modelling is used, both spatial and temporal variability need to be characterized. Spatial definition of the site is particularly important for the application of any microenvironment analysis. Temporal definition of the site is needed to address changes in chemical concentrations over time." (Health Canada, 2010)

**Spatial boundaries** identify and define the area(s) to be considered in the air quality assessment, including local and regional boundaries. The spatial boundaries of air quality effects are project-specific. Depending upon the amount and types of emissions, a project may affect air quality over a larger or smaller area. Often, a local study area (LSA) and a larger regional study area (RSA) are delineated for the assessment. Maps, diagrams and figures should be used to illustrate the boundaries and distances to project site(s). It is good practice to consider adjacent land use if the ecosystem is sensitive; if the land is or will be used for residential purposes; or if on-site contamination is migrating off-site and potentially impacting adjoining properties (Health Canada, 2010). This step of defining boundaries may be conducted in conjunction with the receptor identification step.

It is good practice to focus a discussion of potential human health impacts on locations where people could be most affected, such as those nearest to the emission sources or those who may be exposed to the highest concentrations of COPCs. The latter point is particularly important if there is high variability in air quality within the spatial boundary identified. However, care must be taken to identify those area(s) where there are people who may experience less exposure—but who are at potential greater risk as a result of higher sensitivity. Identification of these areas may be conducted in conjunction with the receptor identification step (Health Canada, 2010). Note that Health Canada is generally interested in all exposures. Medium- and long-range transport is usually evaluated to the extent that it is bounded by the LSA and RSA. Health Canada encourages the evaluation and discussion of long-range transport, if it is important for a particular project.

**Temporal boundaries** address the timing and lifespan of the potential impacts of the project, and may be described based on the various project phases (i.e. construction, operation, modification, decommissioning and abandonment). It is good practice to clearly determine the most appropriate temporal scales and descriptions of air quality data (e.g. seasonal or annual variation, 24-hour maximum and averaging times, such as 8-hour, 1-hour, etc.)—particularly when the EA will include a comparison of measured or predicted values for air pollutants to existing standards or guidelines. To enable the evaluation of the impacts of project-related air quality changes on human health over time, it is important that the temporal scales provided in both the modelling predictions and health effects assessment are consistent.

To better characterize the types of exposure experienced by humans near the project site(s), it is good practice to differentiate between acute and chronic exposures when describing potential air quality impacts on humans.

## 6.2. IDENTIFY AND CHARACTERIZE HUMAN RECEPTORS

The identification and description of all existing and reasonably foreseeable human receptors that may be affected by project-related air emissions are necessary for an assessment of potential air quality impacts on human health. It is a good practice to select the most sensitive or exposed individuals in determining these potential impacts. Some individuals are more susceptible to contamination exposure due to the following:

- Physiology (e.g. newborns, children, pregnant or breastfeeding women and elderly people);
- Health status (e.g. immune-compromised persons, and persons suffering from heart disease, respiratory conditions or allergies);
- Behaviour (e.g. amount of time spent outdoors); and
- Lifestyle (e.g. smoking, Body Mass Index (BMI) and exercise status).

It is important to clearly describe the location and distance from the project site(s) of all potential human receptors (permanent, seasonal or temporary)—taking into consideration the different types of land uses (e.g. residential, recreational, industrial, etc.); and identifying all sensitive people (e.g. in schools, hospitals, retirement complexes or assisted care homes). Note that the types of residents and visitors in a particular area will depend on land use, and may include members of the general public and/or members of specific population subgroups (Indigenous peoples, campers, hunters, etc.).

To identify the people that may be affected by project-induced air quality changes, it is useful to provide a map illustrating through isopleths (contour lines showing constant concentration levels) or other means, the predicted pollutant concentrations for those COPCs approaching or exceeding appropriate guidelines and/or standards, overlaid with the receptor locations in the LSA and RSA. Consider that the dispersion of substances into air can affect receptors that are either in close proximity or at considerable distances to the source. If any humans or residences are omitted from the air quality assessment, provide an evidence-based rationale for the exclusion.

Note that occupational exposure and health issues are typically under provincial or territorial jurisdiction.

## 6.3. DESCRIBE EXPOSURE PATHWAYS

Exposure to air pollutants, such as particulate matter, gaseous chemicals or chemicals adsorbed to particulate matter, occurs primarily via inhalation, which is the main pathway considered in an air quality assessment.

Another potential exposure pathway is the consumption of vegetation, dairy products, meat or game meat from crops or animals that have been exposed to elevated concentrations of airborne contaminants through air deposition to produce, fodder and grazing crops. Health Canada possesses the expertise to review the predicted human health impacts of this mode of contamination, but does not have the ability to verify modelling results that are predictive of this exposure pathway (as discussed in Section 4.1.). It is good practice to employ prediction models obtained from published or other sources that have received peer or regulatory endorsement. Modelling results may indicate that over time, the chemical concentration of contaminants in environmental media may increase (e.g. accumulation over time in soils, bioaccumulation and bio-concentration) due to emissions of airborne contaminants.

## 6.4. IDENTIFY CONTAMINANTS OF POTENTIAL CONCERN

COPCs are chemicals whose concentration(s) may become elevated in ambient air as a result of project-related activities, and which have the potential for adverse health impacts based on documented scientific evidence or suspected causal relationships.

The COPCs to be characterized for a project EA are often detailed in the project-specific terms of reference (TOR) or EIS Guidelines. It is good practice to include an inventory of all emissions and potential COPCs resulting from the proposed project in an air quality assessment. All sources should be considered, including project-related processes, on-site vehicle usage and fugitive emissions. All phases of the proposed project should also be considered (e.g. construction, operation, modification, decommissioning and abandonment). The inventory should include the following (as applicable):

- Criteria Air Contaminants, (i.e. sulphur oxides, $NO_x$, particulate matter including total PM, $PM_{10}$, and $PM_{2.5}$, CO, $NH_3$, ground-level ozone, and secondary PM);
- Volatile Organic Compounds (VOCs);
- Air pollutants on the *List of Toxic Substances* in *Schedule 1* of CEPA 1999;
- Diesel PM; and
- Other contaminants as appropriate (e.g. heavy metals and PAHs).

As discussed in Section 5, it is widely accepted that $PM_{10}$ and $PM_{2.5}$ are considered non-threshold substances, meaning that health effects may occur at any level of exposure. Health Canada holds the view that there is more risk associated with exposure to very fine particles, particularly $PM_{2.5}$. IARC recently classified particulate matter as carcinogenic to humans (2013). Health Canada suggests that when assessing the potential health effects of PM, there is acknowledgement that there is no threshold below which there is no adverse health effect.

Various sources can help identify COPCs that may be emitted from development projects. These sources include the following: EIS reports, risk assessments, air modelling studies or monitoring data for other similar projects; Environment and Climate Change Canada's National Pollutant Release Inventory; the US EPA; and the Agency for Toxic Substances and Disease Registry.

## 6.5. ASSESSMENT SCENARIOS AND OTHER CONSIDERATIONS

As good practice, an air quality assessment includes information on baseline conditions and predicted increases in airborne concentrations of COPCs associated with the project, along with appropriate comparisons to applicable standards and guidelines, and discussions of potential impacts and risk to human health due to the predicted changes in air quality.

### 6.5.1 Assessment Scenarios

Health Canada encourages the inclusion of four assessment scenarios in the air quality assessment, namely: *i) baseline; ii) project alone; iii) baseline plus project; and iv) cumulative or future development,* as appropriate. These scenarios are described below. Additional "development or application" cases or scenarios may be assessed for comparative purposes. Assessment scenarios for v) *decommissioning or abandonment* phases may also be relevant.

***i) Baseline Conditions (Pre-project or Base Case Scenario)***

The existing baseline levels of air pollutants must be adequately described in order to establish the extent of possible air quality changes related to future project activities (and thus, the subsequent potential impacts on human health). Baseline conditions are the current levels of air pollutants in the RSA, including existing sources, and are usually reported in concentrations, with units of micrograms per cubic metre ($\mu g/m^3$). Comparing predicted COPC concentrations for the project activities to this type of baseline provides information on the sole impact of the project, and the project contributions to the airshed;[1] it does not, however, consider the predicted contributions of already-approved developments in the area.

In some EAs, baseline conditions are reported as concentrations of air pollutants from baseline plus approved but not-yet-built developments. These baseline conditions have higher COPC concentrations than a baseline that excludes approved developments. Comparing predicted COPC concentrations for the project activities to this type of baseline does not present as clear a picture of the contributions of the proposed project alone; it may also contain additional uncertainties associated with the predicted emissions of the approved developments. However, the use of this baseline in the application/development scenario will yield predictions that are higher than the contributions of the project alone, and this may result in additional mitigation measures or more intensively applied mitigation measures to reduce the impacts of the project. It is a good practice to clearly describe if the baseline conditions include—or exclude—approved but not-yet-built facilities or developments.

1 "An airshed is generally described as an area where the movement of air (and, therefore, air pollutants) can be hindered by local geographical features such as mountains, and by weather conditions." Source: B.C. Air Quality (main page) **www.bcairquality.ca/airsheds/bc-airsheds.html**

In areas where industrial activity is prevalent, the baseline concentrations of contaminants may be elevated compared to surrounding undisturbed or less-developed areas. In these cases, discuss the effect of these higher baseline concentrations of contaminants in the context of project activities during the construction, operation or decommissioning phases.

When describing the existing environment, it may be useful to use actual data available from air quality monitoring networks or stations, including regional or air zone air quality monitoring programs, and monitoring initiated by the proponent or other companies in the project area. Note that Environment and Climate Change Canada collects air quality measurements across Canada through monitoring networks and emissions reporting, although there may be limitations to the applicability of the data (e.g. the distance from the project site to monitors may be substantial). Ambient air quality data for specific monitoring stations can be requested from Environment and Climate Change Canada (see Table B1 in Appendix B) and may also be available from provincial authorities.

For particulate matter ($PM_{2.5}$), Health Canada considers 1.8 µg/m$^3$ to be the average background (or baseline) level of $PM_{2.5}$ in Canada (Judek *et al*, 2004). When there are no site-specific values or measurements, it may be appropriate for the air quality assessment to apply this value as the average background level of $PM_{2.5}$. As previously discussed in Section 5.2, there is no recognized threshold for the health effects of $PM_{2.5}$.

#### *ii) Project Alone Scenario*

Even if the predicted effects of a proposed project may be low, there will be some impacts. Therefore, it is a good practice to report the anticipated project emissions in a "project alone" scenario (i.e. not added to the baseline concentrations). The project-alone scenario provides a clear description of the project's contribution to regional air quality. These data may be predicted using air quality and atmospheric dispersion modelling software—or estimated using measurements obtained from other project operations of a similar type and scale.

It is important to report the emissions from the project alone, as in the following situations:

- in urban or near-urban areas;
- in those regions subject to continuing development; and
- when the assessment includes application scenarios that comprise existing and future facilities.

When discussing predicted concentrations for this scenario, also consider the importance of the values for each project phase, e.g. what percentage of the project is construction versus operation? For example, a construction phase may last 1–2 years, producing types of emissions that would not be released during the project's operation phase.

#### *iii) Baseline + Project Scenario (Application or Development Case)*

It is a good practice to report the development case as the combination of the baseline conditions and the predicted concentrations of COPCs associated with the project (i.e. the project alone scenario). This scenario is key to the determination of air quality impacts of a project, as it estimates the potential future air quality conditions that would exist if the project is approved and proceeds.

#### *iv) Cumulative or Future Development Scenario(s) (Baseline + Project + Future Projects)*

Cumulative effects are the environmental effects of the proposed project in combination with effects from existing and reasonably foreseeable future projects within the same area of influence. An assessment of cumulative effects is required under CEAA 2012 (refer to Section 7 of this document).

Cumulative effects for air quality may be assessed as one scenario, often called the cumulative or future development scenario. Typically, this scenario includes the baseline conditions and predicted changes in COPCs from the project—plus the predicted contributions of COPCs from facilities that are approved but not yet operating, and/or other proposed or likely developments within the study area. The EA may also assess additional future development or application case scenarios for comparative purposes, and to provide additional information on potential future ambient air quality. To model predicted changes in air quality, emissions data from existing projects can be combined with predicted emissions from reasonably foreseeable future projects (estimated from industry averages).

When considering a cumulative effects assessment (CEA) for air quality, note that the evaluation of multiple sources of a COPC from the project (for example, diesel PM from generators and truck-traffic emissions) is considered to be the project-specific scenario and does not constitute a CEA.

#### *v) Project Decommissioning or Abandonment Scenario*

If applicable to the project, consider and discuss anticipated changes in air quality due to decommissioning or abandonment of the project facilities in the air quality assessment. The COPCs to consider will depend on the specific post-project activities undertaken—but are likely to resemble those generated in the construction phase. Identify the duration of decommissioning activities, and the measures that may be incorporated to monitor and control PM and other emissions generated from heavy machinery during demolition. Special consideration is advised when decommissioning or abandonment activities of contaminated soils introduce additional COPCs to ambient air. If applicable, it is good practice to provide information related to monitoring and mitigation measures during the decommissioning phase to ensure acceptable air quality is maintained.

### 6.5.2 Considerations

It is good practice for the air quality assessment to consider the following points for all scenarios:

- Include a map clearly showing the study area(s) and receptor locations. For COPCs with concentrations predicted to approach or exceed guidelines and/or standards, include maps illustrating the predicted concentrations and the location of the human receptors.
- Provide an evidence-based rationale for the omission of any COPCs from the assessment. (Note that the absence of an applicable screening guideline is not a sound rationale for excluding a COPC from further assessment.)
- Provide the predicted or estimated COPC concentrations for the maximally exposed population, for the most sensitive receptors and at the point of maximum impingement.[2]

2 A point of impingement is a technical term used in dispersion modelling of air pollutants - it is the pollutant concentration measured when the plume from a source reaches the ground or a building. Maximum point of impingement concentrations are the maximum level projected by the air quality model. Point of impingement concentrations are used in provincial regulations of industrial sources (rather than top-of-stack levels).

- Report data in concentrations (µg/m$^3$) (see equations for converting units at the end of Appendix C) that are determined or predicted for time periods corresponding to the applicable health-based standards, guidelines or objectives (e.g. 30- minute, 8-hour, 24- hour and annual intervals). Health-based reference concentrations[3] (RfCs) for COPCs will provide guidance on the appropriate averaging times for COPC concentrations (e.g. if there is a 1-hour RfC, then 1-hour averaging of concentrations should be reported and compared).
- It is necessary to consider both **acute (short-term) exposures and chronic (annual/long-term) exposures** for some COPCs. Annual average concentrations for COPCs with chronic health effects should be provided. For COPCs capable of causing toxic effects following short-term exposures (i.e. chemicals to which short-term exposure may result in human health effects), average daily maximum values may not provide adequate information to address potential health risks. Consider $SO_2$, where short-term exposures such as 1-hour or in some cases 8-hours, are more important than long-term exposures in terms of toxicity and health effects.
- To enable a comparison of predicted data to health-based standards and guidelines, report contaminant concentrations in µg/m$^3$, rather than reporting only the emission rates, such as tonnes/year.
- Include predictions of particulate matter in the assessment, including $PM_{2.5}$. When benchmarking predicted air quality levels against the CAAQS or other standards, it is important to consider not just the numerical target of the standard—but also the averaging time period and the statistical form (for the CAAQS, see Table C1 in Appendix C). For $PM_{2.5}$, there are two CAAQS aimed at reducing the health effects of short-term and long-term exposure. The CAAQS are not a "pollute-up-to" level and population health effects occur at levels below the CAAQS. Jurisdictions are urged to take remedial and preventive actions to reduce anthropogenic emissions to the extent practicable to protect against significant air quality deterioration—as there are no recognized thresholds for the health effects of $PM_{2.5}$ and ozone.
- Ozone itself is rarely emitted from project activities, although its precursors often are. The effect of a proposed project on ground-level ozone levels should not be dismissed because the predicted change will be "very small." Ideally, the project's contribution to regional formation of ground-level of ozone will be modelled and included in assessments. If not, provide a discussion of the regional environment, for example, a description of ozone formation, and the regional emissions and conditions that influence its formation. Compare the predicted ozone levels against the CAAQS. As with $PM_{2.5}$, health effects of ozone exposure occur at all levels.
- Discuss the emission of precursors to urban smog and ground-level ozone ($NO_2$, $SO_2$, VOCs, etc.). If secondary pollutants (e.g. ground-level ozone and secondarily-formed PM) are not being considered in an air quality assessment, include a thorough, evidence-based rationale for their exclusion. If a quantitative assessment is not possible, it is useful to include a qualitative assessment that analyzes the likely directional impact—based on precursor emissions and the local air quality regime.

3 **Reference Concentration:** An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer health effects during a lifetime (US EPA).

## 6.6. DETERMINE IMPACTS OF CHANGES TO AIR QUALITY

Compare predicted concentrations for each assessment scenario to appropriate and relevant human health-based air quality guidelines and standards. If predicted concentrations or levels of COPCs and particulate matter remain well below the CAAQS or applicable criteria or guidelines, then generally no further assessment is necessary. However, it is important to identify and comment on the project's overall contribution of pollutants to the local airshed, regardless of whether the predicted values are well below the standards or criteria. Keep in mind that CAAQS for $PM_{2.5}$ and ozone are not to be considered as thresholds or limits of pollution.

Where the predicted COPC concentrations approach or exceed air quality guidelines and standards, the environmental assessment should include a discussion of the potential impacts of these exceedances on human health. In some cases, it may be prudent to proceed to a further level of assessment—using a detailed quantitative human health risk assessment (HHRA).

It is a good practice to conduct a quantitative HHRA in the following situations:

- The assessment predicts that COPC values exceed applicable guideline or standards.
- The project contributes to local air pollutant levels (e.g. the project is the dominant source of pollutant "X" in the area).
- The project contribution leads to a significant deterioration in air quality compared to current levels.
- The project is proposed for a region that is already experiencing environmental pressures from other development projects.

Note that in some cases, contaminants bound to PM may pose unacceptable risk to human health at low levels of PM concentrations—making further assessment necessary to determine if an unacceptable risk may occur.

A detailed quantitative HHRA generally yields more refined conclusions of risk, especially for complex projects with various activities. An HHRA considers the hazards and risks of multiple COPCs, toxicities and exposure pathways, including country foods. In keeping with the precautionary principle, a quantitative HHRA should assess COPCs that are known or suspected carcinogens as carcinogens (i.e. where there may be limited information on carcinogenicity in humans, but strong evidence based on animal studies). IARC provides information and classification on the carcinogenic risks of various substances.

## 6.7. MITIGATION

Mitigation aims to eliminate, reduce or control adverse environmental effects related to a project. Health Canada prefers that all projects attempt to minimize air emissions to the greatest extent possible, regardless of any upper limits referenced in the applicable criteria, guidelines or standards.

Health Canada views mitigation of negative impacts to air quality as important, especially in the following situations:

- The project contribution leads to a significant deterioration in air quality over existing levels.
- Exceedances or near-exceedances of air quality objectives and guidelines are anticipated.
- The project "load" or contribution to the local airshed is a large proportion of the criteria or guideline value.
- The project is proposed for a region that is already experiencing environmental pressures from other development projects.
- Potential human health impacts are predicted.

Health Canada encourages the use of all available mitigation measures that are technically and economically feasible to limit negative impacts to air quality. The best management activities outlined in *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* (Cheminfo, 2005) can be implemented to mitigate air quality effects during the site preparation and construction phase.

Health Canada prefers that mitigation measures also be used in instances when project-related human health impacts are considered minor (in keeping with the CAAQS principles of KCAC and CI). If a low-cost mitigation measure exists and its ability to reduce harmful air emissions is well established, Health Canada encourages the implementation of the measure. It is good practice to describe in the EA documentation the mitigation measures to be employed to address any exceedances or near-exceedances of guidelines. If possible, include details of modelling studies, monitoring or past experience with a mitigation strategy to outline the anticipated effectiveness of a specific measure. If substantial baseline air quality contamination exists at or near the project site(s), the potential for air quality contamination introduced by project-related activities may necessitate consideration of additional mitigation measures.

**An Air Quality Management Plan,** often part of an environmental management plan for a project, may form the basis for mitigation measures; ideally, this plan addresses the management of all potentially harmful emissions from project-related activities. Such a plan may be implemented during the various project phases, to ensure that potentially harmful air pollutants and possible adverse human health impacts are minimized. Air quality management plans often include measures to limit the frequency and duration of people's exposure to COPCs, airborne dust and $PM_{2.5}$ during all phases of the project.

Upon request from a responsible authority, review panel or other jurisdiction conducting an EA, Health Canada may review an air quality management plan and provide information or knowledge on the effectiveness of any proposed mitigation measures.

## 6.8. MONITORING

For some projects, air quality monitoring may be advisable to determine the accuracy of predictions; to help verify whether standards are being met; and to assist with implementing or modifying mitigation measures. The extent of monitoring will depend on the project activities, predicted health effects and predictions of COPCs approaching unacceptable concentrations. Monitoring activities may be part of a follow-up program as defined in CEAA 2012.

Health Canada encourages the monitoring of air contaminants when exceedances or near-exceedances of air quality criteria, standards and/or guidance values are predicted or reported—or if the project is predicted to contribute significantly to the elevation of COPC levels above baseline concentrations. Monitoring is also advisable if there is a high degree of uncertainty regarding the project's effects on air quality.

The following questions may assist in determining if monitoring is appropriate:

- Is there significant public concern about the possibility of changes in air quality?
- Is there uncertainty about one or more predicted emissions/COPCs as a result of project activities (e.g. due to difficult modelling issues)?
- Is there potential for novel contaminants to be released, emitted, mobilized or modified as a result of project activities?
- Are new technologies, substances and/or monitoring techniques being used for project activities?
- Have any exceedances been predicted for COPCs in any of the assessment scenarios?
- Are there especially sensitive receptors nearby (e.g. children or seniors)?

Health Canada may make available information or knowledge regarding monitoring plans upon request by a responsible authority, review panel or other jurisdiction conducting an EA. In regards to monitoring activities, Health Canada prefers that a representative number of samples be collected, during different seasons, at locations where potential receptors may be affected. Upon request, Health Canada may also make available information or knowledge on the siting of monitoring stations for regions with an appreciable human presence (e.g. permanent residences, seasonal or temporary residences).

# 7 ASSESSMENT OF CUMULATIVE EFFECTS

Under CEAA 2012, subsection 19(1), an environmental assessment must consider "the environmental effects … and any cumulative environmental effects that are likely to result from the … designated project in combination with other physical activities that have been or will be carried out."

Considerations for a cumulative effects scenario in an air quality assessment are discussed in Section 6.5 of this document. If the cumulative effects assessment identifies changes to ambient air quality that exceed project-only effects, Health Canada encourages that further monitoring and/or mitigation measures be considered.

For guidance on assessing cumulative effects, consult the Canadian Environmental Assessment Agency's website for up-to-date guidance materials: **www.ceaa.gc.ca**

# 8 FOLLOW-UP PROGRAMS

Under CEAA 2012, a "follow-up program" means a program for:

a) verifying the accuracy of the environmental assessment of a designated project; and

b) determining the effectiveness of any mitigation measures.

It may be appropriate to consider a follow-up program for air quality if one of the following applies (note: this is not a comprehensive list):

- There is uncertainty about the modelling of contaminant(s) emissions;
- There is uncertainty whether proposed mitigation measures will be effective (e.g. the use of novel technologies or complex systems); or
- The project is located near large population centres, therefore posing a greater potential for exposure and health effects.

For further and up-to-date information on follow-up programs, contact the Canadian Environmental Assessment Agency, Canadian Nuclear Safety Commission, or National Energy Board, as appropriate.

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# APPENDIX AI **AIR QUALITY IN EA CHECKLIST**

This checklist can be used to verify that the main components of an air quality assessment have been completed. It is helpful to include this checklist with the EIS or application, to indicate where the components of the air quality assessment are located in the document. This is especially helpful if the components are located in more than one section of the document.

| **OVERALL** | | |
|---|---|---|
| ✓ | ***Item*** | |
| | 1. Background concentrations of air pollutants and predicted values of Contaminants of Potential Concern (COPCs) are presented in concentrations (i.e. reported in µg/$m^3$), not only as emission rates, to enable comparisons to human health-based guidelines. | |
| | 2. All phases of the project activities are considered in the assessment (construction, operation, etc.). | |
| | 3. Assumptions are clearly stated and justified (modelling of worst-case scenarios, etc.). | |
| **DESCRIPTION OF BOUNDARIES, COPCS, ETC.** | | |
| ✓ | ***Item*** | ***Section in EA*** |
| | 4. Spatial and temporal boundaries are clearly reported. | |
| | 5. Potential human receptors, with particular attention to Indigenous peoples, are identified and characterized. Distances from the project site(s) to all potential human receptors within the area affected by the project are delineated (using maps if applicable), and different land uses are identified (residential, recreational, Indigenous, etc.). | |
| | 6. All possible COPC emissions as result of project activities are identified. | |
| | 7. Any COPCs not carried forward to assessment are identified and accompanied by a scientific rationale. | |
| **SCENARIOS FOR THE ASSESSMENT** | | |
| ✓ | ***Item*** | ***Section in EA*** |
| | 8. The assessment scenarios are clearly described and assumptions are stated, and include i) baseline, ii) project alone, iii) baseline plus project, iv) cumulative or future development, and v) decommissioning or abandonment. | |
| | 9. Predictions are accompanied by map(s) showing the estimated COPC concentrations and the location of human receptors. | |
| | 10. The assessment discusses the project's contribution to the local airshed and considers the importance of the project phases (e.g. the portion of the project that consists of construction activities). | |
| | 11. The assessment includes a discussion of ground-level ozone levels, and any project emissions that are precursors to formation of ozone and urban smog in the area affected by the project. | |
| | 12. Predicted exceedances of health-based reference concentrations are identified and their significance is discussed. | |

| MITIGATION MEASURES, MONITORING ACTIVITIES AND FOLLOW-UP PLANS | | |
|---|---|---|
| ✓ | ***Item*** | ***Section in EA*** |
| | 13. The mitigation measures to be employed are described in sufficient detail, including any criteria for the implementation of mitigation. | |
| | 14. The assessment includes a discussion of how the Canadian Ambient Air Quality Standards (CAAQS) principles of Keeping Clean Areas Clean and Continuous Improvement will be taken into account in designing mitigation measures, monitoring and follow-up activities. | |
| | 15. The details or a description of monitoring activities (i.e. frequency and duration of monitoring activities, COPCs to be monitored) are provided. | |
| | 16. A description of the air quality portion of the follow-up program is provided, if available. | |

# APPENDIX B1 NATIONAL AND PROVINCIAL AIR QUALITY: ONLINE RESOURCES

**Table B1.** Nationally focused ambient air quality resources and information available online (Current as of the publication date of this guidance document)

| SOURCE | RESOURCE | URL |
|---|---|---|
| Environment and Climate Change Canada | Backgrounder: Clean Air Regulatory Agenda | **www.ec.gc.ca/default.asp?lang=En&n=56D4043B-1&news=295B1964-9737-4F80-B064-B3088D9910BE** |
| Government of Canada | Health; Environmental Health; Air Quality | **www.healthycanadians.gc.ca/health-sante/environment-environnement/outdoor-air-exterieur/index-eng.php** |
| Canadian Council of Ministers of the Environment (CCME) | Our Work: Air (Main page) | **www.ccme.ca/ourwork/air.html** |
| CCME | Air Quality Management System (*includes link to CAAQS levels*) | **www.ccme.ca/ourwork/air.html?category_id=146** |
| Health Canada | Air Quality (Main page) | **www.healthycanadians.gc.ca/healthy-living-vie-saine/environment-environnement/air/index-eng.php** |
| Environment and Climate Change Canada | Air Quality (Main page) | **www.ec.gc.ca/air-sc-r** |
| Environment and Climate Change Canada | Air Quality Science and Research (includes link to *"Access air quality data"*) | **www.ec.gc.ca/air-sc-r** |
| Environment and Climate Change Canada | Air Quality (Main page) | **www.ec.gc.ca/rs-mn** |
| Environment and Climate Change Canada | The National Air Pollution Surveillance Network (NAPS) | **www.ec.gc.ca/rnspa-naps** |
| Environment and Climate Change Canada and Health Canada | Air Quality Health Index | **www.airhealth.ca** |
| Environment and Climate Change Canada and Health Canada, 2012 | Canadian Smog Science Assessment: Highlights and Key Messages. | **www.ec.gc.ca/Publications/default.asp?lang=En&xml=AD024B6B-A18B-408D-ACA2-59B1B4E04863** |

**Table B2.** Select provincial ambient air quality resources, guidelines, objectives and standards available online (Current as of the publication date of this guidance document)

| PROVINCE | RESOURCE | DATE | URL |
|---|---|---|---|
| British Columbia | British Columbia Air Quality Objectives and Standards | January 18, 2016 | **www.bcairquality.ca/reports/pdfs/aqotable.pdf** |
| | B.C. Air Quality (main page) | | **www.bcairquality.ca/** |
| Alberta | Alberta Ambient Air Quality Objectives | March 2016 | **aep.alberta.ca/air/legislation/ambient-air-quality-objectives/default.aspx** |
| | Alberta Air (main page) | | **esrd.alberta.ca/air/default.aspx** |
| | Clean Air Strategic Alliance (main page) | | **casahome.org** |
| Saskatchewan | Saskatchewan Ambient Air Quality Standards | 1996 | **www.environment.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=6b1f40c1-7d4a-499b-a366-e5ffa76324d5** |
| | Saskatchewan Environment, Programs and Services: Air (main page) | | **www.environment.gov.sk.ca/Default.aspx?DN=23774f60-0917-47ed-ba54-3a40d99e23c0** |
| Manitoba | Objectives and Guidelines for Various Air Pollutants: Ambient Air Quality Criteria | July 2005 | **www.gov.mb.ca/conservation/envprograms/airquality/aq-criteria/ambientair_e.html** |
| | Manitoba Conservation: Air Quality Management (main page) | | **www.gov.mb.ca/conservation/envprograms/airquality/index.html** |
| Ontario | Ontario's Ambient Air Quality Criteria (Sorted by Contaminant Name) | April 2012 | **www.airqualityontario.com/downloads/AmbientAirQualityCriteria.pdf** |
| | Air Quality Ontario (main page) | | **www.airqualityontario.com** |
| Quebec | Les normes et critères québécois de qualité de l'atmosphère (version 4) | 2014 | **www.mddep.gouv.qc.ca/air/criteres/Normes-criteres-qc-qualite-atmosphere.pdf** |
| | Normes et critères de qualité de l'atmosphère (main page) | | **www.mddep.gouv.qc.ca/air/criteres/index.htm** |
| New Brunswick | New Brunswick Air Quality Objectives | March 2002 | **www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/OrderEstablishingObjectives.pdf** |
| | New Brunswick Environment—Air Quality (main page) | | **www2.gnb.ca/content/gnb/en/departments/elg/environment/content/air_quality.html** |

| | | | |
|---|---|---|---|
| Nova Scotia | Air Quality Regulations | 2014 | **www.novascotia.ca/just/regulations/regs/envairqt.htm** |
| | Nova Scotia Environment—Air (main page) | | **www.novascotia.ca/nse/air** |
| Prince Edward Island | Air Quality Regulations | 2004 | **www.gov.pe.ca/law/regulations/pdf/E&09-02.pdf** |
| | PEI Environment—Air (main page) | | **www.gov.pe.ca/environment/air** |
| Newfoundland and Labrador | Air Pollution Control Regulations, 2004 | 2004 | **www.assembly.nl.ca/legislation/sr/regulations/rc040039.htm** |

# APPENDIX C1 CANADIAN AMBIENT AIR QUALITY STANDARDS (CAAQS) AND NATIONAL AMBIENT AIR QUALITY OBJECTIVES (NAAQOs)

The values listed in the tables below are valid as of the date of publication of this document. In addition, you will find information and equations for converting units. Check the appropriate source(s) (i.e. CCME, provincial authorities, etc.) for the most up-to-date and current criteria, standards, and/or objectives. Consult the CCME website for the latest updates and information on the implementation of the Air Quality Management System, including the Canadian Ambient Air Quality Standards (CAAQS).

CAAQS for fine particulate matter and ground-level ozone are listed in Table C1. The CAAQS were established under CEPA in 2013 and replace the Canada-wide Standards for $PM_{2.5}$ and ozone (2000). The CAAQS are both more stringent (i.e. lower) and more comprehensive with the addition of a new long-term standard for $PM_{2.5}$.

National Ambient Air Quality Objectives (NAAQOs) are listed in Table C2. However, these NAAQOs are in the process of being reviewed and updated. CAAQS are currently under development for nitrogen dioxide and sulphur dioxide, with the intent to replace the existing NAAQOs for these pollutants.

**Table C1.** CAAQS for $PM_{2.5}$ and ozone (CCME, 2012)

| POLLUTANT | AVERAGING TIME | STANDARDS (numerical values) | | METRIC |
|---|---|---|---|---|
| | | 2015 | 2020 | |
| **$PM_{2.5}$** | 24-hour (calendar day) | 28 µg/m$^3$ | 27 µg/m$^3$ | The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations |
| **$PM_{2.5}$** | annual (calendar year) | 10.0 µg/m$^3$ | 8.8 µg/m$^3$ | The 3-year average of the annual average concentrations. |
| **Ozone** | 8-hour | 63 ppb | 62 ppb | The 3-year average of the annual 4th-highest daily maximum 8-hour average concentrations. |

**Table C2.** National Ambient Air Quality Objectives for Canada (NAAQOs) (Canada Gazette Part I, August 12, 1989)

| POLLUTANT | YEAR | AVERAGING TIME | MAXIMUM DESIRABLE LEVEL | MAXIMUM ACCEPTABLE LEVEL | MAXIMUM TOLERABLE LEVEL |
|---|---|---|---|---|---|
| Carbon Monoxide (CO) | 1996 | 8 hours | 5 ppm | 13 ppm | 17 ppm |
| | | 1 hour | 13 ppm | 31 ppm | – |
| Nitrogen Dioxide ($NO_2$) | 1989 | Annual | 32 ppb | 53 ppb | – |
| | | 24 hours | – | 106 ppb | 160 ppb |
| | | 1 hour | – | 213 ppb | 532 ppb |
| Sulphur Dioxide ($SO_2$) | 1989 | Annual | 11 ppb | 23 ppb | – |
| | | 24 hours | 57 ppb | 115 ppb | 306 ppb |
| | | 1 hour | 172 ppb | 334 ppb | – |
| Total Suspended Particulates (TSP) | 1989 | Annual | 60 µg/m$^3$ | 70 µg/m$^3$ | – |
| | | 24 hours | – | 120 µg/m$^3$ | 400 µg/m$^3$ |

## Definitions and Equations for Converting Units (mg/m$^3$ to parts per million)

**Milligrams per cubic metre (mg/m$^3$):** milligrams of gaseous pollutant per cubic metre of ambient air.

**Parts per million (ppm):** one part per million (by volume) is equal to a volume of a given gas mixed in a million volumes of air.

**Parts per billion (ppb):** one part per billion (by volume) is equal to a volume of a given gas mixed in a billion volumes of air.

Convert concentrations in **ppm to mg/m$^3$** using the following general equation:

$$Y_{mg/m^3} = (X_{ppm})\ (MW)\ /\ 24.45$$

Convert concentrations in **mg/m$^3$** to ppm using the following general equation:

$$X_{ppm} = (Y_{mg/m^3})\ (24.45)\ /\ (MW)$$

Where:

$\mathbf{Y_{mg/m^3}}$ is the concentration of an element or compound expressed in units of mg/m$^3$

$\mathbf{X_{ppm}}$ is the concentration of an element or compound expressed in units of ppm

**24.45** is a constant (unitless) representing the volume (litres) of a mole (gram molecular weight) of a gas or vapour when the pressure is at 1 atmosphere and the temperature is 25 °C

**MW** is the molecular weight of the gaseous pollutant (element or compound) expressed in units of grams/mole. The molecular weight of an element (atomic weight) can be found in the periodic table of elements. The molecular weight of a compound is the sum of the atomic weights of each element comprising the compound.

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Guidance for Evaluating
Human Health Impacts
in Environmental Assessment:

# DRINKING AND RECREATIONAL WATER QUALITY

Canada

**Health Canada is the federal department responsible for helping the people of Canada maintain and improve their health.** We assess the safety of drugs and many consumer products, help improve the safety of food, and provide information to Canadians to help them make healthy decisions. We provide health services to First Nations people and to Inuit communities. We work with the provinces to ensure our health care system serves the needs of Canadians.

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Email: ead@hc-sc.gc.ca

# 1 ACRONYMS

| ACRONYM | MEANING |
|---|---|
| CEAA 2012 | *Canadian Environmental Assessment Act*, 2012 |
| DOC | dissolved organic carbon |
| DWTP | drinking water treatment plant |
| EA | environmental assessment |
| *E. coli* | *Escherichia coli* |
| EIS | environmental impact statement |
| GCDWQ | *Guidelines for Canadian Drinking Water Quality* |
| GCRWQ | *Guidelines for Canadian Recreational Water Quality* |
| HHRA | human health risk assessment |
| TDS | total dissolved solids |
| TOC | total organic carbon |
| VOCs | volatile organic compounds |
| RA | responsible authority |

# 2 PURPOSE OF THIS DOCUMENT

This document provides generic guidance on predicting health risks of water quality in federal environmental assessments (EAs) of proposed major resource and infrastructure projects (such as mines, dams, pipelines and other projects). It presents the principles, current practices and basic information Health Canada looks for when it reviews environmental impact statement (EIS) or other reports submitted by project proponents as part of the EA process.

It was prepared for the benefit of proponents and their consultants and to support an efficient and transparent project review process. The foundational information described here should be supplemented appropriately with additional information relevant to specific projects.

The guidance was also prepared for responsible authorities and stakeholders to the EA process to communicate our normal areas of engagement and our priorities within these areas to help ensure that sufficient evidence is available to support sound decisions. As part of its review, Health Canada may suggest that a responsible authority (RA), review panel or others collect information not specifically described here in order to assess the health effects of specific projects. As the guidance provided here is generic and designed to support EA under multiple jurisdictions, the scope of our review will also necessarily be amended according to specific jurisdictional requirements.

Health Canada updates guidance documents periodically and, in the interest of continuous improvement, accepts comments and corrections at the following address: ead@hc-sc.gc.ca

Please verify that you are reading the most recent version available by consulting: **www.healthycanadians.gc.ca/publications/department-ministere/hc-sc/environmental-assessment-evaluation-environnementale/index-eng.php**

# 3 INTRODUCTION AND CONTEXT

Health Canada provides expertise to assist RAs, review panels and/or other jurisdictions leading environmental assessments to determine whether there are potential health risks associated with proposed projects and how to prevent, reduce or mitigate them.

Health Canada brings to bear its expertise in health risks associated with air quality, water quality, radiation, noise and country foods when it reviews and provides comments on information submitted by proponents in support of proposed projects. Health Canada also provides guidance to help stakeholders, including responsible authorities, review panels and affected communities, better understand how to conduct health assessments for proposed major resource projects.

This document concerns the assessment of health risks associated with water quality. It contains information on Health Canada's role with respect to drinking and recreational water quality; steps in Health Canada's preferred approach to human health risk assessment (HHRA) and assessing water quality-related health effects; and assessing cumulative effects.

Appendix A contains a checklist that can be used to verfiy that the main components of a water quality assessment are complete and to show where this information can be found within an EA document.

# 4 HEALTH CANADA'S ROLE WITH RESPECT TO DRINKING AND RECREATIONAL WATER QUALITY

In Canada, the responsibility for the safety and quality of drinking and recreational waters is shared between federal and provincial/territorial levels of government. The primary responsibility, including for regulations, generally rests with the provinces and territories. Health Canada provides scientific leadership by developing the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) and the *Guidelines for Canadian Recreational Water Quality* (GCRWQ), in partnership with the provinces and territories. These guidelines are used as the basis for provincial/territorial drinking and recreational water quality requirements. For the most recent listing of these guidelines, refer to Health Canada's publication at: **www.healthcanada.gc.ca/waterquality**

Provincial and territorial standards may differ from the GCDWQ, depending on local considerations and needs. Upon request, Health Canada may provide scientific and technical advice to a federal department. This advice may be in the context of an environmental assessment (in this case, advice may also be provided to a province for projects substituted under *Canadian Environmental Assessment Act*, 2012 [CEAA, 2012], or to a territory) or general advice on emergency response to a spill—and could include the development of drinking water guidance values.

Drinking water guidance values are developed upon request to provide a level that is considered to be safe for exposure to a specific chemical contaminant in drinking water, under specific conditions. They are generally developed for contaminants for which no GCDWQ are available.These guidance values are developed for use within the department or government that has made the request, and are based on the limited scientific information available at the time of the request, and not on a thorough research of all existing studies. They are not subject to a review at the level of the GCDWQ, which undergo internal/external peer review and public consultation before being approved by the Federal-Provincial-Territorial Committees on Drinking Water and on Health and the Environment. Drinking water guidance values apply to water intended for human consumption, and do not replace or supersede existing guidelines or regulations.

For more information, refer to Health Canada's publication entitled *Water Talk—Drinking Water Quality in Canada* at: **www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/drink-potab-eng.pdf**

# 5 HEALTH CANADA'S APPROACH TO HUMAN HEALTH RISK ASSESSMENT

One of the key tools that Health Canada promotes for evaluating the potential health impacts of project-related exposure to contaminants is called a "human health risk assessment" (HHRA). An HHRA can help identify whether there are potential human health risks associated with a proposed project.

Three components must be present for a "risk" to exist: 1. a hazard (for example, a chemical or a radionuclide) 2. a receptor (individuals or communities) and 3. an exposure pathway (a means by which people are exposed to the contaminant).

Within an environmental assessment, an HHRA is defined as the process used to estimate the probability of adverse health effects for people who may be exposed to contaminants through different routes/pathways (ingestion, inhalation and/or dermal contact) in specific environmental media (air, foods, soil, water and/or sediment).

An HHRA provides qualitative and/or quantitative estimates of the likelihood of adverse effects to human health, depending on the available information. These estimates are based on the inherent characteristics of the contaminants, as well as factors specific to the project being assessed—such as the characteristics of the exposed population and the media through which the exposure would take place.

Although conducting an HHRA is not always a requirement of an EA and is dependent on the potential effects of particular project, it can provide increased support for the conclusions of an EA. The findings of an HHRA are particularly useful for determining the significance of a potential effect, and for establishing appropriate mitigation measures, follow-up programs, and plans for monitoring, remediation and/or risk management.

With respect to water quality, an HHRA can be used to assess the risk of potential contamination of drinking or recreational water by taking into consideration the levels of contaminants in the water sources and the exposure of humans to these contaminants. By combining these two factors, one can estimate the potential effects of the intake of contaminants on human health. However, a complete HHRA may not always be necessary in an EA focused solely on water quality—for example, when the project's predicted impacts meet applicable guidelines and standards (such as the GCDWQ, GCRWQ or provincial standards)—given that extensive HHRAs have been already performed to establish these guidelines and standards.

In other cases where multiple pathways of exposure are being evaluated, exposure to contaminants in drinking and recreational water should be included in a multi-media HHRA.

# 6 ADDRESSING THE POTENTIAL CONTAMINATION OF DRINKING AND RECREATIONAL WATER IN ENVIRONMENTAL ASSESSMENTS

A water quality assessment is typically performed as part of an EA. If the EA demonstrates that a project will not result in any exceedances of applicable water quality guidelines or standards at the point of human consumption or exposure, it is reasonable to conclude that negative impacts on human health are not expected from exposure to drinking or recreational water.

If groundwater is consumed directly without treatment, then its water quality parameters could be compared to applicable drinking water limits. When water is treated before consumption, the water quality assessment for the project should examine whether the technology and capacity of the existing drinking water treatment plant (DWTP) are sufficient to ensure that the treated water will be of adequate quality.

It is not necessary for source water to meet guidelines or standards before treatment; however, this does NOT mean that source water can be contaminated up to the limits set by the guideline or standard. Health Canada holds the view that the assessment should demonstrate the steps to be taken to minimize the impacts of contamination on the quality of source water.

Water quality assessments should consider water quality parameters that are specific to the project, as well as common parameters that could have an impact on drinking water treatment. These common parameters include the following: total dissolved solids (TDS), turbidity, pH, temperature, ammonia, total organic carbon (TOC) and dissolved organic carbon (DOC). Surface water should never be consumed without treatment; this also applies to groundwater under the direct influence of surface water (in cases such as seepage of surface water through well casing or fractured rock)—which should be considered to be surface water for water quality purposes.

If a facility may be affected by a project and rendered unable to treat water to meet the applicable drinking water guidelines or standards, this fact should be considered in the water quality assessment, particularly because upgrading an existing DWTP may take several years.

## 6.1 ASSESSING POTENTIAL IMPACTS ON DRINKING WATER QUALITY

Assessing the potential impacts of projects on drinking water quality often involves simply comparing predicted concentrations of substances and parameters to the most recent version of the *Guidelines for Canadian Drinking Water Quality* (GCDWQ), published by Health Canada on behalf of the Federal-Provincial-Territorial Committee on Drinking Water. However, when the predicted concentrations approach or exceed the values suggested in the GCDWQ, it is advisable to include drinking water as a pathway in the HHRA conducted for the project.

Health Canada does not establish rules under the CEAA 2012 concerning the format and presentation of data and results when assessing potential impacts on drinking water quality. However, inclusion of the following components is suggested:

1. Identification of sources used for drinking water (locations and proximities to the proposed project);
2. Determination of potential changes to source and well water quality;
3. Determination of impacts of changes in water quality;
4. Mitigation;
5. Assessment of residual risk;
6. Monitoring (if required); and
7. References.

It is Health Canada's preference that only qualified professionals with suitable experience assess potential effects on drinking water quality.

### 6.1.1 Identification of sources used for drinking water

The water quality assessment should identify and describe all sources of drinking water in the area that may experience a change as a result of the project. Such sources may include source water intakes for DWTPs; sources that are consumed directly (for example, private wells). It is useful to include a statement indicating that all drinking water sources have been listed in the assessment.

The potential spread of contamination through the local watershed should be taken into consideration, when deciding which drinking water sources may experience a change as a result of the project. If a DWTP is present in the project's area of influence, Health Canada suggests that the water quality assessment identify the treatment technologies used in the facility (for example, chlorination, filtration, ozonation) and provide information from the facility (if available) on intake and treated water monitoring. If no sources of drinking water exist in the project area, either public or private, then no assessment with respect to drinking water would be suggested.

### 6.1.2 Determination of potential changes to source and well water quality

Any potential project-related changes in the quality of drinking water sources should be determined (including the risk of spills or accidents) and quantified to the greatest extent possible in the assessment. Health Canada also suggests provision of basic information on the local watershed; the geographical/hydrological influence of the project on drinking water supplies; and potential human exposure pathways.

Modelling may be used to estimate contaminant levels in water after the project proceeds—through the phases of construction, operation and/or decommissioning, as appropriate. Ideally, the estimates should be based on models recommended by Environment Canada, Natural Resources Canada and/or the United States Environmental Protection Agency, and the water quality assessment should document the models used.

If a potential impact on water quality has been identified, Health Canada would prefer that the water quality assessment include a comprehensive list of potential contaminants and their physicochemical properties. To properly identify these contaminants, the assessment should consider the following types of factors: the nature of the project; the effluents, materials and chemicals present; excavation and construction methods; potential flooding; rerouting of waterways; landscape changes; and waste management.

Health Canada would also prefer that the assessment take into account naturally occurring sources of contamination in the project area (for example, substances found in soils and/or water), as well as contamination from previous industrial activities, which could be mobilized by the project activities. Examples of potential contaminants are metals, pesticides, pathogens, hydrocarbons and volatile organic compounds (VOCs).

A change in physical characteristics, as well as in levels of ammonia or bromide, can affect water treatment. If no water quality changes are expected to occur in the source water of nearby DWTPs or in untreated well water, a statement with proper justification indicating this fact should be included.

### 6.1.3 Determination of impacts of changes in water quality

If any changes to source or well water quality are predicted, Health Canada prefers that the water quality assessment include discussion of the potential impacts of these changes. In the case of untreated well water or any other untreated drinking water source, the predicted water quality should be compared to the GCDWQ or to the applicable provincial or territorial standards.

The potential risk to human health caused by contaminants for which no Canadian human-health-based guidelines or standards exist needs to be assessed on a case-by-case basis. If there are potential guidelines or standard exceedances, Health Canada suggests that the assessment discuss monitoring and mitigation.

If source water is to be treated, Health Canada prefers that the assessment include discussion of the type of treatment used and/or the capacity of the facility, and whether the facility will be able to address the predicted or possible changes in water quality. If the facility is provincially or territorially regulated, it is advisable to consult with the appropriate authorities and/or facility operators to confirm the expected adequacy of the facility.

### 6.1.4 Monitoring and mitigation

If the assessment determines that a project poses a risk of a change to the environment or an effect of a change to the environment on a drinking water source—and where that effect cannot be eliminated by existing treatment plants—the assessment should describe the measures to be taken to manage this risk. In addition, Health Canada encourages development of plans for mitigation measures that further reduce small impacts. It is suggested that all recommendations, including any projected mitigation and monitoring plans, be listed and described.

**Monitoring**

The periodic monitoring of drinking water parameters can be used to verify water quality predictions. If there is uncertainty as to whether water quality will meet applicable guidelines or standards—either due to predicted concentrations being near guideline or standard concentrations or high uncertainty in predicted values—Health Canada suggests that a commitment be made to undertake a monitoring program.

In general, Health Canada prefers that monitoring of drinking water quality be done in accordance with provincial and territorial regulations. The following factors may be of assistance in planning monitoring studies:

- Information on contaminants typically of concern related to similar development projects and similar sites;
- Discussion with local residents;
- Consultation with local health and/or environmental health officials; and
- Previous studies conducted in the project area.

Health Canada does not have specific expertise in development of site-specific sampling plans; however, if it receives a request under Section 20 of CEAA 2012, it may make available information and knowledge to guide the conducting of human health risk assessments (HHRAs) after monitoring data is obtained.

Health Canada prefers that historic drinking water quality data (baseline conditions prior to any project activities in the affected watershed) be collected before the project begins. These data can then be compared to predicted changes in water quality due to project activities, as well as to water quality data collected after the project is underway. Baseline data may be obtained from DWTPs and from nearby wells that may be influenced by the project.

If no monitoring is to be undertaken, Health Canada prefers that the water quality assessment include a justification for this decision.

**Mitigation**

If an environmental effect on drinking water sources is either predicted or possible, the water quality assessment should include a mitigation plan. Possible mitigation measures include the following:

- Measures to reduce predicted changes in water quality;
- Improved treatment technology or capacity in DWTPs;
- Implementation of water treatment where it was previously absent; and
- Provision of an alternative drinking water source.

If a DWTP's source water quality could be affected by a project, Health Canada prefers that the owners/operators of the facility be notified, and that the assessment include information on this notification and how it will be done. Health Canada also prefers that private well owners affected by a project be notified of potential changes in their water quality.

Health Canada prefers clarifying whether any monitoring, mitigation or other risk management measures will be undertaken conditionally or unconditionally. If the measures are conditional, Health Canada prefers that the water quality assessment clearly describe the conditions under which the measures will be implemented.

### 6.1.5 Assessment of residual risk

A water quality assessment should discuss potential impacts on drinking water quality after all proposed mitigation and management measures have been applied. This discussion should include human health risks in cases of accidents or spills and in cases where water quality at any stage of the project is found to be different than predicted. If there is a possibility of exposure to contamination in drinking water that is above applicable guidelines or standards, Health Canada prefers that the risk to the health of nearby residents be estimated using methods appropriate for the contaminant in question.

It is very important that the GCDWQ related to *Escherichia coli* (*E. coli*) not be exceeded. *E. coli* is used as an indicator of faecal contamination, which means that disease-causing microorganisms may also be present. People may become sick very soon after being exposed to faecally contaminated water. Other guidelines, many of them for chemicals, are based on the best available science and give a good indication of human health effects that might be seen if levels exceed the GCDWQ over the lifetime of a project.

Some guidelines are aesthetic and exceeding them would not present a human health risk. In other cases, guidelines are risk-managed (due to limitations in analytical methods or treatment technologies) and some risks to human health may be present even below GCDWQ levels. An example is the case of arsenic where the concentration in drinking water representing an "essentially negligible" risk of internal organ cancers is 0.3 µg/L, however, current residential scale drinking water treatment technologies are only certified to reduce arsenic levels to 10 µg/L (the current GCDWQ); the guideline also recommends that every effort should be made to reduce arsenic levels in drinking water to as low as reasonably achievable. More information on the assessment of risk associated with short-term guideline exceedances can be found in the GCDWQ technical documents at: **www.healthcanada.gc.ca/waterquality**

Health Canada prefers that a rationale be provided in the water quality assessment as to why certain expected risks are found to be acceptable.

## 6.2 ASSESSING POTENTIAL IMPACTS ON RECREATIONAL WATER QUALITY

For the purposes of this guidance document, recreational waters are any natural fresh, marine or estuarine bodies of water, including artificial lakes and quarries, used by people for leisure. As described in The GCRWQ, a recreational water activity can be considered as any activity involving intentional or incidental immersion in natural waters and can be further categorized as:

- *Primary contact:* Activities in which the whole body or the face and trunk are frequently immersed or the face is frequently wetted by spray, and where it is likely that some water will be swallowed (such as swimming, surfing, waterskiing, white-water canoeing/rafting/kayaking, windsurfing and subsurface diving); or
- *Secondary contact:* Activities in which only the limbs are regularly wetted and in which greater contact (including swallowing water) is unusual (for example, rowing, sailing, canoe touring and fishing).

If project activities could affect recreational waters such that waters might not meet the recreational water quality guidelines of the appropriate jurisdictional authority (provincial/territorial or federal), Health Canada prefers that a water quality assessment be undertaken. Such an assessment would be similar to what is described in this document for drinking water and it is advisable to include information from consultations with the authorities responsible for the recreational water in question.

The GCRWQ do not include guidelines for specific chemical parameters. In the case of chemical contamination, Health Canada prefers that the potential risk to human health be assessed on a case-by-case basis.

Considerations specific to the risk assessment of recreational water quality include the following:

- Potential human exposure pathways include ingestion, inhalation and direct contact with the skin and mucous membranes. Health Canada prefers that the water quality assessments include a description of the types of activities practiced on or in the waters, to identify potential exposure pathways.
- Natural recreational waters are not subject to treatment. Similar to the case of untreated source water quality, mitigation of the impact of a project on recreational water quality and related predicted changes (including possible spills and accidents) would involve developing plans to implement measures to reduce this impact and monitor recovery in the water quality.

If recreational water quality could be subjected to an environmental effect due to a project, Health Canada prefers that the appropriate authorities be notified and recreational users be informed.

# 7 ASSESSMENT OF CUMULATIVE EFFECTS

Under CEAA 2012, subsection 19(1), an environmental assessment must consider "the environmental effects … and any cumulative environmental effects that are likely to result from the … designated project in combination with other physical activities that have been or will be carried out."

In the case of drinking and recreational water quality, Health Canada suggests that an assessment of cumulative effects, if required, include the following:

- Changes in levels of contaminants in drinking and recreational water resulting from all past, present or known future projects and activities (in other words, changes in exposure); and
- Whether future projects could result in new access to recreational and drinking water sources that may be contaminated and that were previously inaccessible (for example, a new road or bridge providing access to water, or modified water flow as a result of a project making previously un-navigable watercourses navigable).

If the cumulative effects assessment identifies water quality effects that exceed project-only effects, Health Canada suggests that further monitoring and/or mitigation measures be considered.

For guidance on assessing cumulative effects, consult the Canadian Environmental Assessment Agency's website for up-to-date guidance materials: **www.ceaa.gc.ca**

# 8 FOLLOW-UP PROGRAMS

Under CEAA 2012, a "follow-up program" means a program for:

a) verifying the accuracy of the environmental assessment of a designated project; and

b) determining the effectiveness of any mitigation measures.

It may be appropriate to consider a follow-up program for water quality (drinking and recreational) if one of the following applies (note: this is not a comprehensive list):

- There is uncertainty about the modelling of contaminant emission, release, mobilization, deposition or modification in the environment, and uptake into groundwater or surface water sources;
- There is uncertainty about the capacity of the DWTP to respond adequately to changes in source water quality;
- There is a possibility that a novel substance may be introduced into water bodies as a result of project activities;
- There is uncertainty whether proposed mitigation measures will be effective (e.g. the use of novel technologies or complex systems); or
- There is a possibility that water sources may be contaminated unexpectedly (for example, by a sudden release of untreated effluent).

For more information on follow-up programs, contact the Canadian Environmental Assessment Agency, Canadian Nuclear Safety Commission, or National Energy Board, as appropriate.

# 9 REFERENCES

## 9.1 CANADIAN WATER QUALITY GUIDELINES

Health Canada. 2012a. *Guidelines for Canadian Drinking Water Quality—Summary Table*. Ottawa, Ontario. Health Canada. Available online at: **www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php**

Health Canada. 2012b. *Guidelines for Canadian Recreational Water Quality*. Ottawa, Ontario. Health Canada.

Health Canada reports and publications on water quality in relation to radiological, chemical/physical, bacteriological and microbiological parameters can be found at the following link: **www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php**

## 9.2 ENVIRONMENTAL ASSESSMENTS

*Canadian Environmental Assessment Act*. S.C. 2012, c. 19, s. 52. 2012. Available online at: **laws-lois.justice.gc.ca/eng/acts/C-15.21/index.html**

## 9.3 WORLD HEALTH ORGANIZATION GUIDELINES

WHO. 2011. *Guidelines for Drinking-water Quality. Fourth Edition. Volume 1, Recommendations*. Geneva, Switzerland.

WHO. 2003. *Guidelines for Safe Recreational Water Environments. Volume 1, Coastal and Fresh Waters*. Geneva, Switzerland.

## 9.4 HUMAN HEALTH RISK ASSESSMENT GUIDANCE

Health Canada. 2010. *Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA)*, Version 2.0 (revised 2012). Contaminated Sites Division, Safe Environments Directorate, Ottawa.

# APPENDIX AI **WATER QUALITY IN EA CHECKLIST**

This checklist can be used to verify that the main components of a water assessment have been completed. It is helpful to include this checklist with the EIS or application, to show where the components of the water quality assessment are located in the document. This is especially helpful if the components are located in more than one section of the document.

| **OVERALL (throughout the EA)** | |
|---|---|
| ✓ | ***Item*** |
| | 1. Worked examples are included for calculations, if a quantitative risk assessment was completed. |
| | 2. Units are clearly stated and consistent (or conversion calculations are included as appropriate). |
| | 3. Assumptions are clearly stated and justified (modelling of worst-case scenarios, etc.). |
| | 4. Principles of minimizing impacts are considered (e.g. not polluting up to guidelines). This concept includes identifying mitigation measures to minimize increases in concentrations of contaminants as a result of project activities. |
| | 5. All Indigenous receptors are clearly identified and their potentially increased exposure to sources of water contamination is characterized |

| **DRINKING WATER SOURCES** | | |
|---|---|---|
| ✓ | ***Item*** | ***Section in EA*** |
| | 6. All sources used for drinking water are identified in the EA study areas (project, local and regional) including:<br>• Source water intakes for DWTP(s) and/or sources from which water is consumed directly (e.g. wells) and their distance from the project;<br>• Whether all sources of drinking water have been identified;<br>• The responsibility/jurisdiction for DWTP(s) in the EA study area (municipal/provincial/territorial/federal). | |
| | 7. Information is included on whether there are predicted or measured changes to source water quality due to project activities (includes spills and accidents, where relevant). If yes, the following is included: | |
| | a. A comprehensive list (including quantitative information) of potential organic, inorganic and microbial contaminants, as well as their physical characteristics. | |
| | b. A comparison of predicted or measured changes in individual parameters to appropriate guidelines or standards. | |
| | c. A conclusion with respect to the ability of DWTP(s) to address the predicted or measured changes in water quality. | |
| | d. Information on how managers of DWTP(s) will be informed of any predicted or measured changes in source water quality. | |
| | e. If the province or territory is responsible for managing the DWTP(s), confirmation from the appropriate authority of changes to the drinking water treatment protocol associated with predicted or measured changes to source water parameters. | |

| PRIVATE WELLS | | |
|---|---|---|
| ✓ | ***Item*** | ***Section in EA*** |
| | 8. Information is included on whether there are any private wells in the EA study area. If so, a discussion is included on whether any changes to the quality of the well water are likely due to project activities (including spills and accidents). | |
| | 9. If changes to well water quality are predicted or measured as a result of project activities, the following is included: | |
| | a. A comprehensive list (including quantitative information) of predicted organic, inorganic and microbial contaminants, as well as their physical characteristics. | |
| | b. A comparison of individual parameters to appropriate guidelines or standards—for both the baseline case and predicted future concentrations during project construction, operation and decommissioning, and in the event of accidents/malfunctions (as applicable). | |
| | c. Details on how well owners will be notified of potential changes in water quality. | |

| RECREATIONAL WATER QUALITY | | |
|---|---|---|
| ✓ | ***Item*** | ***Section in EA*** |
| | 10. All water bodies that are currently being used or may be used in the future for recreational purposes—and which may be affected by project activities—are identified, and a characterization of recreational activities in affected water bodies (swimming, canoeing, fishing, etc.) is included. | |
| | 11. Information is included on whether there are predicted or measured changes to recreational water quality due to project activities (includes spills and accidents, where relevant). If so, the following is included: | |
| | a. A comprehensive list (including quantitative information) of predicted or measured microbial, organic, and inorganic contaminants, as well as their physical characteristics. | |
| | b. A comparison of predicted or measured changes in individual parameters to appropriate guidelines or standards (provincial/territorial standards or the GCRWQ, which also apply on federal lands and First Nation reserves south of the 60$^{th}$ parallel). | |
| | c. As the GCRWQ do not include guidelines for specific chemical parameters, in the case of chemical contamination, a comparison of predicted changes in individual parameters to appropriate guidelines or standards, as determined in consultation with the responsible authorities. | |

| NEED FOR AN HHRA | | |
|---|---|---|
| ✓ | ***Item*** | ***Section in EA*** |
| | 12. Are there predicted exceedances of any provincial or territorial standards or federal guidelines after the application of mitigation measures? If so, it is suggested that an HHRA for the drinking or recreational water pathway be completed for contaminants. | |

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*Your health and safety… our priority.* *Votre santé et votre sécurité… notre priorité.*

Guidance for Evaluating
Human Health Impacts
in Environmental Assessment:

# NOISE

Canada

**Health Canada is the federal department responsible for helping the people of Canada maintain and improve their health.** We assess the safety of drugs and many consumer products, help improve the safety of food, and provide information to Canadians to help them make healthy decisions. We provide health services to First Nations people and to Inuit communities. We work with the provinces to ensure our health care system serves the needs of Canadians.

Également disponible en français sous le titre :
*Conseils pour l'évaluation des impacts sur la santé humaine dans le cadre des évaluations environnementales : Le bruit*

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# TABLE OF CONTENTS

## TABLES



## APPENDICES



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Any questions or comments on this document may be directed to:
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# 1 ACRONYMS

| ACRONYM | MEANING |
|---|---|
| %HA | percent highly annoyed |
| %HSD | percent highly sleep disturbed |
| ANSI | American National Standards Institute |
| CEAA 2012 | *Canadian Environmental Assessment Act*, 2012 |
| CSA | Canadian Standards Association |
| CTA | Canadian Transportation Agency |
| dB | decibel |
| dBA | A-weighted decibels |
| dBZ | Z-weighted decibels |
| EA | environmental assessment |
| EIS | environmental impact statement |
| ERCB (EUB) | Energy Resources Conservation Board, Alberta (formerly Energy and Utilities Board) |
| FA | federal authority |
| Hz | hertz |
| ISO | International Organization for Standardization |
| Ld | daytime sound level |
| Ldn | day-night sound level |
| Leq | equivalent continuous sound level |
| Ln | night-time sound level |
| LAeq | A-weighted equivalent continuous sound level |
| LAmax | maximum A-weighted sound level |
| LSA | local study area |
| MNL | mitigation noise level |
| NIHL | noise-induced hearing loss |
| RA | responsible authority |
| REDA | *Radiation Emitting Devices Act* |
| RSA | regional study area |
| SEL | sound exposure level |
| WHO | World Health Organization |
| US EPA | United States Environmental Protection Agency |

# 2 PURPOSE OF THIS DOCUMENT

This document provides generic guidance on predicting health risks related to levels and/or types of sound predicted in federal environmental assessments (EAs) of proposed major resource and infrastructure projects (such as mines, dams, pipelines and other projects). It presents the principles, current practices and basic information Health Canada looks for when it reviews the environmental impact statement (EIS) or other reports submitted by project proponents as part of the EA process.

It was prepared for the benefit of proponents and their consultants and to support an efficient and transparent project review process. The foundational information described here should be supplemented appropriately with additional information relevant to specific projects.

The guidance was also prepared for responsible authorities (RAs) and stakeholders to the EA process to communicate our normal areas of engagement and our priorities within these areas to help ensure that sufficient evidence is available to support sound decisions.

As part of its review, Health Canada may suggest that an RA, review panel or others collect information not specifically described here in order to assess the health effects of specific projects. As the guidance provided here is generic and designed to support EA under multiple jurisdictions, the scope of our review will also necessarily be amended according to specific jurisdictional requirements.

Health Canada updates guidance documents periodically and, in the interest of continuous improvement, accepts comments and corrections at the following address: ead@hc-sc.gc.ca

Please verify that you are reading the most recent version available by consulting:
**www.canada.ca/en/services/health/publications/healthy-living.html#a2.5**

# 3 INTRODUCTION AND CONTEXT

Health Canada provides expertise to assist RAs, review panels and/or other jurisdictions leading environmental assessments to determine whether there are potential health risks associated with proposed projects and how to prevent, reduce or mitigate them.

Health Canada brings to bear its expertise in health risks associated with air quality, water quality, radiation, noise and country foods when it reviews and provides comments on information submitted by proponents in support of proposed projects. Health Canada also provides guidance to help stakeholders, including responsible authorities, review panels and affected communities, better understand how to conduct health assessments for proposed major resource projects.

This document concerns the assessment of health risks associated with noise. It contains information on the division of roles and responsibilities for issues related to noise at various levels of government in Canada, health effects associated with noise, indicators of these effects, and steps in Health Canada's preferred approach to assessing noise-related health effects.

Appendix A contains a Glossary that defines the technical terms used throughout.

Appendix B contains a checklist of noise impacts that can be used to verify that the essential components of a noise-related health assessment are completed.

Appendices C through H contain additional technical and supplementary information related to noise assessment in EAs.

# 4 ROLES AND RESPONSIBILITIES WITH RESPECT TO NOISE

In Canada, noise is managed by different levels of government. Federal examples include Transport Canada (aircraft noise), the Canadian Transportation Agency (rail noise), and Employment and Social Development Canada (specifically the Labour Program: occupational noise in workplaces under federal jurisdiction). Health Canada has a regulatory role via the *Radiation Emitting Devices Act* (REDA), which controls the sale of devices that create an unnecessary noise hazard or do not comply with regulatory standards. Outside of these specific federal mandates, noise may be regulated directly through provincial and territorial legislation and guidelines, or through municipal by-laws, which may apply broadly or only to specific project types or sectors. Few or many different criteria may be used to establish noise guidelines, which may include, but not be limited to, noise impacts on sleep, hearing and high annoyance.

In the context of environmental assessments, one of Health Canada's roles concerning noise exposure is to review acoustical assessments for scientific validity and potential risks to human health from project-related changes in environmental noise. This role is fulfilled via leadership in science, research, participation in national and international bodies that develop standards (Canadian Standards Association (CSA) and the International Organization for Standardization [ISO]) and participation in the development of guidelines (World Health Organization [WHO]) for noise and human health.

Health Canada's scientists conduct, evaluate and remain current on domestic and international scientific research pertaining to the human health impacts of noise. Their expertise regarding the potential human health effects of noise is made available to responsible authorities conducting assessments of projects subject to EA legislation. The responsibility for determining the significance of these effects rests with the RAs, review panels or other jurisdictions conducting assessments.

Health Canada does not enforce noise thresholds or standards, but can make available information and knowledge acquired from Canadian and international sources regarding the potential adverse human health effects of noise—based on the type of community (e.g. urban, suburban or quiet rural areas). When noise levels have the potential to induce adverse human health effects, Health Canada may make available information or knowledge on mitigation measures. When mitigation measures are to be implemented, appropriate mitigation strategies based on all applicable guidelines should be considered. Health Canada encourages proponents to consult with other government authorities to determine which enforceable standards for noise exist for specific regions.

## 4.1 HEALTH CANADA'S APPROACH TO NOISE ASSESSMENTS IN ENVIRONMENTAL ASSESSMENTS

Noise is a somewhat special type of change to the environment, as it is an energy added to the air in the form of acoustical waves. Below the exposure threshold of biological damage to the ear, noise can also cause potential health impacts, such as sleep disturbance and/or cause long-term high annoyance, an indicator of potential health impacts. These impacts depend on the interference of the noise with what one is trying to do (e.g. sleep, concentrate or communicate) and the expectation of peace and quiet during such activities (e.g. in a quiet rural area or during Indigenous spiritual ceremonies).

Human response to noise varies among individuals and according to the specific situation. Response to noise can be characterized using different methodologies and endpoints, and may be affected by several factors. These factors include how noise moves from source to receptor, how it is measured, and what behavioural/physiological and/or psychological changes it evokes in humans.

A particular standard or guideline may not cover all possible considerations or the inherent variability in noise characterization. Several approaches to assessing noise impacts exist, and these various approaches often rely on different noise guidelines and/or regulations that may not be easily reconciled. For example, a guideline may be established to protect against hearing loss, but consideration of additional human health endpoints, such as sleep disturbance, may also be warranted. Some guidelines and/or regulations are based on limiting absolute noise levels, whereas others emphasize the relative change in the noise environment.

This document provides general information on Health Canada's preferred methodology for various human health endpoints used to determine these potential impacts. The prediction of potential impacts is necessary to understand the nature, extent and severity of human health effects that may occur due to noise generated during various stages of a proposed project. These calculations also serve to evaluate the feasibility of the project proponent's planned mitigation measures in reducing human health effects and whether a specific mitigation measure is expected to achieve the desired result. Health Canada reviews the methodology and calculations provided in the noise assessment, as well as the subsequent discussion of potential noise-related impacts on health, for accuracy and completeness. This information may be complementary to the applicable regulations, EIS guidelines or requirements of other jurisdictions.

Depending upon the nature of the project, the responsible authority, review panel or other jurisdiction conducting the EA may want to consider the assessment of noise impacts (specifically, sleep disturbance) on off-duty workers residing in or near the project area. Note that occupational exposure is typically under provincial or territorial jurisdiction, and Health Canada does not review this information in the context of EAs. Also, Health Canada does not possess information or knowledge on the impacts of noise on wildlife or ecosystems.

# 5 IMPACTS ASSOCIATED WITH NOISE

In reviewing an EA, Health Canada emphasizes only those endpoints that have demonstrated a reasonable causal relationship between noise exposure and adverse human health effects. In the context of an environmental assessment, the associations that have been reported between noise exposure and hearing loss, sleep disturbance, interference with communication, noise complaints and a high level of annoyance are particularly relevant (WHO 1999, 2011). The information and knowledge that Health Canada makes available is based on the following: the modelled changes between the existing and predicted daytime and night-time sound levels (for construction, operation and decommissioning activities); predicted noise-level changes at specific receptor locations (see Appendix G) where people are or will be present; the characteristics of the noise (e.g. impulsive or tonal); and/or the type of community (e.g. urban, suburban or quiet rural area).

## 5.1 NOISE-INDUCED HEARING LOSS

There is no known risk of permanent hearing loss associated with sound levels below 70 A-weighted decibels (dBA), regardless of the exposure duration. However, as sound levels increase, the duration of daily exposure becomes an important risk factor for hearing loss. The time period before damage occurs shortens as the average sound level increases (WHO 1999; Health Canada 2012).

Hearing loss impacts are not typically considered in EAs because project-related sound levels rarely reach these high levels at the locations of impacted receptors. However, noise-induced hearing loss (NIHL) may be a concern when project activities such as blasting, pile driving and jack hammering are expected. When considering impulsive noise, Health Canada suggests following the WHO recommendation to avoid hearing loss resulting from impulsive noise exposure and that peak sound pressures not exceed 140 Z-weighted decibels (dBZ) for adults and 120 dBZ for children (WHO, 1999).

## 5.2 NOISE-INDUCED SLEEP DISTURBANCE

Sleep disturbance encompasses the following: difficulty falling asleep; awakenings; curtailed sleep duration; alterations of sleep stages or depth; and increased body movements during sleep. The effects of sleep disturbance have been shown to include, but are not limited to: increased fatigue; irritability; and decreased concentration and performance. These effects are generally experienced in the days subsequent to significant disturbances in sleep. Ongoing disturbed sleep has been reported to be linked to a wide variety of health effects, including, but not limited to cardiovascular effects, mental health and accidents (WHO 2009; Zaharna and Guilleminault 2010).

The guidelines and recommendations of the WHO (1999, 2009) regarding sleep disturbance should be considered in the EA. In particular, WHO guideline levels should not be exceeded for quiet rural areas and susceptible populations, such as those in hospitals, or convalescent or senior homes. For estimating the likelihood of sleep disturbance on any given night, the WHO's *Guidelines for Community Noise* (1999) report a threshold for sleep disturbance as being an indoor sound level of no more than 30 dBA LAeq for continuous noise, during the sleep period. For individual noise events, the WHO has stated: "*For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dBA LAmax more than 10–15 times per night....*" Health Canada recognizes that in many cases, people will want to keep windows at least partially open, depending on the season. Unless specified otherwise, it is assumed by Health Canada that an outdoor-to-indoor transmission loss with windows at least partially open is 15 dBA (United States Environmental Protection Agency [US EPA] 1974; WHO 1999). Fully closed windows are assumed to reduce outdoor sound levels by approximately 27 dBA (US EPA 1974).

More recently, the WHO has published night-time noise guidelines that are intended to protect the public, including the most vulnerable groups, from adverse health effects associated with sleep disturbance due to night-time noise. The recommended annual average is 40 dBA Ln outdoors (WHO 2009). As this is an annual average, there may be times when the sound level is above and below 40 dBA; however, there should be no long-term impact on health if the annual average does not exceed 40 dBA.

Consistent with the view expressed above, when care facilities, including hospitals, nursing homes, daycare centres and homes for the elderly, are identified as receptors that could be impacted by project-related noise, it is a good practice to consult with these facilities to determine whether certain sensitivities to sleep disturbance exist during the day. Should any such sensitivities be noted, the threshold level for sleep disturbance specified in the WHO's Guidelines (1999, 2009) may be used to assess the severity of potential impacts on these receptors. Where there is interest in estimating the prevalence of sleep disturbance—expressed as the percentage self-reported highly sleep disturbed (%HSD)—Miedema and Vos (2007) have published dose-response relationships for estimating %HSD by road, rail and aircraft noise.

## 5.3 INTERFERENCE WITH SPEECH COMPREHENSION

To maintain good speech comprehension, the recommended sound levels vary, depending on whether the noise from project activities is measured (or estimated) indoors or outdoors. For good speech comprehension, speech levels should exceed that of background noise by 15 dB. The same difference is also desirable for music or television listening. Normal indoor speaking levels are typically 55 to 58 dBA (Levitt and Webster 1991), which is in line with the US EPA 1974 recommendation that indoor background noise levels should not exceed 40 dBA to achieve 100% sentence intelligibility. According to the WHO (1999), speech in relaxed conversation is 100% intelligible in background noise levels of about 35 dBA, and can be understood fairly well in background levels of 45 dBA. Therefore, Health Canada holds the view that background noise levels (i.e. noise due to project activities as measured indoors) be maintained below 40 dBA to sustain adequate speech comprehension.

People generally tend to speak in a louder voice when outdoors, where the separation between speakers is typically larger than indoors. In outdoor environments where distances of up to two metres exist between speakers, US EPA 1974 suggests that 95% sentence intelligibility is acceptable, and recommends a background noise level of 55 dBA outdoors (i.e. 60 dBA with a 5-dBA margin of safety). To sustain good outdoor speech comprehension, background outdoor noise levels for continuous noise should be kept below 55 dBA.

When a school is identified as a potentially impacted receptor, it is suggested that the EA address the special sensitivity of this type of receptor to daytime noise. The WHO recommends an ideal background noise level of 35 dBA in the classroom (WHO 1999). This level is the threshold below which no impacts are expected. This recommendation is based especially on speech interference, but also on the impacts of disturbing message communication and the extraction of information (e.g. speech comprehension and reading), and annoyance.

## 5.4 INDICATORS OF POTENTIAL HUMAN HEALTH EFFECTS

Health Canada holds the view that certain community reactions to project-related noise represent potential indicators of adverse health; that is, if the noise is experienced over a long period of time, it could potentially increase one's risk of developing health effects. In the context of noise exposure, two of the most common community reactions are complaints and annoyance.

### 5.4.1 Noise Complaints

Many municipal policies concerning noise are based on the resolution of complaints. Noise-related complaints can be an indicator of human health effects and are used, in US EPA 1974, to help identify sound levels that would protect public health and well-being. Summarizing the US EPA document, Michaud *et al.* (2008) state that a "no reaction" response corresponded to a normalized outdoor day-night sound level (Ldn) of 55 dBA for the intruding noise. They also state that sporadic complaints can occur in communities when this noise level exceeds 55 dBA or widespread complaints, at a level exceeding 58 dBA. Michaud *et al.* (2008) discussed the divergence between "sporadic complaints" and "widespread complaints," when the normalized Ldn of the intruding noise (i.e. project noise) reached 62 dBA. Based on this work, Health Canada uses a normalized Ldn of 62 dBA when it considers effects related to widespread complaints. When project sound levels are greater than a normalized 75 dBA Ldn level, complaints can be expected to include strong appeals to authorities to stop noise. Reliance on noise complaints may only provide a partial indication of a noise problem (Michaud *et al.* 2008) and when possible, the estimated magnitude of complaints should be supplemented with other measures, such as the calculated change in the percentage of highly annoyed (%HA) in an average community and/or estimated impacts on sleep.

### 5.4.2 Long-term High Annoyance

Annoyance can be described as the effect of noise that most people are aware of. The consideration of community annoyance due to noise is useful; the %HA can be thought of as an aggregate indicator of assorted noise effects, present to varying degrees, which are creating a negative effect on the community and which may not be measurable when considered as separate negative effects.

High annoyance has been widely used as one way to estimate a community response to noise levels. High annoyance is an endpoint that is not directly measured but has been synthesized from self-reported annoyance in numerous large, community-based surveys. Although individual reaction varies greatly, the reported change in %HA among an average community in reaction to certain sound levels provides usable exposure-response relationships (Michaud *et al.*, 2008). Thus, the calculated %HA provides information on how an average community responds to a noise level. Health Canada uses the change in %HA as an appropriate indicator of noise-induced human health effects from exposure to project operational noise (see Section 6.3.2) and to long-term construction noise (see Section 6.3.1) exposure.

There have been more than 50 years of social and socio-acoustic research that either directly or indirectly studied the impact of noise on community annoyance. These studies have consistently shown that an increase in noise level is associated with an increase in the percentage of the community indicating that they are highly annoyed. The relationship between noise levels and high annoyance is stronger than any other self-reported measure, including complaints. Canadian research on road-traffic noise also shows that respondents highly annoyed by traffic noise are significantly more likely to perceive their annoyance as having a negative impact on their health (Michaud *et al.* 2008).

To assess the impacts of noise from projects using this indicator, the project-related change in the sound environment and the related increase in %HA are evaluated. Using the dose-response relationship between noise levels and annoyance, as per ISO 1996-1:2003, one can calculate the percentage of a typical community that would report being "highly annoyed," expressed as %HA. The %HA increases exponentially as sound levels increase. Due to the non-linear nature of the relationship between noise and %HA, there can be a substantial increase in the %HA, with relatively small changes in the noise environment—in situations where the initial baseline noise level is high. In other words, the higher the initial noise level, the more the annoyance will increase when there is an increase from the baseline noise level. In general, this dose-response relationship may be a useful tool in characterizing and quantifying average community response to noise levels and changes in noise levels.

Health Canada prefers the use of the dose-response relationship only for long-term noise exposure considerations in EAs, and holds the view that %HA be calculated only for receptors exposed to long-term project noise (more than one year). It is important to emphasize that these annoyance responses are not applicable to a particular individual or group, but represent an average community. Appendix F presents the methodology for obtaining variables used in the equations to calculate %HA. Health Canada prefers that the increase in %HA per representative receptor (i.e. a group of residences in similar geographic proximity to the noise source) be evaluated and not the average increase in %HA for all receptors—which could underestimate the project-related impact on community annoyance.

Noise mitigation measures should be considered when a change in the calculated %HA at any given receptor location exceeds 6.5%. The ISO method does not characterize the nature of the increase in terms of severity of impact. However, the U.S. Federal Transit Administration describes a long-term increase of more than 6.5%HA as representing a severe project-related noise impact (Hanson *et al.* 2006). This increase is based in part on the historical acceptability in the U.S. of no more than a 5-dBA increase in Ldn in an urban residential environment (not immediately adjacent to heavily travelled roads and industrial areas). Further justification for using an increase of 6.5%HA as a criterion for a severe noise-related impact may be found in Michaud *et al.*, 2008, and Hanson *et al.*, 2006. ISO 1996-1:2003 notes that research has shown that there is a greater expectation for, and value placed on, "peace and quiet" in quiet rural areas, which may be equivalent to up to 10 dB in noise. Unless specified otherwise in an EA, this expectation is assumed by Health Canada to be equivalent to an adjustment of 10 dB (ISO 1996-1:2003).

Note that the change in %HA is only one potential indicator of noise-related human health effects and that all possible human health endpoints may be considered in an assessment. In situations where baseline noise levels exceed an Ldn of 77 dBA , and project noise levels alone exceed an Ldn of 75 dBA, it may be too difficult to meet the WHO guidelines for sleep disturbance and vulnerable populations (see Section 5.2). It may also be too difficult to reduce these environmental noise levels to meet the levels suggested in Section 5.3, regarding adequate speech comprehension indoors for residents. Therefore, Health Canada holds the view that mitigation of project noise be applied if it exceeds an Ldn of 75 dBA, even if the change in %HA does not exceed 6.5%. For example, if project noise alone exceeds an Ldn of 75 dBA, it may be that the levels noted in Sections 5.2 and 5.3 are not achievable in typical residences, even in situations where the highest level of outdoor-to-indoor transmission loss is achieved. In situations like this, project noise should be cautiously mitigated to a level below an Ldn of 75 dBA, which includes a consideration of uncertainty in predictions.

# 6 AN APPROACH FOR ASSESSING THE HEALTH IMPACTS OF NOISE

The approach preferred by Health Canada for noise assessment involves obtaining the best possible characterization of the acoustical exposure that may impact potential noise receptors. This description includes sound level and duration, and noise characteristics, such as whether the noise is tonal, impulsive, highly impulsive, etc. (see Appendix B).

To obtain the highest-quality data in acoustical studies, acoustical assessments should be completed by professional and properly trained consultants, using equipment and methods that are recognized as the industry standard for acoustical measurements. Occasionally, limitations may exist in the technology and expertise available for some projects. Whenever uncertainty exists in the selection of appropriate monitoring equipment or in the application of standard techniques for noise characterization in EAs, government authorities are encouraged to consult Health Canada for assistance or additional guidance.

The main steps in assessing the potential health impacts of changes in noise associated with a project are the following:

- Identify people (receptors) who may be affected by the project-related noise;
- Determine the existing (baseline) noise levels at representative receptors, by measurement or estimation;
- Predict project-related changes in noise levels for each phase of the project (construction, operation and decommissioning) and describe the sound characteristics;
- Compare predicted noise levels to relevant guidelines and/or standards;
- Identify and discuss the potential human health impacts associated with predicted changes in noise levels;
- Consider mitigation measures, their implementation, and any residual effects, after the measures are implemented;
- Consider community consultation and prepare a complaints-resolution plan; and
- Consider the need for monitoring of noise levels.

## 6.1 IDENTIFICATION OF HUMAN RECEPTORS IN PROJECT AREAS

It is important to identify and describe all existing and reasonably foreseeable human receptors in the area that may be influenced by project-related noise—including a description of how the receptors were identified (e.g. recent land use maps, verification in person). The characterization of potential receptors typically includes the distance(s) to the project's local study area (LSA) and regional study area (RSA) for each receptor, and map(s) illustrating modelled noise levels from the project at receptor locations in the study area. While sound levels at one receptor site are typically averaged over time, it is not appropriate to assess noise impacts using the average increase in sound levels across receptor locations because sound level ranges, and therefore noise impacts, may be different at different locations.

Health Canada prefers that noise assessments identify and describe any particular receptors that may have a heightened sensitivity to noise exposure (e.g. Indigenous Peoples, schools, child care centres, hospitals). Specifically note in the EA documentation if receptors with heightened sensitivity are not present in the study area. A list of commonly encountered receptors and related characteristics is provided in Appendix G.

When identifying receptor sites at which noise impacts will be assessed, it is a good practice to consider and note the following:

- how the sites are representative of potentially impacted receptors;
- any receptors who have rented dwellings or land; and
- any receptors who live outside Canada that may be impacted by a project, where applicable.

If any local receptors that may be influenced by project noise are not being assessed in the EA, provide a rationale for this exclusion. If no human receptors are (or will be) present in the local or regional study area during the construction, operation or decommissioning phases of the project, no further assessment with respect to noise is necessary.

It is important to identify and describe any receptors in rural areas that could be considered to have a greater expectation of "peace and quiet" (i.e. quiet rural areas). Health Canada considers a "quiet rural area" to be a rural area with Ldn due to human-made sounds to be below 45 dBA. For areas with the most stringent permissible noise levels, provincial regulatory criteria may also be used to define "quiet rural areas," provided these areas are adequately described.

Due to the expected heightened sensitivity to noise, baseline levels in quiet rural areas are adjusted by adding 10 dB (ISO 1996-1:2003, ANSI, 2005). This 10 dB adjustment also applies to the predicted project noise levels for all phases of the project (i.e. construction, operation and decommissioning) in determining percent highly annoyed (%HA). The effect of this +10 dB adjustment in quiet rural areas is to produce a greater change in %HA than would occur with unadjusted noise levels. The exponential relationship between %HA and noise levels, as discussed in Section 5.4.2, produces increasingly larger changes in %HA for equal increases in project noise, compared to the baseline level.

An example follows:
*If the initial baseline noise level is 45 dBA and the project-related noise level is 55 dBA, the unadjusted change in %HA would be 3.01 (using equations in Appendix F). When the +10 dB adjustment to both baseline and project-related noise is applied in a quiet rural area, the baseline rating level used to calculate the %HA becomes 55 dBA and the project-related noise rating level becomes 65 dBA in the calculation of %HA. At these rating levels, the resulting change in %HA is 9.79. Therefore, a 10-dBA project-related noise increase from a baseline of 45 dBA in a quiet rural area will result in exceeding the suggested mitigation level of 6.5%, while a 10-dBA increase in project-related noise from a baseline of 45 dBA in a more urbanized area would not exceed this level.*

## 6.2 ASSESSMENT OF BASELINE NOISE

Baseline noise levels that are determined by measurement or estimation can be applied to noise impact assessments for all project phases (construction, operation and decommissioning). Health Canada prefers that measured or valid estimated baseline noise levels for both daytime (Ld) and night-time (Ln) at all representative receptor locations be assessed and reported in the EA. It is a good practice to clearly indicate whether sound levels are measured or estimated, and to identify the exact location of the baseline measurement (e.g. outdoors at the building facade, or on the lower level, upper level, property line, etc.).

### 6.2.1 Measuring Baseline Noise

When baseline measurement is conducted, Health Canada prefers that the measurement be completed in accordance with ISO 1996-2:2007 at each representative receptor, and that the reports include the dates and hours used to characterize these measurements. Sounds that are not generated by human activity (e.g. ocean, wind and animal noises) should not be included in determining a baseline sound level. Wind and rain can also create false signals in the microphone used to measure sound levels. As a result, sound is not measured in the presence of precipitation or when wind speeds exceed 14 km/hr, unless an appropriate wind screen is used.

To minimize uncertainty of the validity of measured baseline-sound-level data, Health Canada suggests that the EA report provides the following information:

- the number of hours or days used for measurement, and a rationale for why the reported sound levels can be considered representative;
- an estimate of seasonal differences and any differences between the weekend and weekday baseline noise levels;
- where applicable, any differences due to weather conditions;
- all noise sources that contribute significantly to the baseline, by type (e.g. traffic, aircraft, trains, industrial); and
- a characterization of each noise type described in the assessment using descriptors such as continuous, intermittent, regular impulsive, highly impulsive, high-energy impulsive, and continuous tonal and intermittent tonal.

### 6.2.2 Estimating Baseline Noise

Although the standard approach for baseline sound determinations is direct measurement, there may be situations where baseline measurement data are not available. In such cases alternative approaches to estimating baseline levels exist. One conservative (i.e. most protective) approach is to consider a reasonable worst-case scenario and assume Ldn baselines of 35 dBA for rural areas and 45 dBA for urban/suburban areas. However, defaulting to these lower baseline sound levels may result in greater values obtained for change in %HA when calculating noise effects for construction lasting more than one year or for operational noise. Note that the estimate of an Ldn of 45 dBA for urban/suburban areas does not consider the inherent variability in baseline noise estimates based on population density, proximity to busy roads or adjacent industrial activity.

The use of alternative approaches to estimating baseline noise may yield higher baseline estimates than the reasonable worst-case scenario described above. To adequately review the reliability of such estimates, Health Canada prefers that sufficient supporting rationale is provided in the EA, particularly where the accuracy of the selected estimation approach decreases (see below).

Other approaches to estimating baseline noise in order of decreasing accuracy may include the following:

- predictions based on computer models whose inputs, algorithms and outputs are based on accepted standards;
- manual calculation procedures based on well-accepted models or standards;
- the use of known baseline levels from areas with very similar acoustical environments (e.g. very similar types of baseline noise sources, distances from sources to receptors, meteorological conditions, shielding, etc.); and/or
- approximate values from Table 6.1 (see below).

Table 6.1 describes the estimation of baseline noise levels, based on a qualitative description of community characteristics and an average census-based population density (ERCB Directive 038, 2007). If this method (based on US EPA 1974 and ERCB 2007) is used in a noise assessment, provide a rationale to support the validity of its use.

**Table 6.1: Estimation of Baseline Noise Levels Using Qualitative Descriptions and Population Densities of Average Types of Communities**

| Community Type (Qualitative Description) | Average Census Tract Population Density, Number of People Per Square km | Estimated Baseline Sound Level[1], Ldn (dBA) |
|---|---|---|
| **Quiet rural** dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers | 28 | ≤45[2] |
| **Quiet suburban residential** remote from large cities, industrial activity and trucking | 249 | 48–52 |
| **Normal suburban residential** not located near industrial activity | 791 | 53–57 |
| **Urban residential** not immediately adjacent to heavily travelled roads and industrial areas | 2493 | 58–62 |
| **Noisy urban residential** near relatively busy roads or industrial areas | 7913 | 63–67 |
| **Very noisy urban residential** | 24,925 | 68–72 |

1. Note that a range of values is provided and that selection of the appropriate estimated value would typically be based on the precautionary principle in the absence of adequate justification for a higher baseline. All day-night sound level (Ldn) values, except those of the quiet rural area community type, are based on the US EPA levels document (US EPA 1974).

2. The quiet rural area (Ln = 35 dBA) estimated baseline noise level and population density were obtained from ERCB Directive 038 (revised Feb 16, 2007). The difference between Ld and Ln was obtained from ERCB and US EPA, and was approximated as 10 dBA. As such, quiet rural areas are considered to be less than or equal to 45 dBA Ldn.

## 6.3 ASSESSMENT OF PROJECT-RELATED NOISE

It is a good practice to document the criteria used to review the human health impacts of project-related noise and to characterize the potential for change in the sound environment due to any project activity, including construction, operation and decommissioning. In the noise assessment, it is important to compare predicted noise levels during construction and operation to the baseline noise levels at each representative receptor, as this will clearly demonstrate the predicted changes in noise levels experienced by each receptor. Health Canada suggests that the type of measurements used and the uncertainty associated with any sound-level monitoring, modelling or estimates be provided for all reported data.

It is important to consider that human health effects related to noise may be evaluated by a variety of endpoints and indicators, as discussed in Section 5. Health Canada holds the view that the evaluation of each potential noise-induced human health effect by one method alone is not necessarily representative of all possible human health effects related to noise exposure. For example, when using %HA as an indicator in a noise impact assessment, the change in %HA of receptors exposed to long-term noise may not exceed 6.5%, but these receptors may experience sleep disturbances due to an exceedance of the WHO indoor sleep-disturbance threshold limits discussed in Section 5.2. When changes in the sound environment have been characterized, Health Canada suggests that a discussion of the severity of these changes and how they impact human health be included in the noise assessment. Such an evaluation would typically describe all appropriate endpoints or indicators used to address potential impacts on human health, as described in this guidance. Alternative approaches to this evaluation may be acceptable, provided they are supported by adequate scientific justification.

In some cases, a less extensive assessment may be warranted. If noise levels at all receptors are not expected to approach the US EPA's mitigation noise levels (see Section 6.4.2) or to result in a change in %HA exceeding 6.5%, as discussed in Section 5.4.2, Health Canada suggests that a scientifically sound rationale be provided in the EA—to confirm that noise levels will be well below the level where human health effects may occur (see Section 5) and that this rationale has been provided in place of a complete noise impact assessment.

The results and conclusions of the noise assessment should be clearly documented in the EA. Health Canada suggests that the conclusion include a discussion of whether mitigation measures and/or follow-up monitoring is warranted.

The following sections discuss the assessment of project-related construction noise of short-and long-term durations, as well as project operational noise.

### 6.3.1 Assessing Construction Noise

Noise from construction activities has the potential to negatively impact nearby receptors and is often the loudest source of project-related noise. Predicted construction noise levels for both daytime (Ld) and night-time (Ln) at all representative receptor locations should be reported in the EA. To permit a proper comparison of noise levels, the units, averaging times and other measurement parameters (including the uncertainty associated with any of the measurements) should be the same as those used in establishing the baseline.

The method for determining effects related to construction noise depends on the duration of the construction activities as follows:

#### *i. Short-Term Construction Noise Exposure (< 1 year)*

Health Canada suggests using the US EPA (1974) methodology that provides mitigation noise levels (MNLs) and associated adjustments for community types, to determine if adverse effects are likely and if mitigation is suggested. This methodology is discussed in Section 6.4.2, **Mitigating Short-Term Construction Noise Exposure (<1 year)**. Consideration should also be given to potential impacts on sleep, where adverse impacts are reported to begin when sound levels inside bedrooms exceed 30 dBA for continuous noise sources and 45 dBA LAmax for discrete noise events (WHO 1999). With an estimated 15 dBA outdoor-to-indoor transmission loss, the equivalent outdoor levels should be 45 dBA and 60 dBA, respectively.

#### *ii. Long-Term Construction Noise Exposure (≥ 1 year)*

Health Canada suggests that construction noise lasting longer than 1 year be assessed as operational noise. This approach allows for an evaluation of the change in %HA at each receptor, in accordance with ISO 1996-1:2003. Appendix F describes the methodology and equations related to calculating the change in %HA for projects. The appropriate adjustments (see Appendix E) may be applied to the A-weighted calculated or measured noise levels. This method of assessing construction noise is essentially identical to that of assessing operational noise, as discussed in Section 6.3.2 below. Also, potential impacts on sleep should be considered when construction activities may occur at night-time (as noted above in short-term construction).

There may be insufficient information concerning construction activities to permit an assessment of their potential impacts at the EA stage. Conservative assumptions based on similar projects and/or planned activities are often used in estimating noise levels and calculating impacts due to construction. An example of this estimation technique is to assume that all equipment is operating simultaneously for a 12-hour period, even though actual impacts are expected to be lower. In these cases, Health Canada suggests providing as much information as possible on construction activities, schedules, equipment use and any assumptions used, in addition to an explanation of why a more detailed assessment is not possible.

It is a good practice to include a description of construction noise as it relates to exposure duration, rather than construction activity duration. The difference in these perspectives becomes apparent when considering the impacts of construction noise related to road projects. As a road project progresses, noise exposure continually varies from receptor to receptor as the geographic location of the construction equipment changes.

### 6.3.2 Assessing Project Operational Noise

Predicted operational noise levels for both daytime (Ld) and night-time (Ln) at all representative receptor locations should be reported in the EA. To permit a proper comparison of noise levels, the units, averaging times and other measurement parameters (including the uncertainty associated with any of the measurements) should be the same as those used in establishing the baseline.

As discussed previously, the determination of %HA is a widely accepted indicator of the human health effects of long-term noise exposure. Similar to comments in Section 6.3.1 ii above, the assessment of project operational noise may include an evaluation of the change in %HA at each receptor site, in accordance with ISO 1996-1:2003. Appendix F describes the methodology and equations related to calculating the change in %HA for projects. The appropriate adjustments (see Appendix E) may be applied to the A-weighted calculated or measured noise levels. If noise from project operations may occur at night-time, the assessment of operational noise should also consider potential impacts on sleep.

Modelling sound levels (using appropriate software) is one method that is commonly used to estimate present or future operational sound levels. In the assessment, clearly identify the model(s) used and justify their suitability. Specific models may be selected on a site-by-site basis. Health Canada prefers that any assumptions used be conservative (i.e. reasonable worst-case scenario) and be adequately described in the assessment.

If project-related noise levels are provided without being added to the baseline sound levels, this must be clearly indicated. In assessing impacts on human health, the baseline and project noise are added together, as their sum represents what noise effects the receptors will actually experience. Other changes in the sound environment may also be characterized. If project-related operational noise includes audible tonal or impulsive noise (including regular impulsive, highly impulsive and high-energy impulsive types of noise [ISO 1996-1:2003] [e.g. blasting]), appropriate adjustments as presented in Appendix E can be made. Refer to ISO 1996-2:2007 for additional guidance on describing or measuring tonal and impulsive noise. These adjustments apply only when the noise under consideration is audible at receptor sites. In situations where more than one source characteristic adjustment is applicable (e.g. impulsive or tonal), only the higher of the adjustments is used. However, all time-of-day adjustments and the quiet rural area adjustment are to be added to the highest of the applicable source adjustments.

## 6.4 MITIGATION

Noise management and noise monitoring plans, including complaint resolution plans, are often incorporated as part of the EA's Environmental Management Plan. When health effects from project-related noise are possible, Health Canada prefers that a noise management plan detailing the actions that will be taken to minimize human health impacts due to project noise (mitigation measures) be developed and included in the EA. Special consideration should be given to mitigation measures for construction noise that occurs at night, in order to minimize impacts on sleep (i.e. avoiding tonal or impulsive noise sources at night).

Due to the inherent uncertainty in both predicted and/or measured project noise, additional information should be provided to demonstrate that exceedances of the MNL or a 6.5% change in %HA are unlikely. Proposals for specific mitigation measures to limit noise at receptors where this uncertainty exists should be provided in the EA.

Health Canada prefers that any noise mitigation measures proposed for the project be described in sufficient detail to permit Health Canada to adequately review the measures' impacts on achieving noise reduction. When describing possible mitigation or other noise management measures, identify the conditions or circumstances under which various mitigation measures will be applied or implemented.

As it is more effective to use source controls, Health Canada prefers that mitigation measures be applied to the source rather than the receptor site, where this is technically feasible. It should be noted that some estimates discussed in Section 5.2 (e.g. noise attenuation by closed windows or enclosed balconies) may not achieve the desired level of noise reduction, due to variability in construction techniques. While fully-closed windows are assumed to typically reduce outdoor sound levels by 27 dBA (US EPA 1974), the type of enclosures that surround the windows or the presence of ventilation ducts may result in an outdoor-to-indoor noise transmission loss that is lower than 27 dBA.

### 6.4.1 Community Consultation

Developing a community consultation plan can be helpful when projects propose noisy work occurring outside of normal working hours or extended work that produces high levels of noise (such as rock hammering or pile driving). The consultation process may assist in establishing feasible mitigation measures by targeting receptors that have the greatest potential for human health-related effects resulting from noise disturbance. Previous experience in assessing community reaction to noise impacts following community consultation has demonstrated that in these cases, a community is more likely to be understanding and accepting of noise, and more likely to make appropriate adjustments to limit noise exposure. This has been noted particularly when the information provided during the consultation process is accurate and does not attempt to understate the likely noise level, and when commitments made by the proponent to limit noise during specific hours are respected.

The EA should specify whether community consultation with respect to noise has occurred, and whether any human health concerns have been expressed by potentially impacted receptors.

The comments or recommendations received during the consultation process may provide an indication of which project elements are likely to trigger the greatest level of opposition, particularly where noise issues are identified. Informing the public about project plans early in the process is encouraged, as this may provide additional options for mitigation measures, or at the very least, provide the opportunity to discuss the mitigation measures under consideration. It is a good practice to undertake community consultation prior to the creation of work schedules (e.g. continuous versus specific construction times) and to discuss the preferred means of informing the public of the time and duration of noisy activities. When construction delays or other problems result in extended construction schedules, Health Canada suggests that a plan for community consultation be implemented and that this consultation process be described in the EA, where applicable. When a project proponent deems it to be manageable, it may be preferable to consult with residents individually.

When the community receives information about expected changes in sound levels through a consultation process, and feels that concerns with respect to noise may be addressed and resolved, the incidence of noise-related complaints is frequently reduced. Health Canada suggests that this approach be considered in managing both minor and major public concerns related to project-related noise. For more information, refer to ERCB Directive 38 (2007). For information specific to rail projects, refer to the Canadian Transportation Agency's *Guidelines for the Resolution of Complaints Over Railway Noise and Vibration* (2008).

### 6.4.2 Mitigating Short-Term Construction Noise Exposure (<1 year)

Health Canada often suggests mitigation measures to the authority conducting the EA, when the predicted construction noise level (construction lasting less than one year) exceeds the suggested mitigation noise level (MNL). To avoid widespread complaints regarding construction noise at receptor sites, where the exposure duration is less than one year at any given representative receptor site, the basic suggested MNL is 47 dBA (US EPA 1974). This value has been derived from the data presented in Figure D-7 and Table D-7 in US EPA 1974. The basic MNL is applicable for receptors in quiet suburban or rural areas, assuming that all of the construction noise is tonal and/or impulsive.

In order to determine whether mitigation is advisable, consider the following:

1. Use the data in Table 6.1 to characterize the community type based on average census tract population densities and community qualitative descriptions. Validating the community type may be accomplished by monitoring or calculating baseline noise levels.
2. Use the data in Table 6.2 to identify the applicable correction factors for the relevant community type and additional corrections (e.g. construction duration, presence of tonal or impulsive noise, and whether windows are open), and then calculate the suggested construction noise (less than one year) MNL.
3. If the predicted construction noise levels exceed the suggested MNL for construction phase (less than one year), the authority conducting the EA should consider noise mitigation measures.

**Table 6.2: Calculating Suggested Mitigation Noise Level (MNL) for Construction Noise (Based on US EPA 1974)**

| **Suggested Basic MNL 47 dBA Ldn*** <br> ***Suggested MNL for various scenarios*** | | |
|---|---|---|
| ***Community Description*** | ***Applied Correction Factors*** | ***Suggested MNL*** |
| Quiet suburban or rural | +0 dB | 47 dBA Ldn |
| Normal suburban | +5 dB | 52 dBA Ldn |
| Urban residential | +10 dB | 57 dBA Ldn |
| Noisy urban | +15 dB | 62 dBA Ldn |
| Very noisy urban | +20 dB | 67 dBA Ldn |
| **Additional Corrections** <br> If applicable, add any or all of the following corrections: | | |
| Construction duration less than two months | +10 dB | |
| Winter (or windows always closed) | +5 dB | |
| Negligible tonal or impulsive noise§ | +5 dB | |

* Due to backup alarms, slamming tailgates, etc., construction noise normally contains both tonal and impulsive components. For the suggested basic MNL, the reasonable worst-case scenario is used and all of the construction noise is assumed to be due to tonal and/or impulsive noise.

§ When the contribution from tonal and/or impulsive noise may be negligible, +5 dB may be added to the suggested basic MNL. Health Canada prefers that a rationale be provided if this adjustment is applied.

Table 6.3 presents an example of how to establish a mitigation noise level (MNL). The final MNL is obtained through the application of several possible correction factors, as shown in Table 6.3. Calculated MNLs for other construction projects may vary, depending on the applicable correction factors specific to the project type, season and location.

**Table 6.3: An Example of Applying Corrections to Establish a Suggested MNL for a Project in a Very Noisy Urban Community**

| Description | Applied Correction | Suggested MNL |
|---|---|---|
| Basic MNL | 0 dB | 47 (dBA) Ldn |
| Project occurs in a very noisy urban community | +20 (dB) Ldn | 67 (dBA) Ldn |
| Construction duration is less than two months | +10 (dB) Ldn | 77 (dBA) Ldn |
| Noise contains negligible tonal or impulsive noise | +5 (dB) Ldn | 82 (dBA) Ldn |
| Project occurs during winter or in proximity to residences where windows cannot be opened | +5 (dB) Ldn | 87 (dBA) Ldn |
| **Final MNL** | | 87 (dBA) Ldn |

Widespread complaints tend to occur when the suggested MNLs in Table 6.2 are exceeded (US EPA 1974). Therefore, Health Canada suggests the use of quieter technology or other mitigation measures, rather than lengthening construction duration (e.g. lowering the noise by having fewer pieces of equipment running at a time, thereby extending construction duration) to achieve a reduction in human health-related noise impacts.

Some examples of quiet technology and procedures are the following:

- vibratory pile driving or boring, instead of impulsive pile driving; and
- ambient-sensitive backup alarms, signal workers, machinery turning circles, and side loading/unloading trucks to reduce the impact of backup alarms.

If acceptable levels cannot be obtained with quieter technology, community consultation (as discussed in Section 6.4.1) is preferred, in order to seek consensus on construction operations (e.g. no activity during night-time or weekend hours). Some commonly applied construction noise mitigation measures and considerations for noise reduction are described in Appendix H.

### 6.4.3 Mitigating Long-Term Construction Noise (≥ 1 year)

Health Canada suggests that mitigation be implemented when noise levels during long-term construction result in a greater than 6.5% increase in %HA. If the change in %HA exceeds 6.5%, even when implementing quieter technology and construction methods as described in Appendix H, community consultation is important to establish mutually agreeable work schedules and is an acceptable means of informing the public of the time and duration of noisy activities.

Communication with potentially impacted residents is especially important when construction must occur outside daytime hours. Residents' concerns about blasting or other noisy activities can often be addressed through community consultation. Some flexibility among impacted residents may exist regarding construction noise levels, if demonstrable mitigation measures are used. Community consultation can be useful to determine whether the ability to avoid long periods of construction would result in greater community acceptance.

In addition to the consultative process, it is a good practice to consider technically and economically feasible mitigation measures (see Appendix H), in an attempt to reduce noise levels to levels that keep the change in %HA below 6.5% and protect against sleep impacts. In some cases, monitoring and working with the impacted community may address community reactions.

### 6.4.4 Mitigating Blasting Noise

Noise due to blasting has unique characteristics. Therefore, Health Canada holds the view that for blasting during short-term construction (< 1 year), limits on the number of blasts should be implemented irrespective of other noise levels due to background sources or construction activities. Noise effects due to blasting can be assessed in several ways. One approach for blasting exposures lasting less than one year is to use the US EPA 1974 criterion for sonic booms. The rationale for this approach stems from the findings of Schomer *et al.* (1997), whose research indicates that blasts and sonic booms create similar levels of annoyance for equal peaks.

According to US EPA (1974), little or no public annoyance is expected to result from any number of daytime sonic booms per day, if their measured or predicted peak value is below 125-10 log N dB. In this case, dB is interpreted as meaning Z-weighting (dBZ). Health Canada prefers that the US EPA's sonic boom criterion be used as a blasting MNL for blasting that lasts less than one year.

Table 6.4 presents an example of the assessment technique of establishing an MNL based on a representative number of blasts.

**Table 6.4: Mitigation Noise Levels Related to Number of Blasts**

| Number of Daytime Blasts (N) | Blasting MNL (125-10 log N) (dBZ) |
|---|---|
| 10 | 115 |
| 25 | 111 |
| 50 | 108 |
| 100 | 105 |

Health Canada suggests following the recommendations in ISO 1996-1:2003, as described in Appendix E and Appendix F of this guidance document, for blasting of duration of more than one year (≥ 1 year),

### 6.4.5 Mitigating Operational Noise

As with long-term construction noise, Health Canada considers high annoyance with noise generated during a project's operational phase to be an indicator of human health effects. If the change in %HA exceeds 6.5% or the suggested target values noted in Section 6.3.2 for project operational noise, Health Canada suggests that possible mitigation measures target the source, the propagation from source to receptor site and/or the receptor site itself. These measures include, but are not limited to the following:

- reducing noise output, such as using quieter machinery where technically and economically feasible;
- implementing physical barriers, including noise walls, berms (artificial ridges or embankments) and windows with high soundproofing; and
- in some cases, changing project design (e.g. changing the proposed placement of an access road).

In general, implementing mitigation measures that further reduce noise impacts is encouraged.

## 6.5 ASSESSMENT OF RESIDUAL IMPACTS

An assessment of the residual impacts of a project may include discussion of potential noise impacts arising from the project, after all proposed mitigation and management measures have been applied. It is a good practice for this discussion to include characterizing final sound levels at representative receptor locations—in the same manner as is done in establishing the baseline and predicted sound levels—in addition to discussing the potential impacts that may be expected due to these changes.

Mitigating adverse noise effects can at times be technically challenging and costly. The severity of potential impacts on human health caused by noise is only one of many factors that may be considered in making an overall noise assessment of the project. When mitigation measures are judged to be not technically or economically feasible, a detailed discussion justifying the exclusion of these measures may be helpful in addressing potential concerns with respect to residual impacts of project-related noise. In such cases, the community consultation process discussed in Section 6.4.1 may offer alternative options for limiting complaints arising from excessive noise.

## 6.6 SOUND LEVEL MONITORING

The periodic monitoring of sound levels at representative receptor locations can be used to verify predictions made during the EA process. This monitoring is particularly important when predicted noise levels approach the level where adverse human health effects are considered likely and mitigation measures become necessary. If the uncertainty related to predicted sound levels is large and the resulting impacts are more severe than expected, monitoring is considered particularly useful. It is also helpful to describe in the EA any commitments to evaluate the need for additional mitigation measures, if actual project-related noise levels are higher than predicted or if community reaction is stronger than expected.

If post-project monitoring is not being undertaken when predicted noise levels are close to the suggested mitigation-measure levels, Health Canada holds the view that the EA documentation should include a rationale explaining why monitoring is not considered appropriate.

# 7 ASSESSMENT OF CUMULATIVE EFFECTS

If the proposed project is in a region where there are other proposed or ongoing development projects that may contribute to noise levels, an assessment of cumulative effects is an important consideration. In attempting to predict sound levels from the project when contributions from other sources are possible, Health Canada suggests that these sources be included in the modelling to establish potential cumulative effects.

In selecting a baseline for a cumulative effects assessment, the pre-project baseline is the most appropriate comparison for noise-related human health impacts, as this comparison is predictive of the absolute change in the noise environment, when all project and additional noise sources are considered.

For guidance on assessing cumulative effects, consult the Canadian Environmental Assessment Agency's website for up-to-date guidance materials: **www.ceaa.gc.ca**

# 8 FOLLOW-UP PROGRAMS

Under CEAA 2012, a "follow-up program" means a program to:

a. Verify the accuracy of the environmental assessment of a designated project; and

b. Determine the effectiveness of any mitigation measures.

It may be appropriate to consider a follow-up program for noise if there is uncertainty about (not a comprehensive list):

- Modelling of project construction and/or operational noise; and/or
- Whether proposed mitigation measures (e.g. the use of novel technologies or materials) will be effective.

For further and up-to-date information on follow-up programs, contact the Canadian Environmental Assessment Agency, Canadian Nuclear Safety Commission or National Energy Board, as appropriate.

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***Note:*** *Effective June 17, 2013, the ERCB has been succeeded by the Alberta Energy Regulator (AER). No changes have been made to Directive 038 by the AER, and the Directive continues to contain references to the ERCB. When a new edition of the Directive is issued, the ERCB references will be revised. The Directive may also contain references to the former Energy Utilities Board (EUB), which had been realigned to the ERCB on January 1, 2008.*

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# APPENDIX AI **GLOSSARY**

| TERM | DEFINITION |
|---|---|
| **Acoustics** | The interdisciplinary science that deals with the study of sound, ultrasound and infrasound (all mechanical waves in gases, liquids and solids). |
| **Ambient sensitive backup alarms** | Alarms that warn workers that a vehicle is backing up. These alarms increase or decrease in volume based on background noise levels to maintain a readily noticeable tone to workers, while reducing community noise annoyance. The alarms work best on small equipment such as backhoes and trucks.<br>Note: The Construction Safety Association of Ontario notes that alarms offer the greatest benefit when traffic is limited to only one or two vehicles. The warning effect of the alarm is greatly reduced when it becomes part of the background noise on-site. |
| **Annoyance** | A state, or adverse reaction, that may be referred to as being annoyed, disturbed, bothered, (or dissatisfied).<br>*Noise annoyance:* A degree of annoyance measured by a subject's response to an annoyance questionnaire as part of a social survey on noise and annoyance.<br>*High annoyance:* A degree of noise annoyance with a minimum cut-off of 71–73 on a scale of 0 to 100 (7–10 if the ISO-recommended scale of 0–10 is used) or the top two categories (very or extremely) of an adjectival scale.<br>(ISO/TS 15666:2003[1]) |
| **Average community** | A community that would yield the same reaction to noise as that obtained from social surveys on noise in a large number of communities around the world (Michaud *et al*. 2008). |
| **Berm** | An artificial ridge or embankment used to shield receptors from intruding noise. |
| **Community** | An agglomeration of residents whose reaction to noise is being measured.<br>(For the complaint assessment method using US EPA 1974 only, see the Michaud *et al.* 2008, and US EPA 1974 references).<br>*Very noisy urban residential community:* day-night sound level (Ldn) typical range 68–72 dBA, average 70 dBA; no qualitative characterization.<br>*Noisy urban residential community:* Ldn typical range 63–67 dBA, average 65 dBA; qualitative characterization: near relatively busy roads or industrial areas.<br>*Urban residential community:* Ldn typical range 58–62 dBA, average 60 dBA; qualitative characterization: not immediately adjacent to heavily travelled roads and industrial areas.<br>*Normal suburban community:* Ldn typical range 53–57 dBA, average 55 dBA; qualitative characterization: not located near industrial activity.<br>*Quiet suburban or rural community:* Ldn typical range 48–52 dBA, average 50 dBA; qualitative characterization: remote from large cities, industrial activity and trucking. |

1 ISO (2003). ISO/TS 15666:2003 Acoustics – Assessment of noise annoyance of social and socio-acoustic surveys. **www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=28630**

| TERM | DEFINITION |
|---|---|
| **Decibel** | A logarithmic unit of measurement that expresses the magnitude of a physical quantity (pressure, power or intensity) relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit. The decibel is useful for acoustics and confers a number of advantages, such as the ability to conveniently represent very large or small numbers, and a logarithmic scaling that roughly corresponds to the human perception of sound. The decibel symbol is often qualified with a suffix, which indicates which reference quantity or frequency weighting function has been used. An example of this is dBA and is discussed in Appendix D. |
| **Environmental noise** | Also called community noise, refers to non-occupational noise. The main sources of community noise include road, rail and air traffic, industries, construction and public work. In the context of this document, environmental noise refers almost always, if not entirely, to the above. In a more general context, the term may also refer to neighbourhood noise and indoor sources; primarily ventilation systems, home appliances and neighbours (e.g. in apartments). (Adapted from WHO 1999.) |
| **Equivalent continuous sound level Leq (t)** | A sound level obtained from energy averaging over a specified time interval (t). This level is obtained using an integrating averaging sound level meter, which determines the mean of the square of the sound pressure over a specified time interval (t), and expresses the result in decibels.<br>*Day-night sound level (Ldn, also referred to as DNL):* An equivalent continuous sound level taken over 24 hours, with the night-time (10 p.m. to 7 a.m.) contributions adjusted by +10 dB. (This is a type of rating level because of the night-time adjustments.) The night-time adjustment (or addition of 10 dB to the night-time period) is used to account for the expected increased annoyance due to noise-induced sleep disturbance and the increased residential population at night relative to daytime, by a factor of 2–3. US EPA 1974 suggests that in quiet areas, the night-time levels naturally drop by about 10 dB and this level of adjustment has been used with success in the U.S.<br>*Daytime sound level (Ld):* An equivalent continuous sound level taken over 15 hours from 7 a.m. to 10 p.m. (In some jurisdictions, the start of daytime hours can be as early as 6 a.m. and the end of daytime hours can be as late as 11 p.m.)<br>*Night-time sound level (Ln):* An equivalent continuous sound level taken over 9 hours from 10 p.m. to 7 a.m. (In some jurisdictions, the start of night can be as late as 11 p.m. As well, in some jurisdictions, the end of night can be as early as 6 a.m.)<br>*Day-night rating level ($L_R$dn):* A day-night sound level to which an adjustment has been added.<br>*Daytime rating level ($L_R$d):* A daytime sound level to which an adjustment has been added.<br>*Night-time rating level ($L_R$n):* A night-time sound level to which an adjustment has been added.<br>*LAeq (t):* An A-weighted equivalent continuous sound level in the denoted time interval.<br>*LAeq (24):* An A-weighted equivalent continuous sound level for a specified 24-hour time interval.<br>*LAeq (1):* An A-weighted equivalent continuous sound level for a specified 1-hour time interval. |

| TERM | DEFINITION |
|---|---|
| **Frequency weighting** | A relative value applied to the spectrum of a sound in each defined frequency interval.<br>*A-weighting (dBA):* A weighting of the frequencies in a sound that approximates the response of the human ear to frequencies in moderately loud sounds (sound pressure levels in the range of 45-65 dBA).<br>*C-weighting (dBC):* A weighting of the frequencies in a sound that approximates the response of the human ear to frequencies in very loud sounds. It emphasizes the low frequencies of a sound much more than the A-weighting.<br>*G-weighting (dBG):* A frequency weighting used for infrasound measurements. It is defined in ISO 7196 as 0 dB at 10 Hz. Between 1 and 20 Hz (the highest weighted frequency), the weighting approximates a straight line with a slope of 12 dB/octave.<br>*Z-weighting (dBZ):* A frequency weighting defined in International Electrotechnical Commission (IEC) 61672-1:2002 with 0 dB weighting from 10 Hz to 20 kHz, within tolerances defined in the standard. |
| **Infrasound** | Like **Sound** but with frequency content below 20 Hz. |
| **Maximum A-weighted sound level (LAmax)** | The maximum value of the sound pressure level during a noise event, measured with a sound level meter using a Fast Time Weighting. This level can be applied to pass-by noise from transportation noise sources and impulsive noise events. |

| TERM | DEFINITION |
|---|---|
| **Noise** | Unwanted sound.<br>*Low-frequency noise:* Noise with frequency content in the range of 20-200 Hz. Where it produces a 16, 31.5 or 63 Hz octave band sound-pressure level of more than 65, 65 or 70 dBZ, respectively, low frequency noise can be associated with the introduction of noticeable vibrations and rattles in some structures (e.g. as from a nearby idling locomotive).<br>*Tonal noise:* Noise containing prominent (audible) tones such as backup alarms on trucks. Here "tones" refers to tonal sound, defined in ISO 19961:2003 as sound characterized by a single frequency component or narrow-band components that emerge audibly, **at the receptor position**, from the total sound. If the audibility is in dispute, ISO 1996-2:2007 contains a (rather complex) method for analyzing a spectrum to determine audible tonality.<br>*High-energy impulsive noise:* Impulsive noise from any high-energy impulsive sound source, including any explosive source in which the equivalent mass of TNT (trinitrotoluene) exceeds 50 g, or sources with comparable characteristics and degrees of intrusiveness. Internationally agreed upon examples are listed in ISO 1996-1:2003 and include sonic booms, blasting, quarry and mining explosions, demolition or industrial processes that use high explosives, explosive industrial circuit breakers and military ordnance (e.g. armour, artillery, mortar fire, bombs, and the explosive ignition of rockets and missiles).<br>*Highly impulsive noise:* Impulsive noise from any noise source with highly impulsive characteristics and a high degree of intrusiveness. Internationally agreed upon examples of sources are listed in ISO 1996-1:2003 and include impact pile driving, small arms firing, hammering on metal or wood, nail guns, drop-hammering, drop forging, punch pressing, pneumatic hammering, pavement breaking, or metal impacts in rail-yard shunting operations.<br>*Regular impulsive noise:* Impulsive noise from sources that are neither highly impulsive nor high-energy impulsive. Internationally agreed upon examples of these sources are listed in ISO 1996-1:2003 and include slamming car doors and truck tailgates. |
| **Normalized Ldn** | A calculated day-night sound level that is used to determine the potential for widespread complaints. The normalized Ldn is obtained from the measured value and the addition of various corrections in dB (US EPA 1974). |
| **Octave band** | A section (band) of a sound spectrum where the ratio of the maximum to minimum frequency in the band is 2. Nominal centre frequencies (in Hz) of noise octave bands have been standardized as 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000, and 16000. |
| **Sentence intelligibility** | The ability to recognize key words in a sentence using full concentration in a laboratory setting. Due to redundancy in normal conversation, all words in the sentence may not have been understood. |
| **Signal workers or Signallers** | People who signal to a vehicle operator to ensure his or her awareness of other people. Signallers also warn workers that vehicles are backing up. |

| TERM | DEFINITION |
|---|---|
| **Sleep disturbance** | Any of: (i) interfering with falling asleep, (ii) shortening sleep stage duration, (iii) lessening perceived quality of sleep, (iv) awakening people from sleep, or (v) increasing body movements (motility) during sleep.<br><br>*Awakenings:* A transient or indeterminate end of sleep. Awakenings can be measured: (i) behaviourally, by a subject pushing a button upon finding that they are aware of awakening, (ii) when a certain threshold of body movement (motility threshold) is exceeded from a previous low level of body movement (sleep), and (iii) by an objectively defined change in brain wave pattern measured by an electroencephalograph (EEG) (Michaud *et al.* 2008).<br><br>*Percent awakenings due to noise:* Awakenings attributed to noise events divided by the total number of awakenings multiplied by 100 (normally the totals are taken for all subjects in the study).<br><br>*Sleep stage:* a stage of sleep with a well-defined brain wave pattern measured with an EEG. There are 5 stages of sleep. Sleep stage is also related to muscle activity and eye movements. |
| **Sound exposure level (SEL)** | The 1-second equivalent continuous sound level that would be measured if the total energy in a noise event occurred during that one second. This level can be applied to pass-bys of transportation noise sources and impulsive noise events.<br><br>Note: The equivalent continuous sound level for an extended time period that contains a number of noise events can be obtained by energy averaging the SEL values over the time period. |
| **Time weighting** | *Fast weighting:* A time constant of 0.125 second in a sound-level meter used to smooth the square of the measured sound pressure prior to the expression of the sound pressure level in decibels.<br><br>*Slow weighting:* A time constant of 1 second used to smooth the square of the measured sound pressure prior to the expression of the sound pressure level in decibels. |
| **Transmission loss** | In environmental noise, the ratio of the sound energy striking a wall (e.g. the outside of a residence) relative to the transmitted sound energy (e.g. into a living room or bedroom), expressed in decibels. |
| **Vibratory pile driving or boring** | A pile driving system that does not rely on an impact hammer but on a rapidly vibrating hammer that transfers its vibrational energy to the pile to drive it in. |
| **Wind screen** | A screen, commonly a porous sphere or an egg-shaped structure of open cell foam, to protect a microphone's protective grid from turbulence produced by the passage of wind. For a given wind speed, the lower the frequency of noise to be reduced, the larger the windscreen that is needed. |

# APPENDIX B1 **NOISE IMPACTS IN EA CHECKLIST**

This checklist is beneficial in verifying that the main components of a noise impact assessment are completed. It is useful to include this checklist as an index in an environmental assessment (EA) to identify the locations of the key components of a noise impact assessment, especially if the information is found in multiple sections of the EA documentation.

| **OVERALL (THROUGHOUT THE EA)** | | | | |
|---|---|---|---|---|
| ✓ | ***Item*** | | | |
| | 1. In addition to the construction phase, are all other project phases, including operation, decommissioning and abandonment, included in the EA? | | | |
| | 2. When modelling techniques are used to estimate present (baseline) or future (construction and operational) sound levels, are these techniques and any assumptions documented and appropriately justified? | | | |
| | 3. Is information provided that describes any tonal, regularly impulsive, highly impulsive or high-energy impulsive noise that is audible at receptors during the construction, operation and decommissioning project phases? | | | |
| | 4. Does the EA avoid statements relating to the perceptibility or whether changes in noise are noticeable based solely on decibel levels? | | | |
| **RECEPTOR IDENTIFICATION AND CHARACTERIZATION** | | | | |
| ✓ | ***Item*** | | | ***Section in EA*** |
| | 5. Are all currently impacted receptors (including Indigenous Peoples) and potential reasonably foreseeable future receptors, clearly identified? | | | |
| | 6. Is information on all noise-sensitive receptors in the area (including any foreseeable future receptors) and on distances of receptors from the project, included? | | | |
| | 7. Are maps identifying receptor locations relative to the project site, including noise contour diagrams, provided? | | | |
| | 8. Is justification provided for any excluded receptors (if applicable)? | | | |
| | 9. Are receptors identified in "quiet rural areas" assigned a +10 dB adjustment (if applicable)? | | | |
| | 10. Is a description provided of any community consultation that may have occurred concerning noise impacts, including any human health concerns expressed by potential receptors? | | | |
| **IMPACTS ASSOCIATED WITH NOISE** | | | | |
| ✓ | ***Item*** | | | ***Section in EA*** |
| | 11. Does the outdoor annual average for night-time (Ln) exceed 40 dBA? | ☐ No | ☐ Yes | |
| | 12. Do indoor night-time sound levels (or sound levels when nearby receptors are expected to be sleeping) exceed 30 dBA Leq from continuous noise sources at any representative receptors? | ☐ No | ☐ Yes | |
| | 13. Are more than 10–15 night-time individual noise events above 45 dBA LAmax indoors predicted at any representative receptor? | ☐ No | ☐ Yes | |
| | 14. Is an evaluation of the severity of residual impacts (post-mitigation) on sleep disturbance included? | | | |
| | 15. Is any interference with daytime speech comprehension (indoor sound levels greater than or equal to 40 dBA or outdoor sound levels greater than 55 dBA) predicted? | ☐ No | ☐ Yes | |
| | 16. Is an evaluation of the severity of residual impacts (post-mitigation) on speech comprehension provided in the EA? | | | |

| ASSESSMENT OF BASELINE NOISE LEVELS | | |
|---|---|---|
| ✓ | ***Item*** | ***Section in EA*** |
| | 17. Are measured or valid estimates of baseline noise levels provided, including any uncertainties for both daytime (Ld) and night-time (Ln) at receptors? | |
| | 18. When measured baseline noise levels are provided, are the hours during which the measurements were obtained and the exact locations of the measurements provided? | |
| | 19. Is a rationale provided explaining why the baseline is considered representative, including the days, weather conditions and any seasonal variations when monitoring occurred? | |
| | 20. Are all noise sources that contribute to the baseline identified (see Appendix E including a description of the specific noise character(s), and appropriate adjustments made? | |
| | 21. When baseline noise is estimated, are the estimation method and a rationale for using this method provided? | |
| | 22. Is a calculation of baseline percent highly annoyed (%HA) at receptors provided? | |
| **ASSESSMENT OF CONSTRUCTION NOISE LEVELS** | | |
| ✓ | ***Item*** | ***Section in EA*** |
| | 23. Are valid estimates (predictions) of construction noise levels provided for both daytime (Ld) and night-time (Ln) at receptors, including any uncertainties? | |
| | 24. Are the duration of construction activities impacting each receptor and the method of noise assessment (based on the construction duration) provided? | |
| | 25. Are construction noise-related impacts and a noise management plan (if applicable) included? | |
| | 26. Are construction noise levels estimated or modelled for each receptor, and are appropriate adjustments identified? (See Appendix E) | |
| | 27. When construction noise levels are expected to approach a suggested mitigation noise level (MNL), are mitigation measures and a noise management plan provided? | |
| | 28. If an assessment of construction noise impacts is not conducted because the noise levels are predicted to be below the level for widespread complaints at all receptors, is a rationale provided? | |
| | 29. When construction noise is expected to last longer than 1 year at any given receptor, is an evaluation of the change in %HA (from baseline) at these receptors provided? Are all applicable adjustments identified in estimating %HA? | |
| **MITIGATION MEASURES** | | |
| ✓ | ***Item*** | ***Section in EA*** |
| | 30. Are predicted future (operation) daytime (Ld) and night-time (Ln) sound levels provided for all receptors, using the same parameters that were used to establish the baseline (e.g. units and averaging times)? Are appropriate adjustments identified? (See Appendix E) | |
| | 31. Is an evaluation of the change in %HA (from baseline) at each receptor provided for operational noise? | |
| | 32. Are the results and conclusions of the operational noise assessment clearly documented? | |

| SSS | | | | |
|---|---|---|---|---|
| ✓ | ***Item*** | | | ***Section in EA*** |
| | 33. If applicable, is a discussion of whether mitigation measures or follow-up monitoring are warranted included? | | | |
| | 34. When noise is expected to approach suggested mitigation levels either during project construction or operations, is a discussion of planned or conditional mitigation measures included? | | | |
| | 35. Is a residual impacts assessment discussing noise impacts following mitigation included? | | | |
| | 36. When low-frequency noise is emitted, is information describing impacts of any anticipated effects (e.g. rattling) and related mitigation measures included? | | | |
| | 37. After all of the noise mitigation measures are applied, does the calculated change in %HA (from baseline) at any of the representative receptors exceed 6.5%? | ☐ No | ☐ Yes | |
| | 38. Is information provided on how the noise-related complaints will be addressed, including a description of a complaint resolution process? | | | |
| **ASSESSMENT OF CUMULATIVE EFFECTS** | | | | |
| ✓ | ***Item*** | | | ***Section in EA*** |
| | 39. When other ongoing or reasonably foreseeable future projects in the region may contribute to noise levels, is a cumulative effects assessment included? | | | |

# APPENDIX C| **NOISE CHARACTERISTICS**

## C.1 TONAL AND IMPULSIVE NOISE

Tonal (e.g. backup alarms on trucks) and impulsive noise (e.g. hammering on metal) are often perceived as annoying and may have a high potential to disturb receptors (US EPA 1974, ISO 1996-1:2003, ANSI 2005, WHO 1999). Therefore, providing information on tonal, regular impulsive, highly impulsive or high-energy impulsive project noise that is audible at receptors is suggested. This characterization of noise is also important in selecting the appropriate corrections and adjustments in the calculation of noise impacts for construction and operational noise.

As described in ISO 1996-1:2003, regular impulsive noise is sometimes characterized as intrusive but not as intrusive as highly impulsive noise. Examples of regular impulsive noise include the slamming of car doors, outdoor ball games, such as football, soccer or basketball, and church bells. Very fast pass-bys of low-flying military aircraft may also fall under this category.

Impulsive noise sources that have a high degree of intrusiveness may be characterized as either highly impulsive (defined in ISO 1996-1:2003) or high-energy impulsive, as described in ISO 1996-1:2003. For details on these noise types, see Appendix A.

ISO 1996-1:2003 recommends making a +5 dB adjustment to tonal and regular impulsive noise sources and a +12 dB adjustment to highly impulsive noise sources. The expected contribution of project noise and details on how tonality and impulsiveness were accounted for are important elements of the noise assessment. See Appendix F for more information.

## C.2 LOW-FREQUENCY NOISE

Noise occurring at frequencies below 100 to 200 Hertz (Hz) is generally defined as low-frequency noise. Low-frequency noise is commonly not well perceived by the human ear but may induce vibrations in buildings that may be perceptible or cause a “rattle” in these environments. Research indicates that annoyance related to noise is greater when low-frequency noise is present (ISO 1996-1:2003) and one of the main reasons is the annoyance caused by rattles (Schomer and Neathammer 1987; Schomer and Averbuch 1989). As sound environments are usually characterized using A-weighted decibel levels (dBA) that reflect the frequencies most audible to the human ear, the impacts of low-frequency noise may need to be assessed separately.

Guidance for low-frequency sound (or infrasound) in the 16-63 Hz octave bands stems from the ANSI standard on environmental sound regarding noise assessment and the related prediction of long-term community response (ANSI 2005). Where standards or acceptable procedures for the measurement of these frequencies exist, it is suggested that the EA include a description of the potential impacts and any mitigation measures concerning the effects of these frequencies.

The ANSI standard concerns essentially continuous sounds with strong low-frequency content. To prevent rattles from low-frequency noise and the associated annoyance from this effect, ANSI indicates that the (energy) sum of the sound levels in the 16-, 31.5- and 63-Hz octave bands be less than 70 dBZ. If this 70-dBZ "rattle criterion" is exceeded, Health Canada may suggest the implementation of feasible mitigation measures. ANSI 2005 indicates that there is evidence that noise-induced rattles are very annoying, and this annoyance may be independent of the number or duration of events.

Additionally, ANSI 2005 provides a more sophisticated mathematical procedure for assessing %HA when low-frequency noise is present. Health Canada prefers using this procedure when the C-weighted Ldn exceeds the A-weighted Ldn by more than 10 dB. This is further outlined in Appendix D of ANSI 2005.

## C.3 PERCEPTIBILITY

The typical threshold for an increase in sound level that is considered to be "barely perceptible" by the human ear in a controlled laboratory setting varies from 1 to 5 dBA, depending on the sound pressure level and frequency of the sound. In community noise applications, a 5-dBA reduction in highway noise by a barrier is accepted as the minimum that will be clearly noticeable. These findings cannot be broadly generalized in the context of assessing community noise impacts.

Changes to the characteristics of the sound from baseline (e.g. a change in frequency, changes in sound modulation, increased impulsiveness, or a shift in noise from the daytime to being more at night) may be perceived and may cause noise to be more noticeable, even if the absolute equivalent continuous sound level (in dBA) is not substantially increased. Consult ANSI S12.9-2005/Part 4, clause A.1.3 for further information.

It is important to consider that people respond to sound characteristics that do not necessarily appreciably increase the sound level. Therefore, in the context of an EA, it is suggested that statements relating to perceptibility or whether changes in noise are noticeable based solely on decibel levels be avoided, as these statements may be misleading.

# APPENDIX DI **INTRODUCTION TO NOISE**

## SOUND AND NOISE

***Sound*** is defined as mechanical vibrations travelling through the air or other media.

***Noise*** is most simply defined as unwanted sound.

Sound is measured using a calibrated microphone to determine the rapid cyclical changes in pressure (force per unit area) of the sound wave from the normal atmospheric pressure of about 101,000 pascals (Pa). As the human ear is sensitive to sound waves over a very wide range of maximum changes in sound pressure, for convenience, this range is compressed by using a logarithmic scale, and the resulting sound unit used is called a "decibel" (dB). A logarithmic scale is non-linear; as one moves up the scale, the same change in decibels represents a larger and larger increase in sound pressure. This means that decibels cannot be added or averaged in the same way as other linear measurements such as distance or weight.

## D.1 SOUND PERCEPTION

Perception of sound is not related to sound level in decibels in a linear manner. For example, a 10-dB increase is the median change in sound level at 1 kHz, which is perceived as being twice as loud. A typically cited threshold for an increase in sound level that is often stated as being "barely perceptible" by the human ear varies from 3 to 5 dB (see Appendix B). This threshold is often used in EAs, which may state that residual sound increases lower than this threshold will not be perceptible; however, a difficulty with this approach is that humans also perceive and respond to changes in sound characteristics other than loudness. Examples of these characteristics include frequency, sound modulation, impulsiveness and tonality, which are described in Appendix A.

## D.2 WEIGHTING

People do not perceive all sound frequencies equally, and as such, decibel levels are modified (weighted) according to the frequencies present in the sound. The modified levels are termed "A-weighted" and are reported as dBA rather than dB. The A-weighting reduces the contribution from low and high frequencies to capture the mid-frequency range to which the average human ear is most sensitive. Note that low-frequency noise is de-emphasized by A-weighting as its impacts are not perceived as well by the human ear. However, these low frequencies are factors that can induce rattles and vibrations that can be heard and felt. There are other ways to weight decibels, such as C-, G- and Z-weighting. C-weighting is applicable in the EA context to assess the %HA from exposure to frequent blasting (a high-energy impulsive noise) or, potentially, other project noise sources in which low-frequency noise dominates.

## D.3 ADDING DECIBELS

Sounds often need to be added together to determine sound (or adjusted sound) levels (expressed in decibels) for use in EAs. The known/measured/predicted values characterizing the sound are also normally expressed as sound levels in decibels. To add sounds, the starting sound levels Li are changed to mean square sound pressures, $10^{0.1Li}$ which are added, and then the sum is changed back to decibels. Some rapid estimations are particularly useful, e.g. if sounds with 2 equal sound levels are added, the final value will be very nearly 3 dB greater than the starting values.

## D.4 AVERAGING DECIBELS

In calculating an average sound level over a certain time period, the measured sound pressure at each time is squared and then averaged over time (mean square sound pressure). The mean square sound pressure is then converted to decibels. Occasional loud sound events (e.g. a bird landing on a microphone) may inappropriately influence an average. Events unrelated to the assessment are, after being identified, commonly excluded from the calculation of average sound pressure level.

## D.5 MEASUREMENTS ASSOCIATED WITH SOUND LEVELS REPORTED IN EAS

In the context of noise impact assessment, sound levels are typically reported in average decibel level over a defined time period. In some cases, a specific time weighting is also applied to the average, most commonly as a penalty for night-time sound levels before averaging, to account for the additional potential for disturbance during these hours. The measurement used to describe the sound level indicates the duration and time of day of the sound, and whether any weighting was applied. The following describes the **A-weighted metrics** most commonly presented in EAs:

***Ldn (also termed DNL):*** indicates that the sound was averaged over 24 hours with 10 dBA added to night-time sound levels. The standard night-time hours for this measurement are 10:00 p.m. to 7:00 a.m. Tables 6.2 and 6.3 show Ldn used in the calculation of suggested Mitigation Noise Levels for construction noise exposure less than 1 year.

***Ld:*** average daytime level (standard hours 7 a.m. to 10 p.m. although this varies between 6 a.m. and 11 p.m. in some jurisdictions, such as Ontario).

***Ln:*** average night-time level (10:00 p.m. to 7:00 a.m.).

***Leq (24):*** indicates that the sound was averaged over 24 hours without any adjustment applied.

***Leq (1):*** indicates that the sound was averaged over 1 hour.

***Leq (1 hour max):*** indicates that the average sound level of the worst hour (as measured by a provincial inspector) in a 24-hour period is being reported.

# APPENDIX EI **SOUND SOURCES AND SOUND CHARACTER**

Appendix F Determination of Percent Highly Annoyed (%HA), lists equations that show how to obtain %HA values from daytime and night-time rating levels. The rating levels can be estimated from the application of adjustments to the applicable daytime (Ld) and night-time (Ln) sound levels for the noise environments with and without the project. The Ld and Ln are obtained by an appropriate combination of predictions and measurements.

The values of the daytime rating levels $L_R d_i$ and the night-time rating levels $L_R n_i$ for any applicable noise source are obtained by applying adjustments to the sound levels that are energy-averaged to obtain Ld and Ln for the given ($i$-$^{th}$) noise source. Adjustments may pertain to a particular type of source or to a particular character of the noise from a source or to the receiver characteristics.

When adjustments to project or baseline noise are necessary, Health Canada prefers that adjustments be made by following ISO 1996-1:2003. Details of how to apply adjustments are given in Section 6 of ISO 1996-1:2003, in particular for situations where noise sources of specific character are audible and either distinguishable from noise from other sources, or indistinguishable from noise from other sources. Furthermore, this section of the ISO standard indicates how to determine the rating level from combined sources.

With respect to receptor characteristics, an adjustment is made for a "quiet rural area," where a noise receptor (or group of receptors) has a greater expectation for and value placed on "peace and quiet". ISO notes that a +10 dB adjustment should be applied in this situation. In the absence of further information, Health Canada will assume that receptors with a LAeq (7 a.m.–10 p.m.) of 45 dBA or less and a LAeq (10 p.m.–7 a.m.) of 35 dBA or less are in a quiet rural area, and warrant a +10 dB adjustment in the calculation of the change in %HA.

For **air traffic** sources of noise, Health Canada prefers that a +5 dB adjustment be applied.

For **rail traffic**, Health Canada prefers that either a -5 dB (note this is a negative adjustment) or 0 dB adjustment be applied, as applicable. The -5 dB rail traffic adjustment is not applicable to long diesel trains, or to trains operating at speeds in excess of 250 km/hr. These specific adjustments fall within the ranges given in ISO 1996-1:2003.

**Road traffic noise and industrial-type noise** (including construction noise for the purposes of this guidance) have a 0 dB adjustment, as specified in the ISO standard. The 0 dB adjustment for industry/construction noise applies to only two types of sound levels: (i) from noise sources which are not audibly tonal at the receptor and (ii) from non-impulsive sources.

Certain **other noise sources**, as per ISO 1996-1:2003, are considered regular impulsive (+5 dB adjustment), highly impulsive (+12 dB adjustment) or high energy impulsive. (The rating level is based on the C-weighted sound level and can be obtained from Appendix B of ISO 1996-1:2003.) Tonal sound is also addressed in the ISO standard. Health Canada prefers that a +5 dB adjustment be applied to noise which is audibly tonal at the receptor. This value falls within the range specified in the standard.

As per ISO 1996-1:2003, if more than one adjustment applies for the source type or character of a given **single sound source**, only the largest adjustment is applied. However, time period adjustments are always added to the otherwise adjusted levels. Also, the adjustment for receiver characteristics in a quiet rural area is added to any other adjustments.

ISO 1996-1:2003 also explicitly states that adjustments for tonal character should only be applied when the "sound is audibly tonal at the receiver location". The standard also indicates that adjustments for impulsive source character should only be applied to "impulsive sound sources that are audible at the receiver location." The subtle distinction made in ISO 1996-1:2003 between audibly tonal versus audible sources may only be relevant in consideration of high energy impulsive noise. At long distances, high energy impulsive artillery fire can change from an impulse to a rumble without substantially affecting the magnitude of the required adjustment. For more common sources, a source is still impulsive even if it loses the high frequencies at long distances (e.g. ISO 1996-1:2003 identifies the predominantly low-frequency car door slam as regular impulsive).

## E.1 EXAMPLES

**Aircraft noise:** Although an aircraft can create prominent tones during aircraft noise events, which would normally get a +5 dB adjustment, the adjustment for the air traffic type is also +5 dB. Therefore all the air traffic noise receives a +5 dB adjustment.

**Shunting of rail cars:** The **sound sources** which are identified as highly impulsive in ISO 1996-1:2003 are the "metal impacts in rail-yard shunting operations." Thus, only the sound level during the time that the metal impacts are audible should receive the +12 dB adjustment; not the rest of the noise associated with the shunting activity. The noise due to the engine and motion of the rail cars during shunting is separate from the impact noise and is thus a separate component with a 0 dB adjustment.

**Rail wheel squeal:** There are times at the receptor when the noise from the train is audibly tonal, due to wheel squeal, and the +5 dB adjustment applies. However, for that portion of time where the sound is no longer audibly tonal at the receptor, the noise from the train receives either 0 or -5 dB adjustment for source type.

# APPENDIX F1 DETERMINATION OF PERCENT HIGHLY ANNOYED (%HA)

## INTRODUCTION

Appendix F presents the methodology and equations for calculating (the change in) percent highly annoyed (%HA): using Ld and Ln to calculate rating levels $L_R$d and $L_R$n; and using rating levels in the equations below to determine %HA. These calculations are applicable to projects where the construction phase ≥ 1 year's duration, and for projects in the operational phase.

**Note:** Rating levels are an intermediate step in the calculations of %HA, but are generally not reported in an EA. Health Canada prefers the reporting of various details about Ld, Ln and the adjustments applied.

Refer to Section 5.4 for a discussion about complaints and %HA, and consult Appendix A for definitions.

## CALCULATION OF BASELINE, CONSTRUCTION ≥ 1 YEAR DURATION, AND OPERATION DAYTIME (7 A.M.–10 P.M.) AND NIGHT-TIME (10 P.M.–7 A.M.) RATING LEVELS

Energy summation of applicable daytime rating levels will result in a daytime rating level which can be used to calculate %HA.

Daytime rating level

$$(L_R d) = 10 \log_{10} [\sum_i 10^{(0.1 L_R d_i)}] \qquad \text{(F1)}$$

For a quiet rural area, the daytime rating level

$$(L_R d) = 10 + 10 \log_{10} [\sum_i 10^{(0.1 L_R d_i)}] \qquad (F1_{\text{quiet rural area}})$$

Where $L_R d_i$ = any applicable daytime rating level and a quiet rural area is considered an area where a noise receptor (or group of receptors) has a greater expectation for and value placed on "peace and quiet". In the absence of further information, Health Canada will assume that receptors with a LAeq[2] (7 a.m.–10 p.m.) of 45 dBA or less and a LAeq (10 p.m.–7 a.m.) of 35 dBA or less are in a quiet rural area and warrant a +10 dB adjustment.

The same calculation (using Equations F1 or $F1_{\text{quiet rural area}}$) is also applicable to determine the night-time rating level ($L_R$n) needed to calculate %HA.

2 LAeq is an A-weighted equivalent of continuous sound level in the denoted time period.

## CALCULATION OF %HA

The rating level used to calculate %HA is the day-night rating level ($L_R$dn). In general, to calculate the relevant change in %HA values due to the project noise, $L_R$dn values are needed for baseline, construction ≥ 1 year, and operation. The energy summation of baseline and construction $L_R$dn values ($L_R dn_{(\text{baseline and construction})}$) is needed for the construction phase. The energy summation of baseline and operation $L_R$dn values ($L_R dn_{(\text{baseline and operation})}$) is needed for the operation phase. $L_R$dn is a 24-hour energy averaged rating level in which the contribution from the night-time rating level is artificially increased by 10 dB and is calculated using Equation E2.

$$L_R dn = 10 \log_{10} [((15 \times 10^{(0.1 \times L_R d)}) + (9 \times 10^{(0.1 \times (L_R n + 10))}) / 24] \quad \text{(F2)}$$

$$L_R dn_{(\text{baseline and construction})} = 10 \log_{10} (10^{(0.1 \times \text{construction } L_R dn)} + 10^{(0.1 \times \text{baseline } L_R dn)}) \quad \text{(F3a)}$$

$$L_R dn_{(\text{baseline and operation})} = 10 \log_{10} (10^{(0.1 \times \text{operation } L_R dn)} + 10^{(0.1 \times \text{baseline } L_R dn)}) \quad \text{(F3b)}$$

The %HA is calculated using Equation F4:

$$\%HA = 100 / [1 + e^{(10.4 - 0.132^* L_R dn)}] \quad \text{(F4)}$$

The %HA (baseline), %HA (baseline and construction), %HA (construction), %HA (baseline and operation) and %HA (operation) can be obtained by substituting the appropriate $L_R$dn into Equation F4.

The **change in %HA for project construction** is calculated by subtracting %HA (baseline) from %HA (baseline and construction).

The **change in %HA for project operation** is calculated by subtracting %HA (baseline) from %HA (baseline and operation).

Table F.1 is a worked example showing the project noise levels (i.e. construction phase [≥ 1 year] or during the operational phase) that would result in a change of 6.5%HA from the baseline to project scenario. Use this table as a reference to check calculations carried out for a specific project. This table presents rating levels, but note that rating levels are not commonly reported in an EA as they are an intermediate step in calculating %HA (see above).

The table ranges from a baseline of 20 dB (i.e. quiet rural area) up to a project level of 75 dB.

**Table F.1: Worked example showing baseline and project rating levels associated with a 6.5% increase in %HA due to a project's noise.**

| | | | Change in %HA between baseline and project equals 6.5% | |
|---|---|---|---|---|
| $L_R$dn baseline (dB) | $L_R$dn project (dB) | total $L_R$dn (dB) | %HA baseline (%) | %HA project (%) |
| < 20 | 58.6 | 58.6 | 0.0 | 6.5 |
| 35 | 58.9 | 59.0 | 0.3 | 6.8 |
| 42 | 59.4 | 59.5 | 0.8 | 7.3 |
| 46 | 59.9 | 60.1 | 1.3 | 7.8 |
| 48 | 60.2 | 60.5 | 1.7 | 8.2 |
| 50 | 60.6 | 61.0 | 2.2 | 8.7 |
| 52 | 61.1 | 61.6 | 2.8 | 9.3 |
| 53 | 61.3 | 61.9 | 3.2 | 9.7 |
| 55 | 61.9 | 62.7 | 4.1 | 10.6 |
| 56 | 62.2 | 63.1 | 4.7 | 11.2 |
| 57 | 62.5 | 63.6 | 5.3 | 11.8 |
| 58 | 62.8 | 64.1 | 6.0 | 12.5 |
| 59 | 63.2 | 64.6 | 6.8 | 13.3 |
| 60 | 63.6 | 65.2 | 7.7 | 14.2 |
| 61 | 64.0 | 65.8 | 8.7 | 15.2 |
| 62 | 64.5 | 66.4 | 9.8 | 16.3 |
| 63 | 64.9 | 67.1 | 11.1 | 17.6 |
| 64 | 65.4 | 67.8 | 12.4 | 18.9 |
| 65 | 65.9 | 68.5 | 13.9 | 20.4 |
| 66 | 66.5 | 69.2 | 15.6 | 22.1 |
| 67 | 67.0 | 70.0 | 17.4 | 23.9 |
| 68 | 67.6 | 70.8 | 19.4 | 25.9 |
| 69 | 68.3 | 71.7 | 21.6 | 28.1 |
| 70 | 68.9 | 72.5 | 23.9 | 30.4 |
| 71 | 69.6 | 73.4 | 26.3 | 32.8 |
| 72 | 70.3 | 74.3 | 29.0 | 35.5 |
| 73 | 71.1 | 75.2 | 31.8 | 38.3 |
| 74 | 71.9 | 76.1 | 34.7 | 41.2 |
| 75 | 72.8 | 77.0 | 37.8 | 44.3 |
| 76 | 73.7 | 78.0 | 40.9 | 47.4 |
| 77 | 74.6 | 79.0 | 44.1 | 50.6 |

# APPENDIX GI IDENTIFICATION AND CHARACTERIZATION OF SOME COMMON RECEPTOR LOCATIONS

| RECEPTOR LOCATION | CHARACTERIZATION | COMMENTS/ CONSIDERATIONS |
|---|---|---|
| Commercial premises | Retail stores, offices, research facilities and laboratories | Noise effects during business hours |
| Daycare centres | Highly sensitive receptors (children) | Noise effects considered during occupied periods |
| Entertainment establishments | Film and television studios, theatres, restaurants, etc. | Noise effects during periods of operation |
| Hospitals | Highly sensitive receptors (sick people) | Noise effects over a 24-hour period |
| Industrial premises | Factories and other industrial plants | Potential for additive noise in cumulative effects assessment |
| Places of worship and cemeteries | Churches, mosques, synagogues, temples, locations where Indigenous Peoples' cultural or religious ceremonies occur, etc. | Noise effects during religious services, meetings or processions |
| Recreation areas: *Active* | Parks and sports grounds | Noise effects considered during occupied periods |
| Recreation areas: *Passive* | Outdoor grounds used for hunting, fishing, teaching, etc.; includes locations where Indigenous Peoples may hunt, fish or gather country foods | Noise effects considered during activity periods |
| Residences: *Permanent* | Urban, suburban and rural locations containing houses, mobile homes and/or multilevel dwellings | Noise effects over a 24-hour period with particular emphasis on night-time noise levels |
| Residences: *Seasonal* | Cottages, campgrounds and RV parks; includes Indigenous hunting and fishing cabins, and seasonal camping places | Noise effects considered during occupied periods |
| Schools | Education facilities from pre-school to universities; highly sensitive receptors | Noise effects during regular hours of operation, which may include evenings and the possibility of schools being used during summer |
| Seniors' residences | Highly sensitive receptors (elderly) | Consideration of noise effects over a 24-hour period with particular emphasis on night-time noise levels |
| Workers' living quarters[3] | Locations may be on or off the project site | Mitigation measures in the design of temporary living quarters for workers to limit noise |

3 Occupational exposure and health issues are typically under provincial or territorial jurisdiction, and Health Canada does not review this information in the context of EAs.

# APPENDIX HI COMMONLY APPLIED CONSTRUCTION NOISE MITIGATION MEASURES AND CONSIDERATIONS FOR NOISE REDUCTION

The measures below have been adapted from the New South Wales Interim Construction Noise Guideline (July 2009), Department of Environment and Climate Change, New South Wales, Australia. Available at: **www.epa.nsw.gov.au/noise/constructnoise.htm**

## GENERAL MITIGATION MEASURES

- Regularly train workers and contractors to use equipment in ways that minimize noise.
- Ensure that site managers periodically check the site, nearby residences and other sensitive receptors for noise problems so that solutions can be quickly applied.
- Include in tenders, employment contracts, subcontractor agreements and work method statements, clauses that assure the minimization of noise and compliance with directions from management to minimize noise.
- Avoid the use of radios and stereos outdoors and the overuse of public address systems where neighbours can be affected.
- Avoid shouting, and minimize talking loudly and slamming vehicle doors.
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (e.g. minimizing the use of engine brakes and periods of engine idling).

## NIGHT-TIME MITIGATION MEASURES

- Avoid the use of equipment that generates impulsive noise.
- Minimize the need for reversing alarms.
- Avoid dropping materials from a height.
- Avoid metal-to-metal contact on equipment.
- If possible, schedule truck movements to avoid residential streets.
- Avoid clustering of equipment near residences and other sensitive receptors.
- Ensure that periods of respite are provided in the case of unavoidable maximum noise level events.

## CONSULTATION AND NOTIFICATION

- The community is more likely to be understanding and accepting of project noise if related information is provided and is frank, and does not attempt to understate the likely noise level, and if commitments are respected.

## NOTIFICATION BEFORE AND DURING CONSTRUCTION

- Provide advance notification to people concerning construction duration, defining activities that are expected to be noisy and their expected duration, what noise mitigation measures are being applied, and when noise respite periods will occur.
- For night-time work, receptors may be informed in two stages: two weeks prior to construction and then two days before commencement.
- Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual consultation. In some areas, the need to provide notification in languages other than English may be considered. A website may also be established for the project.
- Use a site information board at the front of the site with contact details, hours of operation and regular information updates.
- Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place, and that there is an ongoing commitment to minimize noise.

## WORK SITE AND EQUIPMENT

- In terms of both cost and results, controlling noise at the source is one of the most effective methods of minimizing the noise impacts from any construction activities.

## QUIETER METHODS

- Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting, such as penetrating cone fracture.
- Consider alternatives to diesel and gasoline engines and pneumatic units, such as hydraulic or electric-controlled units, where feasible and reasonable. When there is no electricity supply, consider using an electrical generator located away from residences.
- Examine and implement, where feasible and reasonable, alternatives to transporting excavated material from underground tunnelling off-site at night-time. (e.g. stockpile material in an acoustically treated shed during the night and load out the following day).

## QUIETER EQUIPMENT

- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine (e.g. rubber-wheeled tractors can be less noisy than steel-tracked tractors).
- Pneumatic equipment is traditionally a problem. Consider selecting super-silenced compressors, silenced jackhammers and damped bits, where possible.
- When renting (or purchasing) equipment, select quieter pieces of machinery and construction equipment, where feasible and reasonable. As well, select the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to any equipment to reduce noise.
- Reduce throttle settings and turn off equipment when it is not being used.
- Examine and consider implementing, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin.

## EQUIPMENT MAINTENANCE

- Regularly inspect and maintain equipment to ensure that it is in good working order, including the condition of mufflers.
- For machines with enclosures, verify that doors and door seals are in good working order and that the doors close properly against the seals.
- Return any leased equipment that is causing noise that is not typical for the equipment. The increased noise may indicate the need for repair.
- Ensure that air lines on pneumatic equipment do not leak.

## SITE MITIGATION MEASURES

- Barriers and acoustic sheds are most suited to long-term fixed works, as in these cases, the associated cost is typically outweighed by the overall time savings.

## WORK SITE LOCATION

- Place as much distance as possible between the machinery or equipment, and residences and other sensitive receptors.
- Restrict areas in which mobile equipment can operate, so that they are away from residences and other sensitive receptors at particular times.
- Locate site vehicle entrances away from residences and other sensitive receptors.
- Carry out noisy fabrication work at another site (e.g. within enclosed factory premises) and then transport products to the project site.

## ALTERNATIVES TO REVERSING ALARMS

- Avoid the use of reversing alarms by designing the site layout to avoid reversing, such as by including drive-through for parking and deliveries.
- When applicable legislation permits, consider less annoying alternatives to the typical "beeper" alarms. Examples include smart alarms that are adjustable in volume depending on the ambient level of noise, and multi-frequency alarms that emit noise over a wide range of frequencies.

## MAXIMIZE SHIELDING

- Re-use existing structures rather than demolishing and reconstructing.
- Use full enclosures, such as large sheds, with good seals fitted to doors to control noise from night-time work.
- Use temporary site buildings and material stockpiles as noise barriers.
- Schedule the construction of permanent walls so that they can be used as noise barriers as early as possible.
- Use natural landform as a noise barrier. Place fixed equipment in cuttings or behind earth berms.
- Take note of large reflecting surfaces on- and off-site that might increase noise levels, and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.

## PROVIDE RESPITE PERIODS

- Consult with schools to ensure that noise-generating construction works in the vicinity are not scheduled to occur during examination periods, unless other acceptable arrangements (such as relocation) can be made.
- When night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or per calendar month that the work is undertaken.

## WORK SCHEDULING

- Schedule noisy work during periods when people are least affected.

## SCHEDULE ACTIVITIES TO MINIMIZE NOISE IMPACTS

- Organize work to be undertaken during the recommended standard hours, where possible.
- If the construction site is in the vicinity of a sports venue, consider scheduling work to avoid times when there are special events.

- When work outside the recommended standard hours is planned, avoid scheduling it on Sundays or public holidays.
- Schedule work when neighbours are not present (e.g. outside business hours or on weekends, when commercial neighbours, college students and school students may not be present).
- Schedule noisy activities around times of high background noise (i.e. when local road traffic or other local noise sources are active) where possible, to provide masking or to reduce the amount that the construction noise intrudes above the background noise.

## DELIVERIES AND ACCESS

- Nominate an off-site truck parking area away from residences for trucks arriving prior to gates opening and schedule deliveries only during specified periods.
- Optimize the number of vehicle trips to and from the site. Movements can be organized to amalgamate loads rather than using a number of vehicles with smaller loads.
- Designate access routes to the site through consultation with potentially noise-affected residences and other sensitive receptors, and inform drivers of nominated vehicle routes.
- Provide on-site parking for staff and on-site truck waiting areas away from residences and other sensitive receptors. Truck waiting areas may require walls or other barriers to minimize noise.

## NOISE TRANSMISSION PATH

- Physical methods to reduce the transmission of noise between construction locations and residences or other sensitive receptors are generally suited to construction projects in which there is long-term noise exposure.
- Reduce the line-of-sight noise transmission to residences and other sensitive receptors using temporary noise barriers.
- Temporary noise barriers can be constructed from boarding (plywood boards, panels of steel sheeting or compressed fibre cement board) with no gaps between the panels at the site boundary. Stockpiles and shipping containers can be effective noise barriers.
- Erect temporary noise barriers before work commences to reduce noise from construction as soon as possible.
- Where high-rise dwellings adjoin the construction site, the height of a barrier may not be sufficient to effectively shield the upper levels of the residential building from construction noise. Find out if this is a consideration for the project and examine alternative mitigation measures, where needed.

Environment Canada Environnement Canada

Environmental Stewardship Branch
16th Floor Queen Square
45 Alderney Drive
Dartmouth, NS B2Y 2N6

January 15, 2019

Helen Yeh
Environmental Assessment Officer
Nova Scotia Environment
1903 Barrington Street, Suite 2085
Halifax, NS B3J 2P8

Dear Ms. Yeh:

**RE:** **EAS# 2018-111**

**Highway 104 Twinning, Sutherlands River to Antigonish**

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Environment and Climate Change Canada (ECCC) has reviewed the environmental assessment registration document submitted by Nova Scotia Department of Transportation and Infrastructure Renewal for the above-noted project. It is understood the project would involve the twinning of Highway 104 between Sutherlands River (Pictou County) and Addington Forks (Antigonish County). The Project alignment is approximately 38 kilometers and will include twinning two segments of the existing alignment (approximately 28 kilometers), in addition to the construction of a new four-lane highway (approximately 10 Kilometers) diverging to the south from the present alignment near Barneys River Station and reconnecting west of Exit 30. The Project construction may commence in 2019 and be completed within 5 years.

ECCC has specialist knowledge and information, which should be considered in the EA of the proposed project. ECCC's specialist knowledge stems from the department's mandate as set out in various statutes including the *Canadian Environmental Protection Act*, *Department of Environment Act*, *Fisheries Act* (Section 36), *Canada Water Act*, *Species at Risk Act,* and *Migratory Birds Convention Act*. ECCC is also the lead federal department in promoting a variety of policies and programs concerning the environment including the *Federal Policy on Wetland Conservation*.

**Migratory Birds and Species at Risk**

A number of species at risk (SAR) were identified in the project assessment area:

- Blue Felt Lichen – SARA-listed – Special Concern
- Black Ash – COSEWIC assessed – Threatened
- Pygmy Pocket Moss – SARA-listed – Special Concern
- Wood Turtle and critical habitat – SARA-listed – Threatened
- Little Brown Myotis – SARA-listed – Endangered
- Northern Myotis – SARA-listed - Endangered
- Canada Warbler – SARA-listed – Threatened
- Olive-sided Flycatcher – SARA-listed – Threatened
- Eastern Wood-pewee – SARA-listed – Special Concern
- Evening Grosbeak – COSEWIC assessed – Special Concern
- Barn Swallow – SARA-listed - Threatened

For federal environmental assessments, ss. 79(2) of the Species at Risk Act requires that persons responsible for an environmental assessment: "must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them." These measures must

- be consistent with best available information including any Recovery Strategy, Action Plan or Management Plan in a final or proposed version; and

- Respect the terms and conditions of the SARA regarding protection of individuals, residences, and critical habitat of Extirpated, Endangered, or Threatened species.

It is best practice to consider species that are not yet listed under SARA, but have been assessed and designated by COSEWIC, as though they were listed under SARA. While there is no federal environmental assessment for this project, ECCC advocates a similar approach.

It is recommended that the Nova Scotia Department of Natural Resources be consulted for species-specific technical information for terrestrial species at risk not protected under the *Migratory Birds Convention Act* (MBCA),

Environment and Climate Change Canada is the lead jurisdiction for birds, including SAR, protected under the MBCA, and offers the information, expertise and advice below as the primary management jurisdiction:

- The proponent identified four SARA-listed and one COSEWIC assessed and designated migratory birds in the project area. Of these, Barn Swallow was observed foraging within an agricultural field and was suspected of breeding in a barn located outside the project area and which will not be removed as part of proposed project activities. Canada Warbler, Olive-sided Flycatcher, Eastern Wood-pewee, and Evening Grosbeak were all observed within project area or local assessment area, and breeding habitat for these species will be affected during proposed project activities. However, other than a proposed timing restriction on vegetation disturbance activities to comply with the MBCA and general mitigation measures for migratory birds and species at risk, no species-specific measures to avoid effects on migratory bird SAR are identified, and no monitoring is proposed.

- As indicated in section 8.1.5, species at risk, including Canada Warbler, were identified within a number of wetlands in the LAA. Vegetation conditions of forested wetlands removed or altered by the project will not be re-established for the life of the project, and will result in a loss of wetland habitat function. In section 8.2.3.4, the proponent states, "All wetland removals or alterations will be mitigated via wetland compensation activities, determined in consultation with NSE." As a measure to compensate for the lost habitat function for passerine SAR in instances where such habitat cannot be avoided, ECCC recommends the use of conservation allowances as the preferred form of the compensation step in the mitigation hierarchy of avoidance, minimization, and compensation.

- Also, ECCC generally recommends buffers for landbird SAR as follows during the breeding season:

    - Low disturbance activities – 50 m
    - Medium disturbance activities – 150 m
    - High disturbance activities – 300 m

- A monitoring plan to verify the efficacy of mitigation measures should also be submitted to appropriate regulatory authorities, including ECCC, for review.

- Some species of migratory birds, including the threatened Common Nighthawk, may be attracted to cleared areas for nesting. The proponent should clarify how it would respond should migratory birds nest in previously cleared areas of the site.

- If there is ultimately a need to decommission a building or structure used for nesting by gulls, swallows, or other species of migratory birds, ECCC's Canadian Wildlife Service (CWS) should be consulted in a timely manner in advance of any proposed decommissioning activities for species-specific considerations including potential permitting requirements.

- Since even small spills of oil can have very serious effects on migratory birds, every effort should be taken to ensure that no oil spills occur. The proponents should ensure that all precautions are taken by the contractors and/or staff to prevent fuel leaks from equipment, and that a contingency plan in case of oil spills is prepared.

- Fueling and servicing of equipment should not take place within 30 meters of environmentally sensitive areas (including wetlands).

- A variety of species of plants native to the general project area should be used in revegetation efforts. Should seed mixes for herbaceous native species for the area not be available, it should be ensured that plants used in revegetation efforts are not known to be invasive.

- Measures to diminish the risk of introducing invasive species be developed and implemented during all project phases. These measures could include:

- Cleaning and inspecting construction equipment prior to transport from elsewhere to ensure that no matter is attached to the machinery (e.g., use of pressure water hose to clean vehicles prior to transport); and

- Regularly inspecting equipment prior to, during and immediately following construction in areas found to support Purple Loosestrife to ensure that vegetative matter is not transported from one construction area to another.

- The proponent states in section 1.4 that "Funding for the Project will be jointly supplied by the provincial and federal government, along with a Private Partner." The *Federal Policy on Wetland Conservation* (FPWC) and its goal of no net loss of wetland function are applicable to this project.

  The FPWC is applicable to any Federal Departments exercising a power, duty, or function that would permit the carrying out of the project or associated activities. The policy recognizes the importance of wetlands to the environment, the economy and human health, and promotes a goal of no-net-loss of wetland functions. In support of this goal, the FPWC and related implementation guidance identify the importance of planning, siting and designing a project in a manner that accommodates a consideration of mitigation options in a hierarchical sequence - avoidance, minimization, and as a last resort, compensation.

  For those potentially affected wetlands where the FPWC would be applicable, and avoidance is deemed not possible, a detailed description of potential effects, and of the reasons why avoidance and minimization of impacts were determined to not be possible should be provided. The mitigation measures and monitoring plan, as well as a proposed compensation plan, should be consistent with those proposed for other projects in Atlantic Canada.

  A copy of the FPWC can be found at http://publications.gc.ca/pub?id=9.686114&sl=0.

Applicable Legislation

The *Migratory Birds Convention Act* (MBCA) protects most bird species in Canada. However, some families of birds are excluded. A list of species under MBCA protection can be found at https://ec.gc.ca/nature/default.asp?lang=En&n=421B7A9D-1.

Under Section 6 of the *Migratory Birds Regulations* (MBR), no person shall disturb, destroy or take a nest or egg of a migratory bird; or to be in possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. It is important to note that under the current MBR, no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities. Furthermore, Section 5.1 of the MBCA describes prohibitions related to deposit of substances harmful to migratory birds:

> "5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.
> (2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds."

It is the responsibility of the proponent to ensure that activities comply with the MBCA and regulations. In fulfilling its responsibility for MBCA compliance, the proponent should consider the following:

- Information regarding regional nesting periods can be found at http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1 . Some species protected under the MBCA may nest outside these timeframes

- Most migratory bird species construct nests in trees (sometimes in tree cavities) and shrubs, but several species nest at ground level (e.g., Common Nighthawk, Killdeer, sandpipers), in hay fields, pastures or in burrows. Some bird species may nest on cliffs or in stockpiles of overburden material from mines or the banks of quarries. Some migratory birds (including certain waterfowl species) may nest in head ponds created by beaver dams. Some migratory birds (e.g., Barn Swallow, Cliff Swallow, Eastern Phoebe) may build their nests on structures such as bridges, ledges or gutters.

- One method frequently used to minimize the risk of destroying bird nests consists of avoiding certain activities, such as clearing, during the regional nesting period for migratory birds.

- The risk of impacting active nests or birds caring for pre-fledged chicks, discovered during project activities outside the regional nesting period, can be minimized by measures such as the establishment of vegetated buffer zones around nests, and minimization of activities in the immediate area until nesting is complete and chicks have naturally migrated from the area. It is incumbent on the proponent to identify the best approach, based on the circumstances, to complying with the MBCA.

Further information can be found at http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1

The proponent is also reminded that the prohibitions under the *Species at Risk Act* (SARA) are now in force. The complete text of SARA, including prohibitions, is available at www.sararegistry.gc.ca .

**Water Quality**

The Fisheries Act can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-14/FullText.html. Section 36(3), in particular, prohibits anyone from depositing or permitting the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter any such water.

It is the proponent's responsibility to ensure that all reasonable measures are conducted to prevent the release of substances deleterious to fish from the proposed activities. In general, compliance is determined at the last point of control of the substance before it enters waters frequented by fish, or, in any place under any conditions where a substance may enter such waters.

**Hazardous Materials**

Hazardous materials (e.g. fuels, lubricants, hydraulic oil) and wastes (e.g. waste oil) should be managed so as to minimize the risk of chronic and/or accidental releases. For example, refuelling and maintenance activities should be conducted on level terrain, at a suitable distance from environmentally sensitive areas including watercourses and wetlands, and on a prepared impermeable surface with a collection system.

Proponents are encouraged to prepare contingency plans that reflect a consideration of potential accidents and malfunctions and that take into account site-specific conditions and sensitivities. The Canadian Standards Association publication, *Emergency Preparedness and Response,* CAN/CSA-Z731-03 (reaffirmed 2014), is a useful reference.

All spills or leaks, such as those from machinery, should be promptly contained and cleaned up (sorbents should be available for quick containment and recovery), and reported to the 24-hour environmental emergencies reporting system (Maritime Provinces 1-800-565-1633).

Please feel free to contact me at (902) 426-0992 or stephen.zwicker@canada.ca if you have any questions or concerns.

Yours truly,

*Original signed by Stephen Zwicker*

Stephen Zwicker
Environmental Assessment Section
Environmental Protection Operations Directorate, Atlantic

cc. M. Hingston
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NOVA SCOTIA

**Environment**

Date: January 15, 2019

To: Isaac Lamah, Water Management Unit Manager

From: Senior Surface Water Quality Specialist, Water Management Unit

Subject: Highway 104 Twinning Sutherlands River to Antigonish Environmental Assessment – Review Comments & Recommendations

**Scope of Review**

As Senior Surface Water Quality Specialist with the Nova Scotia Environment Sustainability and Applied Science Division, the following Highway 104 Twinning Sutherlands River to Antigonish Environmental Assessment (EA) review focuses on the following subjects:

- Surface water quality & its management
- General surface and groundwater resources & their management

The following review considers whether the environmental concerns associated with the above subjects and the proposed mitigation measures have been adequately addressed in the Environmental Assessment. The recommendations provided below are meant to supplement the actions outlined in the EA submission documents.

While general comments on fish and fish habitat, wetlands, surface water quantity, and groundwater quality and quantity may be included below, applicable technical specialists should be consulted for specific review and comment.

**Reviewed Documents**

The following document was the basis for this EA review:

CBCL Limited. 2018. *Highway 104 Twinning Sutherlands River to Antigonish Environmental Assessment Registration*. Nova Scotia Transportation and Infrastructure Renewal. 151046.14

**Comments**

*Surface Water Quality*

- Appendix E, Section 2.2 indicates that the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory for British Columbia: Standards and Procedures* (Resource Inventory Committee, 2001) was used to guide the fish habitat assessment. No explanation on why this guide from the northwest Pacific region of North America is applicable to the surface water features and fish species present in Nova Scotia, or why potentially applicable regional specific guidance

documents were not used is presented.

- Table 5.9 presents water quality probe parameter measurements from site reconnaissance visits conducted in 2018 when a turbidity sensor as part of the probe. Several of the 2018 visited watercourses present no turbidity measurement results without explanation as to why there is no data.
- No surface water quality samples were collected during the baseline study and submitted for physical and/or chemical analysis (e.g., general chemistry, metals, nutrients, herbicides, hydrocarbons) at an accredited laboratory.
- Table 8.9 indicates activities that may impact surface water quality and quantity, including vegetation management practices. Table 8.16 indicates potential impacts of the Project on wetlands, including vegetation management practices. Table 8.16 indicates herbicides will be used for vegetation management, but Table 8.9 does not indicate herbicides will be used. Herbicides would potentially have adverse effects on surface water quality.
- Table 8.10 indicates activities that would potentially impact groundwater resources and subsequently surface water quality and quantity.
- Tables 8.8 and 8.10 references potential contamination of soils, surface water and groundwater by exposure of acid-bearing bedrock with reference that this type of bedrock is not expected to be intercepted within the Project Area. There is no reference to an assessment or resource supporting this statement about low likelihood of acid-bearing bedrock being present. Mitigation measures are proposed to address potential contamination if the acid-bearing bedrock is intercepted.
- One of the recommended best management practices (Section 8.2.2) is to develop a surface water quality monitoring program that will be applied throughout this Project with indication of background total suspended solids (TSS) sampling occurring prior to construction activities being initiated, after vegetation clearing and prior to grubbing. A robust surface water quality monitoring program is an effective tool in ensuring mitigation measures are effective and to confirm predicted Environmental Assessment residual effects. The plan indicates that TSS samples will be taken at the same time of year in similar site conditions to account for seasonal and daily variation. No details on these expected variations and their causes is provided. No other specific water quality parameters are listed to be included in the monitoring program. The Registration Document proposes during the development of the project-specific environmental protection plan (EPP) to potentially add further monitoring parameters.
- Sections 8.3.2 and 8.4.2 present that the surface water quality program will be applied during the site preparation and construction phases of the Project only. Section 8.2.2. presents conflicting information stating the monitoring program will be applied throughout the Project.
- The mitigation measures section (8.2) lists that secondary containment will be used whenever possible for equipment such as pumps and generators.
- Section 8.2 indicates that sediment and erosion control measures will remain in place until the vegetation is established.
- The Nova Scotia Transportation and Infrastructure Renewal’s general EPP for the construction of 100 series highways, and general salt management plan are proposed to be implemented for this Project.

- A site-specific EPP is proposed for the Project (Section 9.2.1.2), which may include an environmental effects monitoring (EEM) program as a component. The EEM program would monitor environmental parameters that would indicate potential changes due to anthropogenic activities.
- A residual effects assessment related to impacts to surface water quality was conducted in Section 8.3.2.2 that was separated into two contaminant assessment paths, salt and sediment. The overall result was no significant residual environmental effect on surface water quality.
- Proposed approvals, avoidance of wetlands and watercourses where possible, mitigation (as proposed in the Registration Document and to be further developed in the EPPs & Contingency Plans), and consultation with Fisheries and Oceans Canada and Nova Scotia Department of Environment staff are proposed for the Project. Compensation is also planned for removal/alteration of both wetlands and watercourses with fish habitat.
- The James River designated protected watershed area is located approximately 4 km from the proposed Project watercourse crossing of James River. The location of the water supply is not downgradient of the Project activities and is unlikely to be affected.

*Surface Water Quantity*

- Within the Registration document there is no assessment of other surface water users (e.g., recreational and industrial) downstream of the Project activities and the potential impacts on those uses.
- The valued environmental component (VEC) listed in the Executive Summary is listed as surface water quality. Section 4, Table 4.2 presents the potential VECs for the Project, which includes surface water quality and quantity as an individual VEC. Section 8.1.2.2 states that surface water quality and quantity is a VEC. Whether surface water quantity is a part of the surface water quality VEC is overall inconsistently presented throughout the Registration Document.
- A single site reconnaissance visit in August 2016 or two visits (August 2016 and May/June 2018) was/were used to assess the watercourse size categories (large and small permanent, intermittent or ephemeral) and the quality of fish habitat. No information is provided on how a single site visit is adequate to identify whether a watercourse is a permanent, intermittent or ephemeral feature in the Registration Document.
- August 2016 was a dry period in many areas of Nova Scotia, which is identified in Section 5.6.3 of the Registration Document. No additional discussion on climatic conditions during the assessment period and their potential impact on the reconnaissance site visit results was provided.
- The Registration document indicates that flow values were calculated manually *in-situ* at all watercourses with enough water present. There is no information provided on the methodology used to estimate these values, or how or if they were measured in the field. Table 5.9 presents flow velocities measured at select watercourses, but not all watercourses, with *in-situ* water quality measurements presented as flow velocity measurements. No flow rates (e.g., $m^3/s$) are provided in the Registration Document.
- Section 8.1.2.2 in the ‘Watercourse Diversions and Watercourse Removals’ subsection indicates that watercourse removals are expected to be a temporary impact. The registration document provides no indication that watercourse

removals are all expected to be temporary and not permanent alterations. These removals and alterations are anticipated to occur on watercourse sections not considered fish habitat (Section 8.1.6).
- Section 8.3.2.2 presents the residual effects assessment for surface water quality, which identifies changes to surface water quantity as an impact. The Section does not specifically go through a residual effects assessment for surface water quantity.

**Recommendations**

*General*

- An assessment should be conducted of industrial and recreational water users downstream of the Project activities, including potential impacts to surface water quality and quantity. Mitigation measures to minimize potential impacts should be proposed.
- The site-specific EPP should be provided to the Nova Scotia Department of Environment for review and comment prior to commencement of the Project.
- The EEM program that the Registration Document indicates may be required for the Project, should be developed and applied. This EEM program should include monitoring activities to assess impacts to the surface water quality and quantity VEC. The surface water quality monitoring program could be a component of the EEM program. Baseline monitoring of water quality and quantity parameters will be required, potentially including continuous flowing monitoring and collection of water quality samples for analysis at an accredited lab for parameters associated with the expected Project contaminants of concern (e.g., sediment, salt, herbicides, hydrocarbons). This EEM program should also include vegetation monitoring to identify when it is appropriate to remove sediment and erosion control measures.
- The proposed approval application and government consultation activities associated with alteration and removal of wetlands and watercourses, and subsequent works within, should be implemented to minimize potential impacts to those aquatic ecosystems, and fish and fish habitat.

*Surface Water Quality*

- Discussion should be provided on how the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory for British Columbia: Standards and Procedures* (Resource Inventory Committee, 2001) is appropriate for assessing fish habitat in Nova Scotia watercourses, particularly the guidance criteria for identifying whether a watercourse is intermittent or ephemeral, based on potentially just one site visit. If the fish habitat assessment method used in this EA registration document is identified to be not geographically suitable to identify fish habitat within the Project area, additional fish habitat assessment work should be proposed, conducted and recorded in a revised baseline study prior to the start of site activities.
- An assessment of whether acid-bearing bedrock will be intercepted within the Project Area should be conducted, including assessing potential impacts and identification of appropriate mitigation measures.
- The use of herbicides is indicated as potentially being used for vegetation management for the Project. A herbicide management plan should be developed for their use, including mitigation measures, and submitted to the Nova Scotia Department of Environment for review and comment prior to commencement of

vegetation management activities.

- The surface water quality monitoring program plan committed to be developed for this Project in the Registration Document should be submitted to the Nova Scotia Department of Environment for review and comment prior to implementation. Activities related to interpretation of monitoring results and steps to be taken to modify mitigation measures and operations should be included in the plan. As part of the monitoring program plan methods, details on the establishment of water quality sample sites and sampling frequency should be indicated and associated analysis requirements included, particularly for the Project identified contaminants of concern (e.g., sediment, salt, herbicides, hydrocarbons). The Project phases for when this program will be applied should be clarified based on conflicting information within the Registration Document (e.g., all phases or just site preparation and construction). If the program will not be for all project phases, an assessment of why the program is not required during specific phases should be conducted and presented for review and comment by the Nova Scotia Department of Environment.
- Secondary containment for stationary fuel storage/use equipment (pumps, generators) should be used, and not only whenever possible.
- NSTIR's salt management plan should be submitted to the Nova Scotia Department of Environment for review and comment prior to commencement of the Project.
- Additional details should be provided to support the low permanence categorization in the residual effects assessment in relation to salinity associated with road salt use. This would include details on how surface water features (including wetlands) will be expected to continue to recover to baseline water quality conditions with the use of the proposed mitigation measures. A revised residual effects assessment result should be calculated based on the above requested details (if applicable), and inclusion of additional mitigation measures be considered to minimize the effects to surface water quality.

*Surface Water Quantity*

- The EA Registration document should have clearly indicated that surface water quantity is part of the surface water quality VEC. Additional information and assessment should be provided about the following surface water quantity issues:
    - How expected surface water quantity impacts were estimated?
    - How expected mitigation measures will function to address identified impacts with clear commitments to minimizing changes to surface water flows (e.g., watercourse crossings will be evaluated to ensure no changes in floodline elevations upstream and downstream of proposed infrastructure for design storm and climate change flow scenarios)?
    - Identification of surface water quantity specific mitigation measures to minimize changes to surface water flows upstream and downstream of the Project.
- A residual effects assessment for impacts to surface water quantity should be conducted. This assessment should be done either separately or concurrently within the Surface Water Quality VEC. Additional mitigation measures that may be required to minimize the residual environmental effects should be identified in support of the assessment.
- An assessment on whether surface water quantity monitoring during any of the

Project phases should be conducted based on the results of the above requested surface water quantity residual effects assessment. If a surface water quantity monitoring program is identified as being required, this should be presented to the Nova Scotia Depart of Environment for review and comment.

NOVA SCOTIA
**Environment**

Barrington Tower
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PO Box 442
Halifax, Nova Scotia
Canada B3J 2P8

Date: January 15, 2019

To: Isaac Lamah, Manager, Water Management Unit

From: Senior Hydrogeologist, Sustainability and Applied Science Division

Subject: Review of Class 1 Environmental Assessment - Highway 104 Twinning Sutherlands River to Antigonish Project

Reviews for EA's from the Sustainability and Applied Science Division Hydrogeologist focus on the potential for the proposed undertaking/project to adversely affect groundwater resources, including general groundwater quality and local water wells/water supply.

The project involves the twinning of Highway 104 between Sutherlands River (Pictou County) and Addington Forks (Antigonish County). The Project alignment is approximately 38 kilometres long and will include twinning two segments of the existing alignment (approximately 28 kilometres), in addition to the construction of a new four-lane highway (approximately 10 kilometres) diverging to the south from the present alignment near Barneys River Station and reconnecting west of Exit 30.

Comments

1. The James River Protected Water Area (PWA) is situated 2 km upgradient (north) of the eastern project area. Any water drainage from the project area flows away from the PWA down-gradient towards the east. The up-gradient James River PWA supplies drinking water for the Town of Antigonish.

2. The project area continues through the watershed downgradient of the James River PWA.

3. The Town of Antigonish Wrights River Well Field is located about 5 km east of the end of the project corridor, but in a different secondary watershed drainage system (Rights River), unlikely to be affected by the project activities.

4. There was one Registered Public Drinking Water Supply located (in NSE records) near the community of Marshy Hope, adjacent to the current Highway 104, and about 350 m upgradient to the north. This is the water supply for a private campground. There is a provincial campground located at the James River Park/ Beaver Mountain Provincial Park in the east of the project area, but there is no

Registered Public Drinking Water Supply at that location.

It is noted that on p. 107 the proponent states *"Water quality data are available for five registered or public water supplies mapped as being located within 500 metres of the highway corridor."* The locations of these are not provided and it is not clear in which areas they occur. These were not confirmed by the reviewer. This discrepancy may be due to lack of clarity in the registration document regarding the evaluation area/project area/field of study/project corridor and should be clarified by the proponent

5. The proponent shows twenty-six (26) existing residential water supply drilled wells and five (5) existing residential water supply dug wells in a 1000 m project width (noted as 500 m from the highway centreline in Figure 5.3 and Figure 5.4 respectively). However, the document text on p. 107 indicates that *"Up to 58 water well records are mapped as located within 500 metres of the highway corridor"*. They also note that *"... the georeferencing accuracy/resolution for 47 of these records exceeds 500 metres"*.

   It has been noted previously that the Well Logs Database Records and any mapping based on these records need to be considered in terms of locational errors/accuracy of the original data. In addition, the Well Logs Database does not contain a complete listing of every water supply well in the province and some areas may contain water supply wells not reported. Field truthing and field surveys for water supply well locations is necessary. This is particularly important given the discrepancies in the registration document concerning the number of water supply wells potentially affected.

6. "Hydrogeology and Groundwater Quality" (i.e. Groundwater Quantity and Quality) are identified as Valued Components (VC) by the proponent in Table 8.2 Environmental Effects Analysis (p. 246). Mitigation measures mentioned in Table 8.2 for Groundwater cross-reference to information from other sections in the document, and in particular are often included in surface water descriptions.

7. Section 8.1.2.3 (p. 286) of the document discusses the potential for changes to groundwater quantity and quality due to the project. An important statement regarding groundwater well surveys and potential mitigation measures is made on p. 290, shown below:

   > *"The primary tool for monitoring potential changes to groundwater is a Pre-Construction Water Well Survey. NSTIR maintains a policy and guidelines for Pre-Construction Well Surveys. Surveys are intended to establish baseline conditions in each well within 300 metres of the centreline of the new road or highway (as per NSTIR policy). If, during or post-construction, there is a demonstrated, measurable change to the quantity or quality of water supplied by a well as a result of Project activities, an alternative supply may be offered in the form of well maintenance, improvement, or replacement. Additional mitigation measures for potential groundwater impacts during the Construction phase are discussed in Section 8.2."*

*8.* Acid rock drainage (ARD) due to surface water contact with disturbed soils or bedrock geology is a potential concern where construction projects occur. The proponent on p. 73 refers to the *Provincial Sulphide Bearing Material Disposal Regulations* and their commitment to follow these. However, there are few subsequent references occur in the report to state for example where and how often they may sample for ARD. In fact, on p. 278 it is stated: "*However, no acid-bearing bedrock is expected to occur within the Project Area, and any potential contamination impacts can be avoided or minimized with proper mitigation measures".* On the other hand, in discussing potential effects of the project both Table 8.8 (Geology and Soils) and Table 8.9 (Surface Water) mention "*Disturbance of contaminated soils or acid bedrock"* as a possible risk.

Chapter 9 *Monitoring and Environmental Management* of the document goes no further to specify any evaluation, monitoring or mitigation measures for potential ARD. However, based on the potential effects of ARD noted earlier by the proponent, it would seem prudent to assess in more detail site specific conditions for ARD. This could be done by including some level of testing and evaluation in the *Site-Specific Environmental Protection Plan* mentioned to be developed (p. 433, Section 9.2.1.2.)

9. The proponent states that "*NSTIR'S Salt Management Plan and Integrated Roadside Vegetation Management Plan will also be applicable to this Project*". Road salting activities are mentioned in numerous sections and tables such as for operations and maintenance and mitigation. NSTIR has developed a Salt Management Plan (SMP) for effective addition of de-icers and with consideration of reducing environmental impact however it is not clear how effective this plan is for groundwater protection. The NSTIR SMP was not supplied in the document and no external access reference for it was given. It should also be noted that salt effects on groundwater/water wells may be permanent and cause irreparably water quality damage to them. Mitigation for such effects is not provided in specific relation to discussion of salt management activities in the document. However, well replacement should be considered a potential outcome for wells significantly affected.

10. Section 9.2.2 Monitoring and Follow-up Requirements describes monitoring activities related to the project during construction and following construction. It should be noted that although mentioned elsewhere (p. 290), the NSTIR Pre-Construction Well Surveys are important monitoring considerations that should have been included in this section, or Section 9.2 Environmental Management and Commitments.

11. Although the potential negative effects of blasting are discussed throughout the document the specific details regarding pre-blast surveys was not located in the document. In general, water wells in the vicinity of blast locations should be included in pre-blast surveys for the ability to determine potential effects to groundwater quantity and quality affecting wells. This is also relevant to have been included in Section 9.2 Environmental Management and Commitments.

Recommendations

The following recommendations are suggested for the Highway 104 Twinning Sutherlands River to Antigonish Project:

1. A requirement for field-truthing and mapping locations of both water well and Registered Public Drinking Water Supply locations should be made.

2. The NSTIR should conduct Pre-Construction Well Surveys within the distance for water wells they have already described in the document of 500 metres from highway centreline. These surveys should occur prior to any construction activities.

3. If construction or operation of the project affects water quantity or water quality of any Public Registered Public Drinking Water Supplies, additional interim protection / mitigation /compensation measures should be considered if these businesses become interrupted.

4. It is recommended that standard conditions be provided that state, to the effect, that the Proponent should replace or repair any water supply well found to be adversely affected by the project activities, to the satisfaction of the well owner.

5. Water wells that are in the vicinity of blast locations should be included in Pre-Blast Surveys conducted.

6. Acid Rock Drainage (ARD) testing and evaluation should be included in the EPP or in a separate plan to be carried out prior to and during construction.

7. A 5 year post-construction groundwater monitoring program by the proponent – for water wells located within the pre-construction well survey area - should be required to ensure maintenance of long-term groundwater well water supplies.

**M E M O R A N D U M**

**TO:** Helen Yeh, NS Department of Environment

**FROM:** Department of Lands and Forestry

**DATE:** January 15, 2019

**RE:** Highway 104 Twinning: Sutherlands River to Antigonish Environmental Impact Assessment

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The Department of Lands and Forestry provides the following comments on the above project:

## Crown Land

This project may involve several parcels of Crown lands under the administration and control of the Department of Lands and Forestry. This will require formal requests from the Department of Transportation and Infrastructural Renewal (TIR) to Lands and Forestry for the transfer of lands. The project also involves crossing over several waterbodies which will require various permits from Land Administration.

## Wildlife

The Department of Lands and Forestry recommends that TIR consult with biology experts with this department in both Antigonish-Guysborough County and Pictou County to ensure that the interests for both of these regions within the project area during the planning and implementation of this project. **The following measures are recommended to supplement the actions outlined in the Environmental Assessment (EA) submission documents:**

### Antigonish-Guysborough County:

1. **Avifauna: Species at Risk and Species of Conservation Concern**
   The Breeding Bird Survey has been well conducted at 80 survey locations with 82 species of breeding birds recorded within the study area. However, no surveys were conducted for Common Nighthawks (*Cordeiles minor*; SARA = Threatened; NS ESA = Threatened), a species for which 14 individuals have been recorded in the ACCDC database in close proximity to the study site. In lieu of additional surveys, mitigation measures for the protection of avifauna should assume Common Nighthawks occur on site.

   Although not recorded in the breeding bird surveys, there are several SAR bird species that have been recorded in large numbers in close proximity to the study site for which suitable habitat occur on site, including:
   - Bank Swallow (*Riparia riparia*) - 66 records
   - Boblink (*Dolichonyx oryzivorous*) – 40 records
   - Rusty Blackbird (*Euphagus carolinus*) – 20 records

   As for the Common Nighthawk, the precautionary approach suggests that **these three species be included in temporal mitigation measures for vegetation clearing outside**

**the breeding season for SAR and migratory birds (1 May-31 August) to avoid disturbance to nests, eggs and fledging birds.**

**2.** The EA addresses potential impacts for SAR and SOCC species. It is recommended that **additional mitigation measures be taken as follows:**

**a) Wood Turtles (NS ESA Threatened; SARA Threatened)** – Several watercourses within the study area where valid records for Wood Turtles exist have been designated as significant habitat for this species by NS Lands and Forestry. The EA states that "in-stream construction will be conducted during low-flow periods (i.e., between June 1 and September 30) as identified by NSE and DFO to minimize impacts fish and fish habitat including fish spawning, incubation, and hatching." This timing conflicts with the nesting and hatching period for Wood Turtles from June to September and there is a need to balance the timing of in-stream works between low flow periods and potential impacts to Wood Turtles nests. **A Wood Turtle Management Plan should be created in consultation with Lands and Forestry staff for works conducted in designated Wood Turtle streams that contain suitable overwintering and nesting sites. This plan needs to be submitted as a condition prior to the start of any works near watercourses**.

There seems to be confusion in the EA between the Lands and Forestry designation of significant habitat for wood turtles and "Critical Habitat". Under the federal Species at Risk Act (SARA), Critical Habitat (CH) is "the habitat that is necessary for the survival or recovery of listed extirpated, endangered, or threatened species, and that is identified as CH in a recovery strategy or action plan". Russel Brook/Sutherlands River from Merigomish Harbour to Gristmill Road is the only watercourse near/within the study area designated as Critical Habitat for Wood turtles under SARA. Subsection 61(1) of SARA provides that no person shall destroy any part of the critical habitat of a listed endangered or threatened terrestrial species at risk that is on nonfederal lands. **Any works proposed within this critical habitat should adhere to SARA legislation and proponents should consult with Environment and Climate Change (ECCC).**

**b) Raptor nests** – The EA notes that vegetation clearing or other "activities potentially disruptive to birds or their nests will be avoided during the mid-April to end of August bird breeding period." However, the EA fails to note any actions that will be undertaken to prevent impacts to raptor nests, some of which are protected year-round. Raptors were observed during breeding bird surveys, however, no nest location were noted in the EA. All raptor species and their nests are protected under the *Wildlife Act* and **searches for nests should be undertaken prior to clearing**.

Raptors commence nesting earlier than passerines, and the Mid-April to 1 September no clearing window will not offer adequate protection for raptor nests. **Clearing or road construction within a 100 m of a raptor nest should not be permitted during the nesting period 1 March to 15 August. No clearing permitted within 200 m of an active goshawk nest at any time of year.**

The Department of Lands and Forestry has *Special Management Practices* for conducting works around Bald Eagle nests. **No clearing permitted within 200 m of an active bald eagle nest. However, in consultation with regional wildlife experts, some activities may be permitted within 100 m of a nest outside of the breeding season (1 February to 31 July).**

**c) SAR Bats** – As suggested for birds, prior to maintenance or removal work, bridges and large culverts should be inspected for roosting bats, and, if present, activities delayed until bats have moved on or been relocated.

**d) Additional recommended biodiversity mitigation measures (general):**

- Provide training and identification information in the form of photos and descriptions of SAR species and sensitive habitat features (e.g. raptor) to personal working on site
- Establish a procedure for reporting observations of SAR and SOCC species and unexpected observations on site.
- Access waterways so that riparian vegetation removal is minimized and restricted to the shortest bank length required for the construction activity

**3. Landscape Ecology Planning for Cape George Large Mammal Movements**

The positioning of Highway 104 connecting Sutherlands River, where Russells Brook prevents wildlife movement west, and the Town of Antigonish, which restricts wildlife movement east, has the potential to isolate populations of large mammals (moose, deer, bear) on the Cape George peninsula. **In addition to well-designed fauna crossing structures, TIR should work with Lands and Forestry and Nova Scotia Environment to employ a landscape planning approach for this project to ensure forested wildlife corridors are developed and maintained for larger non-developed tracts of Crown land within the boundaries of the project area.**

The landscape ecology planning should include consideration of future development (50-year plan) on either side of the highway that would result in increased width of the highway corridor and potentially create an impenetrable barrier to wildlife movement, dispersal and gene flow. Without such planning, the potential exists to isolate populations of large mammals on the peninsula, as has occurred in the demographic isolation of the Chebucto Moose population due to twinning of Highway 103 and increased development along the highway corridor.

The EA identified two sightings of moose within 5 km of the project area based on ACCDC data and observed two additional moose signs as part of EA surveys. NS Lands and Forestry BIR data show 40 moose sightings along this highway corridor between 2001 and 2015. These moose records are not focused on one location, but fairly evenly distributed between Weavers Mountain Rd/Barneys River Road and Mill Road.

The proposed locations for two fauna underpasses fall at either end of this area of concentrated moose sightings and correspond to the location of Deer Wintering Areas, thus are good options:

- "at Weavers Mountain, near the southernmost extent of the new four-lane alignment; and
- at a location east of Mill Rd, along the eastern twinning alignment."

**Further data analysis, GIS landscape planning and review of highway design details (including under or overpass design for large mammal usage and the associated length of fencing) will need to be undertaken with Lands and Forestry (and others) for landscape planning and fauna crossings as stated in the EA**. An additional crossing structure should be considered between the two points described above, which are located

13 km apart. Potentially this could be combined with an existing bridge or culvert requirement to reduce costs.

**Long-term monitoring should be planned** to assess the use of fauna crossing structures by wildlife and their success in enabling large mammal movements and dispersal as recommended in the EA.

## Pictou County:

1. ***Habitat Connectivity.*** The project area has a diversity of habitat types (including, but not limited to, wet meadows, floodplains, forested wetlands, spruce-hemlock forests, tolerant hardwood, among others) and a significant number of Species of Conservation Concern (7 vascular plants, 18 lichens and other non-vascular plants, 19 bird species, 5 mammals, 5 invertebrates) were identified during field surveys within the project area. Development of a four-lane divided highway will further fragment habitat in the region and act as a barrier to wildlife movement. Connectivity should be considered an important component during the design phase of this project, not just for large mammals, but the overall movement and flow of biodiversity on the landscape. Crossings should be designed to accommodate a wide variety of species; for example, natural flooring (not concrete or steel) with vegetation to encourage small mammal movement and distribution. A number of crossings should also be of sufficient size to accommodate Moose (*Alces alces*) as this project falls within an Endangered Mainland Moose Significant Population Concentration Area. Additionally, two Deer Wintering Areas (DWAs) are located in the project footprint and crossings should be provided at these locations. Vegetation clearing is not recommended near any crossings in order to enhance habitat connectivity. Where possible, crossing should be developed in conjunction with natural movement corridors (such as stream crossings) and naturally occurring landscape features (e.g. valleys) used as funnels to direct wildlife to these crossing areas; where natural funnels do not exist, fencing will be required of sufficient type and length to mimic this effect. **Consultation with the Department of Lands and Forestry is required during the planning and implementation stage to ensure the design and placement of wildlife crossings are sufficient for biodiversity needs in this region**.

2. ***Black Ash.*** Habitat loss has been identified as a threat to this species under the provincial recovery strategy. If mature seed-bearing trees were or are identified as part of survey work for this project, there is a possibility this area could be considered as core habitat under the definitions provided in the 2015 recovery strategy for the species. It is not clear from information provided if Black Ash "too big to move" (p. 393) will remain and minimum protective buffers in place for the duration of this project. Any vegetation clearing around watercourses or wetlands which have the potential to contain Black Ash is not recommended prior to a completed survey. **Consultation with experts within the Department of Lands and Forestry is required in order to adequately develop measures to protect this species as it pertains to this project**.

3. ***Wood Turtle.*** Although no Wood Turtles were identified during field surveys for this project, certain activities on or near watercourses have been proposed during the species active period (April-October). Work within known critical habitat occurrences or suitable potential habitat should be conducted outside of important seasonal

windows for breeding, nesting, and hatching. **A mitigation plan specifically for Wood Turtle and Wood Turtle habitat, developed in consultation with the Department of Lands and Forestry, should be provided prior to any work being conducted** within Critical Habitat or habitat identified by the department as significant habitat for the species.

4. ***Bats.*** Previously existing culverts and underpasses should be inspected for presence of bats prior to commencing work in that area and appropriate measures taken if any are found.

5. ***Migratory bird species at risk.*** Canada Warbler (*Wilsonia canadensis*), Barn Swallow (*Hirundo rustica*), Olive-sided Flycatcher (*Contopus cooperi*), and Eastern Wood Pee-wee (*Contopus virens*) are migratory birds as defined under the *Migratory Bird Convention Act* as well as species as risk under the *Species at Risk Act*. As a result, protection and recovery for these species fall under federal responsibility. **The proponent should consult with ECCC's Canadian Wildlife Service to determine if mitigation measures identified under this EA are sufficient for the protection and/or recovery of these species at risk**.

6. ***Other SAR species.*** The proponent comments on page 392 that no mitigation measures are required for any other species which may occur in the LAA. Although unlikely, **if additional SAR are found during the course of this project that have not been previously identified or mitigated for within this EA, work must halt and discussions engaged with the Department of Lands and Forestry to determine appropriate next steps**.

7. ***Species at Risk identification.*** Considering the high number of species at risk found within the project footprint, **training of staff on species at risk identification, important habitat features, as well as requirements under the Act and regulations should be considered. A plan should be developed and implemented to address the possibility of encountering species at risk during the scope of work of the project. An on-site environmental monitor is recommended for the length of this project.**

# Memo

To: Helen Yeh, Environmental Assessment Officer

From: Environmental Health Program, Nova Scotia Environment

Cc:

Date: January 15, 2019

Re: Hwy 104 EA

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Helen,

The Environmental Health Program has undertaken a review of the above-noted EA. The following comments are provided.

**Noise**

A noise assessment was undertaken by the proponent to establish baseline noise levels along the existing highway corridor. Several instances were observed where baseline noise levels along the highway exceeded noise limits established within NSE Guidelines for Environmental Noise Measurement and Assessment.

Aside from the collection of baseline noise data, no work was undertaken to assess noise impacts on nearby human receptors. Also, no work was undertaken to characterize human receptors in terms of the number, location/distance and types of receptors existing within close proximity to the proposed undertaking.

The Guidelines for Environmental Noise Measurement and Assessment are designed to be protective of human health, and state that when undertaking noise assessments, “measurements should reflect the effect that the noise has on humans.”

The noise assessment data provides baseline information on noise levels observed along the current highway corridor only, and does not reflect the effect that noise will

have on human receptors during the duration of the project, particularly during the Site Preparation and Construction phases of the project, where noise levels are expected to be highest. As a result, the reviewer is unable to evaluate the extent to which humans will be impacted by noise over the course of this project.

The proponent is encouraged to refer to the Health Canada document entitled, “Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise” for guidance on assessing the impacts of noise on human health.

Thank you.

NOVA SCOTIA

**Communities, Culture & Heritage**

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Tel: (902) 424-6475
Fax: (902) 424-0560

TO: Helen Yeh

FROM: Sean Weseloh McKeane DATE: January 15, 2019

RE: **Environmental Registration**
**EA 18-12-06 Highway 104 Twinning Sutherlands River to Antigonish**

Staff of the Department of Communities, Culture and Heritage has reviewed the EA document for the Twinning of Highway 104 from Sutherlands River to Antigonish and have provided the following comments:

***Archaeology***

Staff reviewed the Registration Document and the sections particular to archaeology. The Archaeological Resource Impact Assessment report by Davis MacIntyre & Associates is summarized. 72 areas of elevated archaeological potential were recorded as well as historic structures, a cemetery, etc. In Section 8.2.5.1 Heritage and Archaeological Resources, page 394-395, the recommendations going forward by Davis MacIntyre & Associates are summarized. Therefore, there are no further concerns at this time.

***Palaeontology***

Staff have reviewed the Registration Document, and sections particular to geology. The project area includes an Ordovician-Silurian and Carboniferous bedrock geology which may contain marine fossils (shells, trilobites, coral). Vertebrate fossils would not be common. If a rich bed of fossils is encountered during construction, a representative of the Museum can be contacted to determine if likely of any significance.

***Zoology***

Staff have reviewed the Zoological elements of the Registration Document. In general, it Appears to be an accurate reflection of the Zoological landscape of the area.

One error was noted in the fish data. Table 5.25 (Fish Species Known to Occur in the Local Assessed Area) noted the presence of Blacknose Dace (noted as *Notropis heterolepis*). Blacknose Dace (*Rhinichthys atratulus*) are not present in the area, see Gilhen, J and A Hebda, 2002, Distribution of Blacknose Dace, (*Rhinichthys atratulus*), in Nova Scotia, Canada, Canadian Field Naturalist, 116(4): 536-546. Museum records indicate that the Blacknose Shiner (*Notropis heterolepis*) may occur in the area. This should be corrected.

Staff at the Nova Scotia Museum would be interested in examining any fish samples that were collected during the field work, specifically the Cyprinids. If voucher specimens were collected, they could be deposited in the Provincial Collection for further reference.

There are also several minor comments to add.

The authors of the report should review final copies of the report specifically to verify the scientific names. Several word-processing programs tend to auto-correct the spelling, and errors have a tendency to occur and persist, if not corrected.

For added information on presence of Tree bats (Red and Hoary, please refer the to: Zoe Lucas and Andrew Hebda, 2011, Lasiurine Bats in Nova Scotia, Proceedings of the Nova Scotian Institute of Science, Volume 46, (2) pp 117-138. The document puts their occurrence in the Province into perspective.

Sincerely,

Sean Weseloh McKeane
Coordinator, Special Places

NOVA SCOTIA

Sustainability and Applied Science

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# MEMORANDUM

**To:** **Helen Yeh, Environmental Assessment Officer**

**From:** **Hydrologist, Industrial Management Unit, Sustainability and Applied Science Division**

**Date:** **January 15, 2019**

**Subject:** **Highway 104 Twinning Project EA Review Comments**

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**Scope of review:**

The scope of this Environmental Assessment review from the NSE Sustainability and Applied Science Division Hydrologist includes the assessment of the potential for the proposed undertaking/project to adversely affect surface water resources, specifically surface water quantity and management. While general comments on wetlands, surface water quality, and groundwater quantity and quality may be included below, applicable technical specialists should be consulted for specific review and comment.

**Documents reviewed:**

The documents outlined below formed the basis for this EA review and are referred to as the 'EA submission' through the rest of this memorandum:

- Class 1 Environmental Assessment Registration – Highway 104 Twinning – Sutherlands River to Antigonish – Environmental Assessment Registration. Reported prepared by CBCL Limited, submitted by Nova Scotia Transportation and Infrastructure Renewal, Dated November 2018, and accessed from https://novascotia.ca/nse/ea/highway-104-twinning-sutherlands-river/

**Comments re: Highway 104 Twinning Project EA document:**

**Surface water quantity:**

- In general, the submission is not clear and/or consistent on where surface water quantity is assessed and considered

    - Table 4.2 outlines a potential VEC as surface water quality and quantity, but in later chapters and tables (e.g., Section 5.2.2, Table 8.2, Section 8.1.2.2), this is referred to only as surface water quality
- It is outlined that a new section of highway of approximately 10 km length will be constructed as part of the works, between Barney's River station and James River.
    - Potential for permanent alterations to flow patterns as a result
    - The submission does not include details surrounding any assessment or consideration of the potential impacts of this on water quantity
- Data collection and field visits for assessment of fish habitat were completed during drought conditions in 2016.
    - This is highlighted in the submission, but how this potentially affected results and/or how this was considered in the assessment of fish habitat and the data collected is not clearly outlined. Was this considered in the final determination of watercourse types (e.g., ephemeral, intermittent), as the drought conditions likely affected their assessments?
- "The methodology used to conduct fish habitat assessments was adapted from the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory for British Columbia: Standards and Procedures* (Resource Inventory Committee, 2001)."
    - Why was this used, and is it appropriate for use in Nova Scotia?
- The submission outlines 'potential watercourse removals' as part of the activities expected in the Project Area, but provides no details to understand the location, extent or significance of these planned removals
    - As a result, it is difficult to understand the potential adverse impacts associated with the works
- "Fish habitat, including habitat for CRA and SAR species, will be permanently altered during watercourse crossings, watercourse diversions, and watercourse removals…The exact total area of fish habitat to be removed at each proposed watercourse alteration location is presently unknown and is pending final Project design." – pg 331
    - Without any estimations or additional details surrounding the extent of these expected permanent alterations, it is difficult to assess the impacts of the proposed works.
- It is stated in the mitigations section that 'All culverts will be designed following applicable legislation, guidelines and standards to maintain ephemeral stream flows and small wetlands' – for clarity, why is this bullet made specific to just ephemeral stream flows and small wetlands?
- 'Alteration of surface water flow patterns' is highlighted in the description of potential environmental effects in the Surface Water Quality VEC entry throughout the submission (e.g., Table 8.2, Section 8.3.2.2, etc) but there is no further assessment or consideration of this within submission text. It is difficult to have confidence in the residual effects assessment in 8.3.2.2 without further information surrounding how this has been assessed and considered.
- 'Flooding' is also highlighted as a potential environmental effect, but this is not elaborated on in text. By installing new structures that will potentially pass more flow (as it is mentioned they will incorporate climate change), there is the potential for this approach to cause impacts to downstream conditions. It is unclear in the submission whether this has been assessed and/or how this will be considered in final designs.

- The residual effects assessment for fish and fish habitat is also difficult to review without more information, as details surrounding the overall extent of watercourse removals and diversions are not provided. In addition, the following approach to significance determination for fish and fish habitat raises questions: “An effect that does not meet the significance determination conditions is considered to be not significant. For example, an effect that results in the permanent loss to fish or fish habitat but can be mitigated through the replacement of lost habitat (off-setting) or salvage/rescue of fish prior to initiation of the activity, will not be considered significant. (pg. 80)”. Is it assumed that all areas that are expected to have permanent loss of fish habitat will be successfully offset, and as such these activities are not significant? How was this concluded? Without more information about the anticipated extents of loss of habitat, how was this conclusion reached?

**Conclusions:**

- As outlined in the project, there is a significant surface water component to the proposed works. This is highlighted by estimation that watercourse alteration activities are anticipated for all 127 watercourses identified in the Project Area.
- In addition, the fisheries assessment has identified several watercourses that will be affected by the works as anticipated to provide habitat for Atlantic Salmon populations, with the James River identified as providing significant Atlantic Salmon habitat and several others affected watercourses having known populations identified.
- In general, there is a lack of information to understand the impacts of the project on surface water quantity
- It is not clear in the document how much permanent loss to fish and fish habitat will occur as a result of the proposed works
- The level of assessment of items related to surface water quantity is not clear.
    - Surface water quantity is described as its own VEC in the document, and then is discussed in the surface water quality section in the latter sections of the document, but with no elaboration of the items that are highlighted in the supporting text
    - Items related to surface water quantity (e.g., alterations of local surface water hydrology, flooding, modified flow volumes) are not elaborated on or assessed in the submission
- Watercourse diversion and removal are outlined as activities for the proposed works in the document, but it is not clear what exactly these will entail and the extent of these activities that is expected to occur
- It is not clear in the document how the permanent loss of fish habitat was considered in the residual effects assessment, and whether the items related to surface water quantity were considered at all

# Native Council of Nova Scotia

The Self-Governing Authority for Mi'kmaq/Aboriginal Peoples residing Off-Reserve in Nova Scotia throughout traditional Mi'kmaq Territory

*"Going Forward to a Better Future"*

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Aboriginal/Treaty Rights Negotiations Facilitating Directorate

NCNS Citizenship Information Office

Education & Student Services

Rural & Native Housing Group

Aboriginal Peoples Training & Employment Commission (APTEC)

Netukulimkewe'l Commission

Wenjikwom Housing Commission

Social Assistance Recipient Support for Employment & Training (SARSET)

Micmac Language Program

Native Social Counselling Agency

Child Help Initiative Program (CHIP)

E'pit Nuji Ilmuet Program (Prenatal)

Aboriginal Homelessness Program

Parenting Journey Program

Youth Outreach Program

Mi'Kma'ki Environments Resource Developments Secretariat (MERDS)

December 27, 2018

Ms. Helen Yeh,
Environmental Assessment Officer
Nova Scotia Department of the Environment
1903 Barrington Street, Suite 2085
Halifax, Nova Scotia
B3J 2P8

RE: Proposed Conditional Approval filing to proceed with works on Highway 104 Twinning Sutherlands River to Antigonish.

Dear Ms. Yeh:

Thank you for informing the Native Council of Nova Scotia, about the aforementioned filing with Nova Scotia Environment, for a conditional approval for construction of works associated with Highway 104 Twinning Sutherlands River to Antigonish.

The Native Council of Nova Scotia Community of section 91 (24) non-status and status Indian Mi'Kmaq Aboriginal People continuing on our traditional ancestral homeland throughout Nova Scotia as Heirs to Treaty Rights, Beneficiaries of Aboriginal Rights, with Interests in Other Rights, asserting Mi'Kmaq Title are very concerned about this proposed project. The generally expressed 28 KM project area is an area accessed for harvesting, fishing, fowling and gathering.

The proposed alignments and building of a new four lane highway for 10 KM between Barney's River Station and James River which is projected to involve a combined total of twenty-five (25) structures as either additional or modified structures to the existing highway structures significantly concerns the Native Council of Nova Scotia Community.

The Native Council of Nova Scotia is concerned about the process being used by the government of Nova Scotia to evaluate the potential environmental affects of this project on our Communities right to harvesting, fowling, fishing and gathering. The Department of Transportation has not developed an engagement plan with our Community of Indian Mi'Kmaq Aboriginal Peoples. We are concerned that the Department of Transportation filing introduces

limited preliminary baseline environmental information which precludes us from providing comments or conducting a substantive evaluation on the environmental affects of this project, subject first to a project approval, and then detailed environmental information on a multitude of project components.

According to the registration document, the purpose of the registration filing is to acquire conditional approval for the purpose of a preliminary design to get a general understanding about the project components. The substantive environmental affects will thereafter be evaluated on a site specific basis after conditional approval is granted. Such an environmental evaluation will be conducted by the process contained in the document titled "Construction of 100-Series highways Environmental Protection Plan" where a proponent could implement any conditions associated with the approval.

What impact or purpose would public scrutiny and revelations about environment affects have on a conditionally approved project where firsthand "Aboriginal Engagement" is restricted to Indian Act Indians living within the confines of Indian Act Federal Reserves, with limited Indian Act Band Consultation Processes, while other Indian Mi'Kmaq Aboriginal Rights Holders continuing throughout their traditional ancestral homeland are not identified as rights holders in the filing document?

How does the Nova Scotia Department of Transportation escape the purpose and Constitutional Law of Section 25 and 35; which for purposes of reconciliation requires Aboriginal Engagement with all rights holders including the Native Council of Nova Scotia Community of off-reserve non-status and status section 91 (24) Indian Mi'Kmaq Aboriginal peoples.

On April 14, 2016, the Supreme Court of Canada in *Daniels vs. Canada (Indian Affairs and Northern Development)* 2016 SCC 12 note:

> "As the curtain opens wider and wider on the history of Canada's relations with its Indigenous Peoples, inequities are increasingly revealed and remedies urgently sought. Many revelations have resulted in good faith policy and legislative responses but the list of disadvantages remain robust. This case represents ***another chapter in the pursuit of reconciliation and redress in that relationship".***

In our opinion, this filing document for conditional approval from the Nova Scotia Department of the Environment is a seriously flawed process because it has excluded the Native Council of Nova Scotia Community of 91 (24) Indian Mi'Kmaq Aboriginal people from meaningful involvement as identified rights holders. This conditional approval process for evaluating potential environmental affects by a project where scant preliminary information is disclosed for the purpose of assisting in the preliminary design of a project; "to get a general understanding about the project components which would then be subject to an implementing process contained in a "Construction of a 100-series Highway" document" requires that only conditions of approval need to be implemented by the proponent. This process begs the question what happened to evaluating the environmental impacts affects of a project or mitigation options available to the proponent to advance a project in an environmentally conscientious and responsible manner respecting sustainability, the environment and Treaty/Aboriginal Rights?

The Native Council of Nova Scotia Community of non-status and status 91(24) Indian Mi'Kmaq Aboriginal Peoples support projects, works, undertakings which do not significantly alter, destroy or affect the sustainable natural life ecosystems, or natural eco-scapes formed as hills, mountains, wetlands, meadows, woodlands, shores, beaches, coasts, brooks, streams, rivers, lakes, bays, inland waters, and the near-shore, mid-shore and off-shore waters with their multitude of *in situ* biodiversity.

Our NCNS Community continues to access and use the natural life within those ecosystems and eco - scapes where the equitable sharing of benefits should arise from works, activities, projects and undertakings to serve a beneficial purpose towards progress in general and demonstrate the sustainable use of the natural wealth of Mother Earth with respect for the Constitutional Treaty Rights, Aboriginal Rights, Other Rights and Title Rights of the NCNS Community of "Indians" Mi'Kmaq Aboriginal Peoples continuing on our Traditional Ancestral Homeland in that part of Mi'Kmaki known as Nova Scotia.

The scant preliminary filing of a project document to acquire firsthand a conditional approval for a project which is anticipated to have a multitude of components, hoping to have some conditions somehow raised and attached and wishfully implemented according to a "100-Series Highway Plan" document, requires us to place a large degree of faith in a proponent who is proposing a project which will have many components, with a filing which has a very scant amount of environmental data.

An engagement plan with the Native Council of Nova Scotia Community is urgently required.

There is an urgent need to provide the NCNS Community with detailed information about the many components of this project before any conditional approval is granted.

There is a urgent need to identify principle environmental matters which this project document filing should address in an open, transparent and detailed manner.

The Native Council of Nova Scotia can not agree with the manner and purpose of this filing, because if the conditional approval is granted first, then all project works including site specific considerations could be implemented according to the "Construction of 100 Series Highways Environmental Protection Plan" 2007, with applicable regulatory approvals authorizations and permits and site specific terms and conditions, before any EA is started to assess any of a multitude of design components to the project.

A post decision evaluation is not a public transparent process vetting environmental affects based on complete and evaluated environmental information.

A post decision condition on an already approved project is not in keeping with the principle and purpose of early Aboriginal Engagement with all the Aboriginal Peoples involved which needs to include the NCNS Community of Aboriginal Peoples continuing on their traditional ancestral homeland.

We object to conditional filing process and the deficient data on components with this project.

Progress through consultation, accommodation
and participatory involvement and partnership

Chief Lorraine Augustine

LA:rjh

Cc Commissioner Tim Martin, Netukulimkewe'l Commission
Joshua McNeely Director IKANAWTIKET
Vanessa Mitchell, MAARS ARM
Roger Hunka, Director Maritime Aboriginal Peoples Council

**From:** @hotmail.com
**To:** Environment Assessment Web Account
**Subject:** Proposed Project Comments
**Date:** Sunday, December 09, 2018 10:34:24 AM

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Project: highway-104-twinning-sutherlands-river Comments: I am in support of the twinning project as I believe it will save lives. That said, the Barney/James/West River watershed is a spectacular and sensitive ecosystem for our precious Atlantic salmon and Brook Trout populations. If the project is going to be successful it must be designed,constructed and maintained in a manner that is supremely protective of this natural wonder. Please take every step necessary for preservation. Our children and grandchildren deserve as much.

**From:** @gmail.com
**To:** Environment Assessment Web Account
**Subject:** Proposed Project Comments
**Date:** Sunday, December 09, 2018 12:13:36 PM

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Project: highway-104-twinning-sutherlands-river Comments: I regularly use the Dartmouth Road between Dartmouth and Bedford. There are two lanes in each direction with a concrete barrier down the middle for the purpose of eliminating head-on collisions. An upgrade to this configuration could be done with no or little additional land and permit the use of all of the existing ramps and bridges. It would save more than half the cost and environmental impact. Public pressure to twin increases with each highway death. The accidents and deaths are caused by bad driving. The decision to twin should be based on traffic volume alone. We should thoroughly explore every cheaper option before we twin this or any other highway.

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|---|---|
| **From:** | Environment |
| **To:** | Environment Assessment Web Account |
| **Subject:** | Proposed Project Comments |
| **Date:** | Sunday, December 09, 2018 1:35:49 PM |

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Project: highway-104-twinning-sutherlands-river Comments: Would it not make more sense to twin the road by adding two lanes just north of the existing highway? This would then allow for the current infrastructure to remain instead of abandoning/destroying it, and would hopefully also help to prevent the lost of wetlands/moose crossings/bird life/etc.. While there are some crossings in these areas which could be pushed up a bit higher instead, most of that northern edge are either forested or fields, which seems more ideal than disturbing the flora and fauna deemed as rare or threatened, and would speed the project along since twinning of the 104 begin in the late 1980s/early 1990s. Name: Email: Address: Municipality: Postal-Code: Phone: ### ### - #### Fax: ### ### - #### email_message: Privacy-Statement: agree x: 27 y: 4

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|---|---|
| **From:** | Environment |
| **To:** | Environment Assessment Web Account |
| **Subject:** | Proposed Project Comments |
| **Date:** | Sunday, December 09, 2018 2:06:14 PM |

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Project: highway-104-twinning-sutherlands-river Comments: This twinning canâ?Tt happen fast enough. Please proceed with environmental mitigation strategies. Name: Email: Address: Municipality: Postal-Code: Phone: ### ### - #### Fax: ### ### - #### email_message: Privacy-Statement: agree x: 46 y: 23

**From:** @ns.sympatico.ca
**To:** Environment Assessment Web Account
**Subject:** Proposed Project Comments
**Date:** Wednesday, December 19, 2018 9:47:44 AM

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Project: highway-104-twinning-sutherlands-river Comments: Construction savings and a better highway can be achieved by a wider median when twinning highways. A 30 meter median used by Nova Scotia restricts the new profile to be within 1 meter of elevation with the existing lanes. This means the new profile cant be designed based on topography. New Brunswick uses an 82 meter median allowing a topography based design reducing cuts and fills and therefore providing a construction savings as much as 25. Other advantages include: 1-No headlight dimming for oncoming traffic. 2-Less stream diversion with staggered culverts 3-Better fish passage with two short culverts instead of one long culvert. 4-Smaller environmental foot print due to shorter slopes 5-Less interference with traffic during construction The construction savings far outweigh the extra land cost. Please consider this before twinning more highways. Name: Email: @ns.sympatico.ca Address: Municipality: STILLWATER LAKE Postal-
:

**From:** @gmail.com
**To:** Environment Assessment Web Account
**Subject:** Proposed Project Comments
**Date:** Saturday, December 29, 2018 11:49:16 PM

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Project: highway-104-twinning-sutherlands-river Comments: Please twin this sooner than later. No one cares if a duck gets displaced where human lives are on the line. We hit slush tonight on a two lane portion of Highway 104 and our vehicle spun around and can inches of hitting a large transport truck speeding by. My spouse and two kids could have been killed tonight as another victim of untwinned highways. Still shaken, since we were lucky to make it home ive been researching all night on NS highway twinning. No one knows how close my family came to dieing tonight, no one. Please consider the environmental assessments as a lower priority. I keep thinking of the amazing amounts of close calls that dont get reported unless there is a death on the highways. Our families story is just one that gets unheard. Name: @gmail.com Address:

**From:** @gmail.com
**To:** Environment Assessment Web Account
**Subject:** Proposed Project Comments
**Date:** January 4, 2019 3:41:32 PM

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Project: highway-104-twinning-sutherlands-river Comments: Thank you!! about time. Name: Email: @gmail.com Address: Municipality: Halifax Postal-Code: Phone: ### ### - #### Fax: ### ### - #### email_message: Privacy-Statement: agree x: 34 y: 8

| | |
|---|---|
| **From:** | @gmail.com |
| **To:** | Environment Assessment Web Account |
| **Subject:** | Proposed Project Comments |
| **Date:** | January 4, 2019 3:48:30 PM |

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Project: highway-104-twinning-sutherlands-river Comments: I do not agree with the need for twinning the highway. The highway that is there now IS needed and is enough. Transportation for humans day-to-day life is needed and that is why highways are built and that is why there is a need to alter animal habitat in order to do so. The highway that exists there now is enough and there is no need to extend it or make it bigger, especially due to the environmental impacts it will cause. Two important species at risk will be affected, those being, the Mainland Moose and Black Ash trees, two of many species that environmental organizations work so hard to try and improve the population numbers and the areas in which they inhibit. Redundant expansion such as this makes that work seem disrespected and irrelevant when really, environmental work is very important. Not only for those species at risk but the air we breathe, the water we drink, the planet we live on. Yes, we may have the rights, but where are the animals rights? the ecos ystems rights? That is what I stand for, and I do not think this project should be sent underway. Name: @gmail.com Address:

**From:**
**To:** Environment Assessment Web Account
**Subject:** Highway Twinning 104 Sutherlands River to Addington Forks
**Date:** January 5, 2019 1:56:38 PM

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As part of the Nova Scotia Environmental Assessment process I am contacting the EA branch of Nova Scotia Environment with comments regarding the Highway Twinning project located between Sutherlands River and Addington Forks. I will be focusing my comments on the Barney's River to James River section due to my knowledge of the area. Currently I am a property owner that will be directly impacted by the proposed newly constructed double lane highway. My property is situated along Pushies Road, as identified in the report. I realize the importance of making our highways safer and support that, however, my comments are related to the EA report.

To give some context to my comments, five generations of my family have lived in the area of Marshy Hope,Pushies Mountain and this is the third time that our families properties have been affected by the construction of a provincial highway and once by the construction of the Railroad. As you can appreciate this is an emotional time for our family, as we gathered on the Pushies Mountain for many years, built a modest cabin, enjoyed nature and were stewards of the environment and enjoyed family hunting trips there for many years. I have hiked and hunted this area for approximately 45 years. I will rely on my 35 years experience working in the Environmental Industry and my Natural Resource background as a source of my comments rather than emotion.

Upon review of the EA report I offer the following comments:

1. In section 1.6 of the report it states that property owners that will be affected have been notified. NSTIR conducted an information session, however, did not identify this as a " Public Consultation session" as required by the EA process. Since I do not live in the local area, I only heard by word of mouth that my property will be directly impacted. Also it was not a "consultation" and no forum for discussion or questions. In my opinion this does not reflect good faith with complying to the EA process for public consultation.
2. In section 2 of the report in relation to "Wildlife Passage," the author states that wildlife will be sharing underpasses with vehicles, atvs, and snowmobiles. I believe this encourages the interaction between vehicles and wildlife. This is not the industry standard.
3. In Appendix H "Ungulate Survey", the transects used to conduct surveys were not located in the project area. Also the transects were not located in wetlands identified in the EA. These wetlands are prime habitat for the Endangered Mainland Moose.
4. In respect to the Endangered Mainland Moose survey, there is no mention of reviewing the DNR Mainland Moose database for reported sightings and observed sign. I have reported sightings and observations for quite sometime, so this may be helpful in determining Endangered Species habitat and relying on a one day observation.
5. In the report the author stated that no owls have been observed. I have observed over my 45 years on this mountain numerous times, Barred, Great Horned, and even Northern Sahwet Owls located in the proposed corridor.
6. The proponent has not submitted and Erosion or Sedimentation Plan(ESP) in the EA report. Since the EA will form the basis of the tender for this project, therefore, and ESP should be required so that the EA branch can adequately review the integrity of the plan.
7. In the report the author mentions that wetland will be affected. Wetlands within the highway corridor will be compensated as per the Nova Scotia Wetland Policy. The author also noted that surface water will be redirected. Redirecting water away from existing wetlands is

considered an alteration under the Nova Scotia Wetland Policy, however, there is no mention of mitigation or compensation for the wetlands that is outside of the project area due to the redirection of surface water. I believe the Nova Scotia Wetland Policy is based on " no net loss of habitat."

8. The report does not mention browse surveys, as a tool to determine existing populations of whitetail. The population determination would be used to determine whitetail deer and vehicular collisions.
9. In the section of Heritage and Archeological the author refers to cemeteries.

10. The reason given for the twinning of the highway is safety. For the most part I agree. Along the existing corridor through Marshy Hope, winter conditions are usually much worse and longer lasting than the majority of the province. That being said the proposed route between Barneys River and James River will experience the winter conditions exasperated by the continuous strong wind, making this passage a much more dangerous passage. There should be an alternate route during the winter season or Jersey Barrier the existing route through Marshy Hope with a widened shoulder and watercourse crossings with a reduced speed limit. The existing corridor will not be safer, with proposed slopes and elevation.

I thank you for accepting these comments as per the Environmental Assessment process.

@hotmail.com