YESAB
Yukon Environmental and Socio-economic Assessment Board

Designated Office Evaluation Report

Yukon Energy Air Emissions Permit Renewal - Whitehorse

Project Assessment 2011-0241

Proponent: Yukon Energy Corporation

Assessment Completion Date: December 30, 2011

Whitehorse Designated Office

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EXECUTIVE SUMMARY

The proponent, Yukon Energy Corporation (YEC), is applying for the renewal of an Air Emissions Permit to continue operating its existing diesel-fired electricity generating facility in the City of Whitehorse. The proposed operation and management of the Whitehorse diesel plant will occur over a three year period beginning January 1, 2012. Views and information on the project were submitted by the Yukon Conservation Society, the Riverdale Community Association, Mr. Chris McNeill, the City of Whitehorse and two Yukon Government branches: Environment and Community Services. Two valued components were identified: air quality and environmental quality.

The assessor has determined that the project will have significant adverse effects on both of the above-mentioned valued components. The assessor believes that mitigations recommended in this report as well as those proposed by the proponent and compliance with the applicable existing non-discretionary legislation are considered adequate to eliminate, reduce or control the significant adverse effects of the project.

OUTCOME

The Whitehorse Designated Office, pursuant to section 56(1) b of the *Yukon Environmental and Socio-economic Assessment Act* (*YESAA*), recommends to the decision bodies that the project be allowed to proceed, subject to specified terms and conditions, as it has determined that the project will have significant adverse environmental or socio-economic effects in or outside Yukon that can be mitigated by those terms and conditions.

THE TERMS AND CONDITIONS OF THE RECOMMENDATIONS ARE AS FOLLOWS

1. Upon permit renewal, the proponent shall develop and implement an air quality monitoring program for the criteria air contaminants (CO, NO_x, SO_2, PM, $PM_{2.5}$). The purpose of the monitoring will be to validate the projections of the October 20, 2011 *Air Quality Assessment Update in Support of Permit Renewal for Diesel Generator Operations* prepared for proponent by SENES Consultants Limited and guide the implementation of measures to prevent the occurrence of significant adverse effects from the project on air quality. This program shall be developed in consultation with and to the satisfaction of Yukon Government.
2. Upon permit renewal, the proponent shall develop and implement a plan to reduce the level of diesel energy production at the Whitehorse Rapids facility when:
    a. hydroelectric generation is insufficient to meet energy demands; and
    b. results of the ongoing monitoring set out in Mitigation 1 indicate that levels of the criteria air contaminants reach 83% of the values identified in the Yukon Ambient Air Quality Standards.

    Diesel use in Whitehorse shall be reduced to a level of energy production and associated emissions that will ensure the Yukon Ambient Air Quality Standards will not be exceeded.

    This plan shall include avoidance, where possible of timing planned maintenance or “exercising” of diesel units during periods outlined in b.

    This plan will be developed in consultation with and to the satisfaction of Yukon Government.

3. During emergency circumstances when diesel generation is required and when Yukon Air Quality Standards are or are likely to be exceeded, the proponent shall notify the public via television, radio, internet and any other means deemed appropriate with regards to:

    a. measures they can take to limit their exposure to impaired air quality and reduce their own activities that may contribute to cumulative air quality; and

    b. when the impaired air quality conditions have ended.

Issued by the Whitehorse Designated Office on December 30, 2011.

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PART A. INTRODUCTION

The following sections present background information for this project and the assessment. This information includes details of the project; the environmental and socio-economic setting of the project area; and a description of the requirement for an assessment. Part A also has a discussion on the scope of the assessment, which includes the identification of values potentially affected by the project.

1.0 PROJECT DESCRIPTION

1.1 PROPONENT INFORMATION

The project proponent is Yukon Energy Corporation (YEC), a Crown corporation that operates at arm's length from Yukon Government. YEC is the main electricity generator for much of the Yukon and operates a variety of hydro-electric, wind and diesel power generation facilities, including the Whitehorse Rapids hydro-electric dam where the project is located. The contact for the proponent is:

Travis Ritchie, Manager of Environment, Assessment & Licensing
(867)-393-5350
Travis.ritchie@yec.yk.ca

1.2 GEOGRAPHICAL CONTEXT

The project is located in the City of Whitehorse at the YEC Whitehorse Rapids property on Robert Service Way adjacent to the Yukon River. Figure 1 provides additional details on the project's location.

Coordinates:
60°41' 54" N
135° 2' 43" W

First Nations Traditional Territories Involved:

Ta'an Kwäch'än Council

Kwanlin Dün First Nation

Watershed (s) and Drainage Region:

Major Drainage Area:
Yukon River

Sub Drainage:
Headwaters Yukon

Sub-Sub Drainage Area:
Headwaters Yukon – Lake Laberge

Nearby water body:

Yukon River (50 m)

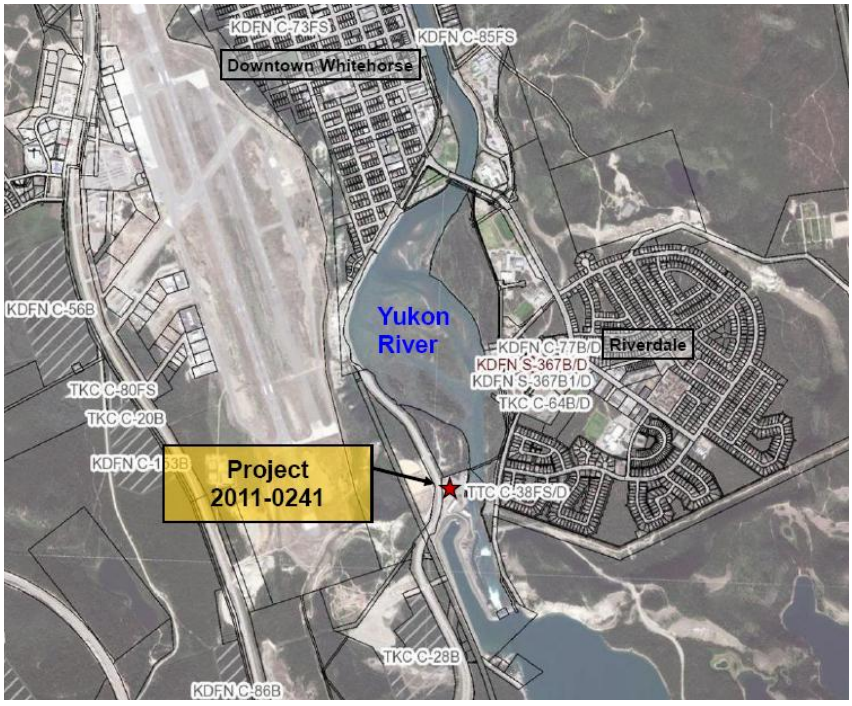

Figure 1 Project Location Overview

1.3 HISTORY OF PROJECT

YUKON'S ENERGY SYSTEM

The Whitehorse Rapids hydro-electric generating facility was built in 1958 on the Yukon River at the south end of the City of Whitehorse. YEC's Whitehorse diesel generation facilities are located at the Whitehorse Rapids site and are comprised of seven separate diesel units that were brought into service at various times between 1968 and 1991. The hydro generation facilities at Whitehorse, Aishihik and Mayo, wind facilities at Haeckel Hill in Whitehorse and diesel units in Whitehorse, Dawson, Mayo and Faro produce the majority of electrical power for the Yukon Territory, which is distributed via the now integrated WAF (Whitehorse-Aishihik-Faro) and MD (Mayo-Dawson) power grids. At present, the Yukon is not connected to the power grid of any other jurisdictions (such as British Columbia or Alaska).

Diesel generation is used to meet peak electricity demands that exceed the available supply from renewable sources on the grid as well as provide emergency back up during both planned maintenance and unplanned outages at the hydroelectric facilities.

By the end of 2011 YEC will have the capacity to generate an approximate total of 133 megawatts (MW) of power as follows:

- 92 MW provided by hydro-electric generation facilities in Whitehorse (40 MW), Aishihik (37 MW) and Mayo (15 MW). This is reduced in winter months as less water becomes available.
- 0.8 MW provided by two wind turbines on Haeckel Hill near Whitehorse
- 40 MW provided by diesel generators located in Whitehorse, Mayo, Dawson and Faro[1].

A separate company, Yukon Electrical Company Limited (YECL) operates the 1.3 MW Fish Lake hydro plant which is connected to the WAF grid. YECL also operates diesel-generating facilities in several Yukon communities not connected to the grid (Old Crow, Beaver Creek, Destruction Bay, Burwash Landing, Upper Liard, Lower Post, Watson Lake and Swift River) and backup generators (Ross River, Haines Junction, Carmacks and Teslin) that are connected. YECL's facilities are not assessed in this report.

ENERGY SUPPLY AND DEMAND IN YUKON

According to Yukon Energy's 2010 Strategic Plan the existing renewable energy sources on the grid may not be sufficient to meet power demand over the next several years:

> *In general, unless conservation measures are combined with new clean or renewable energy there will be a need to burn more diesel to meet base load demand and peak demand.*[2]

[1] YOR Document # 2011-0241-004
[2] Yukon Energy Corporation, 2010 p.7

The Strategic Plan identifies a critical need for implementing demand-side management to be able to carry forward until more renewable power sources are brought on-line. YEC is investigating projects to increase existing hydroelectric capacity via increased storage on Marsh and Atlin Lakes and the Gladstone diversion to the Aishihik facility, as well alternatives such as geothermal, biomass (wood), waste-to-energy and wind. Of the proposed hydro enhancement projects, increasing storage in Atlin Lake by placing a submerged weir in the Atlin River has been removed from consideration due to the creation of a new provincial park in British Columbia[3].

Figure 2 shows the forecast energy demand and supply for the period from 2008 to 2017. YEC's projections illustrate that there will be a significant gap between annual demand and generation at least until 2014 and quite likely into the long term as well. In the near future new industrial users coming on to the grid and expansion of residential energy and heating demand with the growth in the City of Whitehorse will place significant demands on the power grid. Figure 2 further illustrates that new hydro generation capacity (Mayo B and Aishihik 3rd Turbine) and anticipated demand-side conservation measures will not be sufficient to close the gap between supply and demand over the near term.

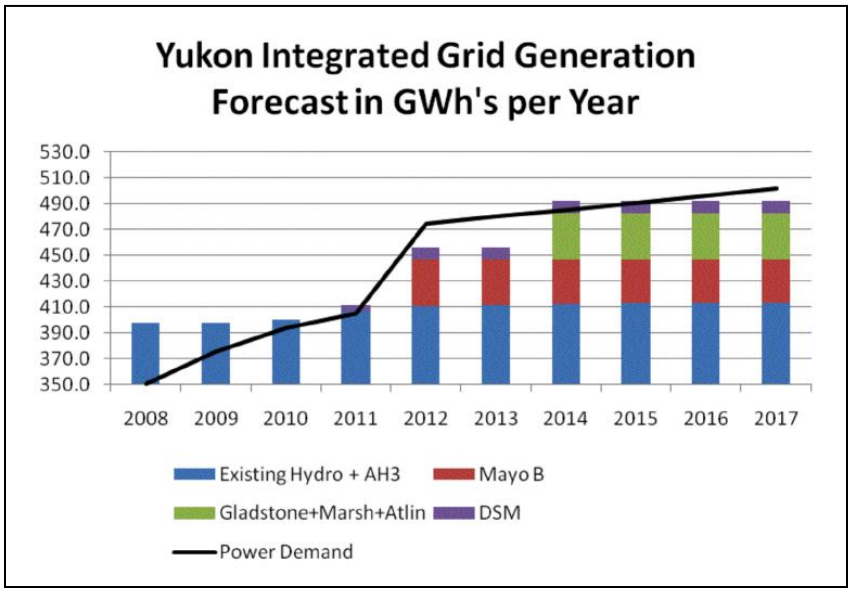

Figure 2. Yukon Integrated Grid Generation and Power Demand Forecast 2008-2017. AH3 and Mayo B should be online by the end of 2011. DSM = demand-side management[4]

With significant planning and infrastructure work required to bring other renewable sources on-line, using existing diesel generators is likely to be the only near-term option to ensure energy supply will meet demand.

In terms of economic factors, burning diesel for energy production is far more expensive than utilizing hydroelectric capacity, although the capital costs of developing hydroelectric generating stations is much larger and must be paid off over a longer period. According to the proponent, the cost of diesel power is approximately $0.30 to $0.35 per megawatt (with fuel costs at $1.00/L), or approximately $300,000 to $350,000 per GWH. Existing hydroelectric power costs $0.08 per megawatt or approximately $80,000 per GWH.

[3] Yukon Energy Corporation, 2011 (b)
[4] Yukon Energy Corporation, 2010

USE OF DIESEL GENERATION

Between 2008 and 2010, the total run time and energy produced by YEC's Whitehorse and Dawson City diesel facilities has increased substantially while numbers have also increased for Mayo and Faro. Total 2010 diesel running time at the Whitehorse facility was 261% of 2008 levels and total power generated from diesel (2.92 Gigawatt hours - GWh) was 294% of 2008 levels (0.99 GWh)[5]. Table 1 provides a summary of annual diesel generation at YEC's facilities for the 2008-2010 period.

Location	2008		2009		2010	
	Run Time (unit hrs)	**Energy Produced** (Gwhr)	**Run Time** (unit hrs)	**Energy Produced** (Gwhr)	**Run Time** (unit hrs)	**Energy Produced** (Gwhr)
Mayo	2	0.00	10	0.00	82	0.08
Whitehorse	**444**	**0.99**	**697**	**1.86**	**1163**	**2.92**
Faro	86	0.08	374	0.25	163	0.39
Dawson City	190	0.17	674	0.29	3181	3.01
YEC Totals	722	1.24	1755	2.4	4589	6.4

Table 1: Summary of Annual Diesel Generation 2008-2010.
Where run time hours show no energy produced units were operated with no load for maintenance purposes[6]

According to energy consumption charts available on YEC's website, the total power consumption across the grid for the 12-month period between November 2010 and November 2011 was 438.5 GWh[7]. Diesel generation was required to meet energy demand every month, with highest use being in the winter months for a total of 19.1 GWh of diesel generation over the whole period. Generally, diesel generation has been required to meet peak demand at times of the day when the combined loads from industrial, commercial and residential users exceeds YEC's hydro-electric capacity (i.e. mornings and evenings when residential energy use in homes is highest, which then decreases when people go to work/school etc.). The addition of industrial users such as the Minto and Bellekeno mines to the grid has placed additional base demands that mean the daily peaks in demand from the daily commercial/residential energy use cycle are much higher than previously. Construction activities at the Mayo and Aishihik hydroelectric facilities resulted in the temporary suspension of hydro generation at these facilities for periods during 2011 and necessitated higher levels of diesel generation in Dawson City and Whitehorse during the summer months than might not have otherwise occurred [8].

[5] YOR Document # 2011-0241-004, p 17.
[6] Adapted from YOR Document # 2011-0241-004, p. 17
[7] Yukon Energy Corporation, 2011 (a)
[8] YOR Document # 2011-0241-005

Despite the statement that "Yukon Energy only (emphasis theirs) uses its diesel-fired generators as back up during renewable energy system outages (planned and unplanned) and, occasionally, to supplement energy demand during colder periods of the year"[9] it is clear that with current and anticipated supply and demand conditions, these generators will be required as a core component of meeting annual energy and peak demands over the near term, particularly over the 3-year period of the proposed Air Emissions Permit renewal. Over time, if the renewable energy projects YEC is currently investigating come online the need for diesel should be reduced.

ASSESSMENT HISTORY

The Executive Committee of the Yukon Socio-economic and Environmental Assessment Board (YESAB) assessed the completion of the Carmacks-Stewart/Minto Spur Transmission line to connect the WAF and MD grids in 2007[10]. This project is of note because it brought the Minto Mine and the community of Pelly Crossing onto the WAF-MD grid, displacing approximately 34 GWh of diesel generation at those locations allowing (at the time) surplus hydro power to be used instead. While this resulted in a net beneficial effect to the territory in terms of reduction in the overall diesel use, the displacement of this demand meant that when diesel is required, it is burned at YEC facilities close to communities (mainly in Whitehorse, see Table 2) rather than at generators in isolated locations. The Executive Committee of YESAB initially looked at the impacts this would have on the air quality in and around Whitehorse, particularly the Riverdale subdivision. However, in the final evaluation it was determined that the effects of any increased diesel usage in Whitehorse should be assessed with the renewal of YEC's air emissions permit in 2008.

The assessment related to the renewal of YEC's Air Emissions Permit (No. 60-010) for their diesel generation facilities was carried out by the YESAB Whitehorse Designated Office in 2008[11]. As a result of that assessment, the Air Emissions Permit was renewed for a 3-year term that expires on December 31, 2011.

In 2009, the YESAB Mayo Designated Office assessed an amendment to YEC's Air Emissions Permit to include diesel generators at the Minto Mine[12]. These generators were not actually acquired by YEC and remain the property of Capstone Mining.

1.4 PROJECT DETAILS

The proponent is seeking a renewal of their Air Emissions Permit for the Whitehorse Rapids Diesel Plant (this assessment) and for their diesel plants located in three other Yukon communities which are subject to separate assessment by their local YESAB Designated Offices: Mayo (YOR Project # 2011-0242), Dawson (2011-0244) and Faro (2011-0246).

[9] YOR Document # 2011-0241-004 p. 5
[10] YOR Project 2006-0286
[11] YOR Project 2008-0229
[12] YOR Project 2009-0057

The Whitehorse diesel generating facility has seven separate generators that are brought into operation as necessary to meet the demand for electricity when:

- Hydro-electric facilities are taken offline for routine maintenance;
- Hydro-electric facilities are offline as a result of an emergency condition;
- Hydro-electric facilities are otherwise unable to meet current demand for energy;
- There is a need to 'exercise' a particular diesel unit as part of regular maintenance.[13]

YUKON ENERGY'S DIESEL RESOURCES

YEC's diesel generation resources across all the various locations on the grid are assigned to a 'dispatch' or 'stacking' order that prioritizes which generators will be brought online based on operational efficiency balanced with consideration to the likely location requiring the need to be met. This stacking order places the bulk of the Whitehorse diesel units ahead of those in other communities for several reasons including: their larger generator size (greater energy produced), their lower cost to operate (staff are already on site and fuel costs are lower compared to other communities) and the greatest demand is almost always in the Whitehorse area. Units undergoing maintenance, unplanned outages and emergencies may result in deviations from the preferred stacking order in some circumstances.[14] Table 2 provides additional details on YEC's diesel generating units.

[13] YOR Document 2011-0241-004
[14] YOR Document 2011-0241-007

Stacking Order	Unit No.	Location	Type	Rating (MW)	In-Service Date
1	WD6	WHITEHORSE	EMD	2.25	1990
2	WD4	WHITEHORSE	EMD	2.25	1975
3	WD5	WHITEHORSE	EMD	2.25	1975
4	WD7	WHITEHORSE	Caterpillar	2.8	1991
5	FD7	FARO	Caterpillar	2.4	1992
6	FD5	FARO	Caterpillar	1.025	1990
7	FD3	FARO	Caterpillar	0.85	1989
8	DD2	DAWSON	Caterpillar	0.92	1987
9	DD3	DAWSON	Caterpillar	0.92	1990
10	DD1	DAWSON	Caterpillar	0.72	1988
11	DD5	DAWSON	Caterpillar	1.4	1996
12	FD1	FARO	Mirrlees	5.15	1970
13	YM1	DAWSON	Caterpillar	1.3	1990
14	WD2	WHITEHORSE	Mirrlees	4.2	1968
15	WD3	WHITEHORSE	Mirrlees	4.2	1970
16	MD1	MAYO	Caterpillar	0.85	1989
17	MD2	MAYO	Caterpillar	0.85	1989
18	WD1	WHITEHORSE	Mirrlees	3.0	1968

Table 2: YEC Diesel Generation Units by stacking order[15]

All of the YEC generators pre-date the establishment of the U.S. Environmental Protection Agency (USEPA) tiered engine emission standards that were implemented in 2000 which is widely referenced in Canada as well. These units are considered “uncontrolled” meaning that there are no engine exhaust emission control devices on any YEC diesel generator. The proponent maintains that short of replacing YEC’s existing diesel units with newer engines that meet Tier 3 or 4 standards there are no upgrades possible to achieve a significant reduction in emissions. The first (and oldest) units (WD1/WD2) are not slated for retirement until 2015 and all units are likely to be replaced (at various times) by 2030[16].

In terms of emission reduction measures, ultra-low sulphur diesel is exclusively used in order to reduce emissions of particulate matter and SO_2 relative to other available fuels.[17] Preventative maintenance is regularly carried out according to the manufacturer’s specifications in order to ensure that units are running at peak efficiency[18].

[15] YOR Document 2011-0241-007
[16] YOR Document 2011-0241-007
[17] YOR Document 2011-0241-007
[18] YOR Document # 2008-0229-005

1.5 PROJECT SCOPE

The scope of the project for this assessment has been determined to be as follows:

The purpose of the proposed project is to renew YEC's Air Emissions Permit in order to maintain the ability to operate its diesel generating facilities. The principle activity is the continued operation of 7 diesel generators located at the site of Yukon Energy's Whitehorse Rapids dam adjacent to the Yukon River in Whitehorse.

The operational life of the generators is greater than 3 years, however the scope of the project assessment will include the maximum term of the Air Emissions Permit, which is 3 years.

2.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

2.1 BIO-PHYSICAL ENVIRONMENT

The project is located within the City of Whitehorse, on the west bank of the Yukon River at the Whitehorse Rapids power dam at an elevation of approximately 641 metres ASL. Immediately to the west the Yukon River valley rises abruptly to form the escarpment known locally as the "clay cliffs" that separate downtown Whitehorse from the airport and residential, commercial and industrial areas off the Alaska Highway above. The project is occurring in an urban setting, and thus wildlife are limited to those species that frequent human settlements. Several species of fish including Chinook and Coho salmon inhabit the Yukon River.

Whitehorse is located in the rain shadow of the St. Elias – Coast Mountain Range and as such its climate is relatively cool and dry with low to moderate annual precipitation. The interaction of local topography and the Yukon River result in generally more moderate temperatures in the river valley and development of ice fog in and around the downtown and Riverdale areas during the winter. Winds are commonly from the south and calm conditions are experienced over 19.6% of the time. Temperature inversions and stagnant wind conditions that can inhibit the movement of air are known to occur in the valley during the winter months which can result in limited circulation of air outside of the downtown / Riverdale areas[19].

2.2 SOCIO-ECONOMIC ENVIRONMENT

As the capital, Whitehorse is the centre of government, tourism and business for the Yukon. Economic circumstances relating to the mining and mineral exploration sectors have helped drive economic and population growth in the city and Yukon as a whole. According to the Yukon Bureau of Statistics, the population of Whitehorse in June 2011 was estimated at 26,711, representing 75.9% of the total Yukon population of 35,175[20]. The population of the city has grown by approximately 23% since 2006[21]. In response to population growth trends, the City of Whitehorse is expanding with new residential

[19] YOR Document # 2011-0241-005
[20] Yukon Bureau of Statistics, June 2011.
[21] City of Whitehorse, 2010

developments including the Whistle Bend subdivision, the proposed Porter Creek D and lot infills in various locations. Whistle Bend alone is projected to house an additional 8000 people when completed[22]. As YEC's facilities provide electrical power to all of Whitehorse, population growth is likely to be indicative of long-term increases in energy demand as more homes and workplaces will need to be lit and heated. Growth in residential, commercial and institutional energy demand is significant as it is longer lasting than demand created because of industrial mining projects that have a limited lifespan as dictated by economic factors and resource availability.

The YEC facility at the Whitehorse Rapids is located south of the downtown core and directly across the Yukon River from the Riverdale subdivision. Immediately adjacent to the north end of the YEC property is the Robert Service Campground, which provides seasonal and short-term camping accommodation for tourists and summer workers from approximately May to October.

All of Riverdale is within 2km of the diesel facilities including 5 schools: Christ the King elementary and Vanier Secondary school within 1000m, Grey Mountain elementary, Selkirk elementary and F.H. Collins secondary school all within 1500m (See Figure 3). Concerns over air quality in Riverdale, particularly during the winter months (when diesel usage at YEC and emissions from home heating with fuel oil and woodstoves are highest) have been raised by local residents in this[23] and previous assessments that have examined YEC's diesel facilities (refer to Assessment History section above).

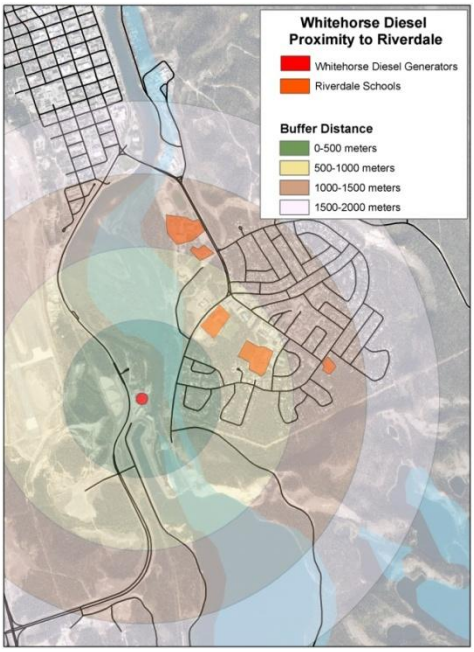

Figure 3: Whitehorse Diesel Proximity to Riverdale[24]

3.0 REQUIREMENT FOR AN ASSESSMENT

An assessment by the Designated Office is required under the following circumstances:

- An activity is proposed to be undertaken that is listed in Schedule 1 of the Assessable Activities, Exceptions and Executive Committee Projects Regulations (Activity Regulations) and not excepted. The proponent proposes to undertake activities listed in part 4 item 2(b) of the Activity Regulations, specifically:

[22] City of Whitehorse, 2011
[23] YOR Documents # 2011-0241-021, -023, -024 and -026
[24] YOR Document # 2008-0229-036

"Construction, operation, modification, decommissioning or abandonment of, or other activity in relation to... a fossil fuel-fired electrical generating station."

- The project is being undertaken in the Yukon; and
- An authorization or the grant of an interest in land by a government agency, independent regulatory agency, municipal government, or first nation is required for the activity to be undertaken.

Decision bodies and authorizations have been identified based on information in the project proposal and information submitted to the Whitehorse Designated Office during the assessment. A list of the decision body(s) and authorizations required for the project can be found in Table 3 below.

Decision Body	Authorization(s) Required	Act or Regulation
Yukon Government – Environment	Air Emissions Permit	Air Emissions Regulations pursuant to the *Environment Act*

Table 3: Decision Body(s) and Authorizations Required

4.0 SCOPE OF THE ASSESSMENT

COMMENTS, VIEWS AND INFORMATION RECEIVED

During the Seeking Views and Information stage of the assessment, comments were received from the following parties:

- Government of Yukon – Community Services, Office of the Fire Marshall
- Government of Yukon – Environment
- City of Whitehorse
- Yukon Conservation Society
- Riverdale Community Association
- Mr. Chris McNeill (Riverdale resident)

See Appendix C for the list of submissions and their corresponding YOR Document numbers for further detail.

GOVERNMENT OF YUKON

The Office of the Fire Marshall commented that a permit is required for the storage of fuel if over 4,000 litres and that fuel storage is to confirm to National Fire Code of Canada, current edition. Additionally, fire protection measures shall meet the current National Fire Code, National Building Code requirements. As these are non-discretionary measures the proponent must adhere to they have been considered as information only for the purpose of the assessment and will not be discussed further.

Environment Yukon identified Air Quality as the key environmental value that may be affected by the project and indicated that the project has the potential to emit pollutants that may affect human health. The department's concern was that ambient air quality criteria may be exceeded if diesel engines or emissions control equipment are not properly operated and maintained, or if fuels of lesser quality are burned.

Environment Yukon provided further comment and analysis on the air quality modelling report (the 2011 SENES Report) developed by the proponent's consultant. It was also noted in the comment submission that the adoption of stack emissions standards by Environment Yukon would have been helpful in determining whether or not emissions from YEC's generators are at levels that are protective of human health and the environment. These comments are considered in section 5.0 – Air Quality.

Comments concerning the modelling report notwithstanding, the conclusion of Environment Yukon's comment was to recommend that the project be allowed to proceed.

CITY OF WHITEHORSE

The City of Whitehorse provided a clear objection to what it views as a change in the anticipated operation of the YEC diesel generators within Whitehorse. Specifically, use of the Whitehorse diesel generators to meet peak demands, in the winter and early spring when the availability of hydro power is at its lowest. The City also drew attention to where the proponent's submissions to YESAB with regards to the use of diesel resources on the WAF-MD grid were in contradiction to statements made in YEC's Resource Plan Submission Overview filed with the Yukon Utilities Board in June 2006[25]:

> "Since 2006, new major industry loads have been added to the system, both WAF and MD, and more are planned in the very near future. The connection of the WAF and MD grids could result in the use of diesel generators in Whitehorse to meet those demands. Indeed, YEC states in response to YESAB information requests 2 and 3(b) filed November 7, 2011 that even with the WAF and MD grids now connected the "stacking order" prioritizes 4 Whitehorse diesel generators as the first 4 preferred units in the diesel fleet. This specifically goes against the 20-year Resource Plan where page 37 of the Overview notes it is "*... not sensible to develop new transmission to service a mine (with associated transmission losses) if the power is being generated via diesel at Whitehorse, when the same power could likely be generated at the mine site using diesel without the associated transmission losses.*" [26]

The City also commented with regards to the project scope being different in YEC's reply argument to the Yukon Utility Board (YUB) concerning the power purchase agreement between Minto Mine and YEC. In it, YEC agreed with the City's position that YEC operating the diesel generators at the mine site when peak loads require diesel generation (i.e. at winter peak capacity) offered advantages in terms reduced

[25] Yukon Energy Corporation, 2006
[26] YOR Document #2011-0241-024

line losses, cost savings due to reduced diesel (when hydro power is in surplus), less GHG (greenhouse gases) and less pollution within the City of Whitehorse[27].

The City of Whitehorse also made several comments and recommendations with regards to the project scope, environmental and health impacts, quality of life issues for City residents, summer hydro power surplus vs. winter hydro shortfalls and the geographic displacement of generation for major industrial users (specifically mines) and the need for demand side management. These comments are considered in section 5.0 – Air Quality.

YUKON CONSERVATION SOCIETY

The Yukon Conservation Society provided comments similar in many respects to those put forward by the City of Whitehorse along with several clear recommendations with regards to: the use of diesel generation by industrial consumers at peak times; demand-side management initiatives; air quality monitoring in Riverdale and downtown Whitehorse; energy audits of industrial consumers; public outreach and education; and energy policy development These comments are considered in section 5.0 – Air Quality.

RIVERDALE COMMUNITY ASSOCIATION

The Riverdale Community Association collected comments from residents both at an association meeting and via email. The Association provided a summary which included comments on: changes in the scope of diesel generation use; air quality and greenhouse gas emissions; the need for air quality monitoring; anecdotal evidence of poor air quality and diesel exhaust emissions year-round; concerns about the potential adverse cumulative effects on human health from long-term exposure to diesel emissions; noise issues; and the need for demand-side management initiatives.[28]

The comment summary provided by the Riverdale Community Association also included the comments made by Mr. McNeill in his direct submission to YESAB that had also been sent to the Association.[29] These comments are considered in section 5.0 – Air Quality.

It is clear from the project submissions, comments and publicly available information that energy generation and consumption is a multi-faceted issue in the Yukon as it is elsewhere. Many of the submitted comments and recommendations serve to inform on territory-wide energy policy issues and larger operational considerations for YEC that while relevant to the overall picture of power generation and use in the territory, are beyond the scope of this assessment. The assessor has considered these comments and recommendations and has attempted to address them where suitable within the scope of the assessment.

[27] YOR Document #2011-0241-024
[28] YOR Document #2011-0241-023
[29] YOR Document #2011-0241-021

As well, it has been noted by both the assessor and in comment submissions, that there is a lack of both specific regulations (in regards to stack emissions standards) and environmental monitoring that would provide much clarity in the assessment on the effects of the project.

Taking into account the submissions by the proponent, the regulator and the interested parties, the values considered in this assessment are:

- Air Quality (section 5.0)
- Environmental Quality (section 6.0)

PART B. EFFECTS ASSESSMENT AND REASONS FOR RECOMMENDATION

The following sections present the effects assessment of project activities related to values identified in Section 4.0. Each section includes an overview, an analysis of how project activities may affect values and, where relevant, measures to mitigate significant adverse effects. Part B ends with a conclusion of the effects assessment.

5.0 AIR QUALITY

5.1 OVERVIEW

The proposed project is the operation of 7 stationary diesel combustion generators for the purpose of power generation. In any given year, the generators may be used at any time for any duration to supplement electricity to the WAF-MD grid. Information provided during the assessment indicates the use of the generators is typically to meet peak demands, to supply electricity during unplanned outages and for planned maintenance of the system. Unplanned outages are understandably not predictable, can occur at any time of the year, under any atmospheric condition and for any length of time. Projected energy demands over the permit period will require significant increases in diesel energy production to meet base demands when hydroelectric generation capacity is exceeded. This is a substantial change from the operating requirements over the previous permit period (see Table 5 for details on diesel use projections for 2012-2014).

The burning of diesel fuel during the operation of the Whitehorse diesel plant has the potential to affect air quality. Air Quality has environmental and socio-economic value in terms of human health and safety and quality of life.

Potential effects of the project to air quality considered in this report include:

- Poor ambient air quality due to emissions of air pollutants.
- Adverse human health effects as a result of breathing degraded air.

The assessor has determined that the proposed project will not result in significant adverse effect to the valued component upon the implementation of the non-discretionary legislation, and application of the proponent's commitments and mitigations as well as the recommended mitigation measures.

The following sections discuss Yukon Air Quality Standards and how the proponent's modeling is considered in this report as well as provide a description of project effects and the rationale used to determine significance of effects of the Whitehorse diesel plant on air quality.

YUKON AIR QUALITY STANDARDS

In 2010, Environment Yukon adopted the *Yukon Ambient Air Quality Standards* for sulphur dioxide (SO_2), ground level ozone (O_3), total suspended particulate matter (TSP), carbon monoxide (CO), fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2). These are in line with Canada-wide minimum standards,

although some jurisdictions including British Columbia have enacted more stringent requirements. The standards are the maximum concentrations of pollutants acceptable in ambient air throughout the Yukon Territory (See Table 4). They are to be used to determine the acceptability of emissions from proposed and existing developments[30].

Parameter	Standard ($\mu g/m^3$)	Standard (ppm)	Standard (ppbv)
Sulphur Dioxide (SO_2)			
1-hour average			172
24-hour average			57
Annual arithmetic mean			11
Ground Level Ozone (O_3)			
8-hour running average			65
Total Suspended Particulate (TSP)			
24-hour average	120		
Annual geometric mean	60		
Carbon Monoxide (CO)			
1-hour average		13	
8-hour average		5	
Fine Particulate Matter ($PM_{2.5}$)			
24-hour average	30		
Nitrogen Dioxide (NO_2)			
1-hour average			213
24-hour average			106
Annual arithmetic mean			32

Table 4: Yukon Air Quality Standards

Note: All ambient air quality measurements will be referenced to standard conditions of 25 degrees Celsius and 101.3 kiloPascals. µg/m3 = micrograms per cubic metre, ppm = parts per million, ppbv = parts per billion by volume.[31]

Environment Yukon's comment submission cautions that these standards represent *overall* (cumulative) air quality from all sources in the environment, point and non-point. Environment Yukon commented further that comparing the incremental emissions from a particular source to the overall standard is technically not a proper comparison[32]. Should these standards be exceeded, it will be because of the cumulative effects of all various emissions to the air – although one point source may tip the balance. There is currently no mechanism in place to rectify the air quality situation if the standards are exceeded. The intent should therefore be to proactively avoid exceeding air quality standards.

In their explanation for the rationale and development of air quality standards, the Province of British Columbia Ministry of Environment notes: "as even low levels of pollution can affect some individuals, air quality objectives should not be viewed as levels we can 'pollute up to' but levels to stay well below.[33]" As such, any circumstances where overall ambient air quality standards are exceeded would be considered significantly adverse to air quality.

[30] Yukon Environment, 2010
[31] Yukon Environment, 2010
[32] YOR Document # 2011-0241-025
[33] Province of British Columbia, 2011

For $PM_{2.5}$, BC has established not only a 24-hour average air quality objective (25 µg/m^3), but also an annual average objective (8 µg/m^3) and a planning goal (6 µg/m^3)[34]. The planning goal is intended to be a voluntary target to guide planning and encourage communities to maintain good air quality in the face of economic growth and development, whereas the objectives are, as noted above, considered levels to stay well below. In comparison, Yukon Environment has set only a 24-hour average air quality objective for $PM_{2.5}$ consistent with the Canada-wide standard of 30 µg/m^3.

In the case of point emitters, stack emissions standards for a particular type of emitter (e.g., diesel generators) would be the appropriate means to assess emissions to determine if they are at levels which are protective of human health and the environment. Such standards would be directly enforceable upon an emitter. Environment Yukon went so far as to state that:

> "...Environment Yukon has not adopted stack emissions standards for diesel generators and that therefore, YEC was unable to compare the results of their 2011 stack emissions tests to such standards. Had such standards been adopted, such a comparison would have been a more appropriate indicator of whether the emissions from YEC's generators are at levels that are protective of human health and the environment."[35]

In lieu of local standards, those deemed reasonable and appropriate from another jurisdiction such as another province or the United States Environmental Protection Agency would likely be applied to assess emission rates, as noted by the proponent these are commonly referenced in Canada and elsewhere[36].

It is important to understand that even if a point emitter is operating within appropriate stack emission standards that are determined to be protective of human health and the environment, the cumulative emissions to the environment from all sources may still exceed the ambient air quality standards.

Reduction in the emissions from non-point sources is difficult, particularly as population grows. Standards applied at the time of production for consumer goods such as vehicles and stoves and public education initiatives are primarily the means through which these reductions are achieved. The greatest reduction in NO_x and PM emissions occur as older vehicles are replaced with ones meeting new emissions and fuel efficiency standards. This has been a primary driver for the decreasing trend in air contaminant levels in various Canadian cities over the last number of years. The City of Whitehorse and Yukon Environment have had an ongoing education campaign since 2008 entitled *Clear the Air* designed to discourage vehicle idling and promote good woodstove burning practices[37]. There are cumulative inputs to air emissions from many sources. However due to their highly visible nature point sources such as YEC's diesel generators represent an important component of air emissions and one where inputs to the environment can more readily be monitored and controlled than those of the collective.

[34] Province of British Columbia, 2009 (a)
[35] YOR Document # 2011-0241-025
[36] YOR Document # 2011-0241-005
[37] Yukon Government, 2008.

AIR QUALITY MODELLING AND LIMITATIONS

The proponent commissioned SENES Consultants Limited to produce a report: *Air Quality Assessment Update in Support of Permit Renewal for Diesel Generator Operations*[38]. The same firm produced an initial air quality modelling report in support of the permit renewal conducted in 2008[39]. It is worth noting that the report provided was an air quality *modelling*, not an air quality *monitoring* report.

The report includes an air emissions inventory as well as modelling of the dispersion of CO, NO_2, SO_2 and fine particulate matter ($PM_{2.5}$) under three operating scenarios for YEC's diesel facilities. Emission levels used in the model were based on stack testing conducted at YEC's Whitehorse facilities in 2011.

The three scenarios presented in the 2011 SENES Report are as follows:

- **Scenario 1** – actual operations in 2010 (a total of 2.4669 GWh diesel generation)
- **Scenario 2** – a projected average operating scenario to 2014 taking into account anticipated increases in power demand in the Yukon (a projected total of 19.4272 GWh/yr by 2014). In this scenario, projected demands were such that all diesel generation requirements were able to be met by the first few units in the stacking order (see Table 2) which are located in Whitehorse. Thus, all diesel generation for the purpose of this scenario was in Whitehorse, when in reality there would be some level of generation dispersed to other generator sites over the course of a year.
- **Scenario 3** – a projected hypothetical, worst-case and extreme operating scenario for extra-ordinarily severe drought conditions (a projected total of 75.8322 GWh/yr by 2014). Diesel requirements in this scenario exceed the generation ability of the first four Whitehorse units in the stacking order and thus some generation occurs at generators outside of Whitehorse.

Table 5 shows the summary of forecasted diesel energy requirements for the renewed permit period between 2012 and 2014. When compared to Table 1 (which shows actual generation 2008-2010) it is evident that diesel use in Whitehorse is projected to increase substantially from the previous permit period under Scenarios 2 and 3. Diesel use in the other communities is projected to increase steadily under Scenario 3. Under Scenario 2, diesel generation in Whitehorse is projected to increase over 2010 levels by 4.7, 6.1, and 7.9 times respectively for each permit year between 2012 and 2014. Under scenario 3 diesel use in Whitehorse is projected to increase over 2010 levels by 29.5, 30.1 and 30.7 times respectively for each permit year.

[38] YOR Document # 2011-0241-005
[39] YOR Document # 2011-0241-005

Facility	Permit Year Diesel Generation (GWhr)								
	2012			2013			2014		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Mayo	0.03	0	4	0.03	0	4	0.03	0	4
Whitehorse	**2.47**	**11.52**	**72.96**	**2.47**	**15.02**	**74.47**	**2.47**	**19.47**	**75.83**
Faro	0.28	0	15.11	0.28	0	16.77	0.28	0	19.64
Dawson City	2.40	0	8.73	2.40	0	11.20	2.40	0	12.72
TOTAL	**5.17**	**11.52**	**101.21**	**5.17**	**15.02**	**106.85**	**5.17**	**19.47**	**112.60**

Table 5: Summary of Forecasted Diesel Energy Requirements for 2012 to 2014[40]

The Designated Office considers Scenario 3 to be the most appropriate scenario on which to base the current assessment. Although Scenario 2 represents a reasonable portrayal of the renewable energy shortfall that is likely to occur over the permitting period, Scenario 3 as a worst-case scenario speaks to the upper end of potential diesel generation and air emissions. Nevertheless, Scenario 3 also presents limitations. One difficulty in considering the reasonableness of Scenario 3 is that it assumes the diesel facilities will be operating at 100% capacity for 24% of the total three-year model run time, less than full capacity for 34% of the time and not operate 42% of the time.[41] Unless otherwise stipulated in the Air Emissions Permit or limited by non-discretionary legislation, YEC may operate their equipment as required, which does not preclude the maximum possible extent, i.e. 100% capacity for 100% of the time. Therefore, even Scenario 3 does not represent the maximum potential emissions that could result from YEC's diesel operations. However, the likelihood that the facility will be operated at 100% capacity for 100% of the time is considered extremely low due to the need for downtime associated with maintenance.

The various components of the model are explained below:

POWER BENEFITS MODEL

Power generation forecasts in the model were created with YEC's Power Benefits Model (PBM), which is distinct from the air dispersion model used by SENES. The purpose of the PBM is to understand how potential forecasted loads may be met from all generation sources YEC maintains and factors in such

[40] YOR Document #2011-0241-004
[41] YOR Document #2011-0241-032

components as water availability for hydro generation throughout the year. When the PBM predicts a load that exceeds hydro capability, it is assigned a diesel generation asset based on the preferred stacking order (see Table 2). The PBM is unable to take into account localized outages that may dictate diesel generation requirements that do not conform to the ideal stacking order.

Another limitation of the PBM is in predicting the likely load requirements as it can be difficult to know in advance what all the potential increases in power demand are going to be from industrial, commercial, institutional and residential growth given the dynamic nature of the economy. For example, the City of Whitehorse has three different population growth projections in their 2010 Official Community Plan (OCP) – 0.5%/yr, 2.0%/yr and 3.5%/yr based on a starting population of 20,461 from the 2006 census[42]. If 2011 population estimates from the Yukon Bureau of Statistics are correct (see section 2.2), growth between 2006 and 2011 has already outpaced the high 3.5%/yr growth rate prediction in the OCP. This serves as a reminder that demand predictions from the PBM are only going to be as good as the information available at the time of input.

CALPUFF AND CALMET

Both the 2008 and 2011 SENES reports utilized a refined air dispersion model called the California Puff Model (CALPUFF) which is a recommended model in the British Columbia Dispersion Modelling Guidelines. CALPUFF utilizes a three dimensional meteorological processor known as CALMET which combines surface and upper air observations (in this case, provided by Environment Canada's weather stations at the Whitehorse airport); terrain maps (from Geomatics Canada); ground cover/land use (from the City of Whitehorse municipal planning maps); and precipitation (from Environment Canada). Hourly output conditions from CALMET combined with the measured stack emissions from YEC, physical characteristics of the YEC emissions (location, stack configuration, exit velocity and exhaust temperatures) and the diesel power generation forecast of the PBM are fed into CALPUFF. CALPUFF then provides a model of how emissions would be dispersed given all of the inputs[43].

CONSISTENCY WITH MODELLING PRACTICES

The 2011 SENES Report was generally consistent with the *Guidelines for Air Quality Dispersion Modelling in British Columbia* except for the method utilized in determining the concentration and dispersion of NO_2. Total oxides of nitrogen (NO_x) are comprised of nitric acid (NO) and nitrogen dioxide (NO_2). Typically, the concentration of NO_2 from combustion sources is 5-10% of the NO_x concentration. Transformation of NO to NO_2 continues in the atmosphere due to the rapid reaction with atmospheric ozone[44]. The Yukon Ambient Air Quality Standards set limits on NO_2 rather than NO because of its higher environmental and health impacts (as do the standards of most other Canadian jurisdictions).

Various methods exist to determine the ratio of more toxic NO_2 in the mixture of NO_x released into the air. Here SENES utilized a method called the "Jensen Method" which was developed from airborne sampling

[42] City of Whitehorse. 2010
[43] YOR Document # 2011-0241-005
[44] Province of British Columbia, 2008. p. 99

above thermal power generation (boiler) plumes in the Netherlands[45]. The "Jensen Method" is not one of the recommended means for determining NO_2 emissions in the BC or Alberta air quality modelling guidelines. Using this method assumes that NO_2 levels in the stack begin at 5% of NO_x, whereas the various methods that are recommended in the BC guidelines start with NO_2 levels in the stack at 10%. Thus, using the "Jensen Method" has the potential to under-represent NO_2 emissions by 2 to 4 times[46].

BACKGROUND AIR QUALITY

To incorporate background air quality into the model, SENES made use of the same air quality monitoring data as their 2008 report, which was obtained between 2001-2005 from the Environment Canada National Air Pollution Surveillance (NAPS) Network monitoring station located at 1091 1st Avenue in Whitehorse. Results from 2004 and 2005 were excluded from the model because of anomalously high levels of small particulate matter ($PM_{2.5}$) and NO_2 resulting from a number of nearby forest fires in those years. In their report, SENES noted that these anomalies made it difficult to define the 'normal' background levels of these contaminants, but it was felt that these years were not representative of the typical levels of $PM_{2.5}$ and NO_2 in Whitehorse[47]. Environment Yukon commented that while it is standard practice to exclude anomalous data, "it should be noted that as a result, the models do not in fact reflect "worst-case" ambient concentrations under the three operating scenarios.[48]"

In the case of Scenario 3, the exclusion of 2004-05 is particularly relevant as severe drought conditions over the summer months would not only impact water availability for hydro-electric use but also increase the severity of the forest fire season and accompanying air emissions from wildfires. Degraded air quality from wildfires would only occur during the fire season months (approximately May to October depending on conditions). If diesel generation were to be required during that period (a likely scenario if transmission on certain lines needed to be shut down due to fires) it would contribute to already substantially degraded air quality.

Environment Yukon also noted in their submission that "*the estimated 'background' air quality as utilized in the model... includes contributions from anthropogenic sources including YEC's own generators*."[49] However, diesel use in Whitehorse during 2001-2005 was significantly lower than present day and what is projected into the permit renewal period. Any contribution from YEC to background contaminant levels as applied to the model would be minimal.

In addition, background air quality used in the report was a 5-year (2001-2005) average of the 98th percentile concentration of CO and a 3-year (2001-2003) average for NO_2 and $PM_{2.5}$ for the reasons discussed above. As a result, background $PM_{2.5}$ and NO_2 rates applied in the model are more conservative than if all the daily or hourly highs and lows over the entire 3 year period were utilized.

[45] YOR Document # 2011-0241-005
[46] YOR Document # 2011-0241-032
[47] YOR Document # 2011-0241-004
[48] YOR Document # 2011-0241-025
[49] YOR Document # 2011-0241-025

More up-to-date data would be of great benefit in assessing the effects of this project. It is acknowledged that one of the limitations of relying on data from the NAPS network is the timing of data publication by Environment Canada. Data up to 2008 was utilized by Yukon Government in the publication of the 2008 State of the Environment Report indicating that more up to date information is available.

MODEL RESULTS

The 2011 SENES report found that YEC emissions alone (with background air quality excluded)

- In Scenarios 1 and 2, the Yukon air quality standards for all contaminants would not be exceeded.
- In Scenario 3, $PM_{2.5}$ emissions would exceed Yukon air quality standards two days of the year (one each in March and April) at the Maximum Point of Impingement (Max POI) on the west side of the YEC property line (see Figure 4) but not at any other locations in Whitehorse. This is due in large part to short exhaust stacks and building downwash effects at the generator facility.
- In Scenario 3, had methods from the BC modelling guidelines been applied rather than the 'Jensen Method', NO_2 emissions may have approached or exceeded the 1-hour Yukon standard at the Max POI and the Millennium Trail bridge over the Yukon River and may have approached or exceeded the 24-hour standard at the Max POI[50].

YEC emissions in combination with averaged background air quality

- In Scenario 1, the Yukon air quality standards for all contaminants would not be exceeded.
- In Scenario 2, the Yukon air quality standards for $PM_{2.5}$ would be exceeded one day of the year at the Max POI.
- In Scenario 3, the Yukon air quality standards for $PM_{2.5}$ would be exceeded 7 days of the year at the Max POI but not at any other locations in Whitehorse.
    - In Scenario 3, $PM_{2.5}$ concentrations would remain at background levels for 155 days of the year, even with severe drought conditions and maximum load operations on the diesel generators.[51]

[50] Based on information in YOR Document 2011-0241-032
[51] YOR Document #2011-0241-005

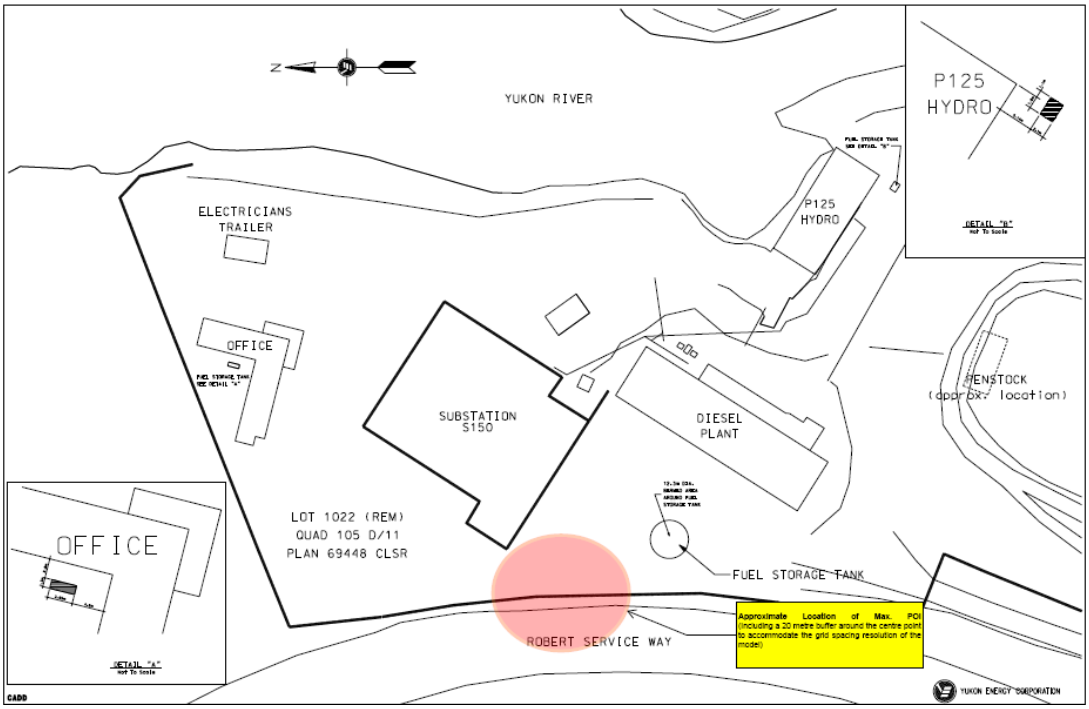

Figure 4: Diagram of Yukon Energy's Whitehorse Rapids Facility.

The Max POI on the western boundary with a 20m buffer surrounding the centre point is illustrated in pink to account for the resolution of the air dispersion model.[52]

5.2 PROJECT EFFECTS

AIR QUALITY

The operation of diesel generators to produce energy requires the combustion of diesel and the creation of diesel exhaust. Diesel exhaust is a complex mixture of combustion products[53]. The composition of the mixture is dependent on fuel composition, the design of the engine, operating conditions, lubricating oil, additives, and the emission control system[54].

Diesel exhaust is known to include approximately 40 toxic substances[55]. Among these toxic substances are substances known or suspected of being carcinogenic. These include: benzene, formaldehyde, arsenic mercury compounds, and selenium compounds. Other toxic substances include endocrine disruptors such as phenol, cadmium, lead, and dibutyl phthalate. Finally diesel exhaust can also contain: Total Particulate Matter (TPM), inhalable particulate matter less than or equal to 10 microns (PM_{10}), respireable particulate matter less than or equal to 2.5 microns ($PM_{2.5}$), Sulphur Oxides (SO_x), Nitrogen Oxides (NO_x), Carbon Oxides (CO_x), ozone (O_3), and volatile organic compounds (VOC's).

[52] YOR Document 2011-0241-007
[53] Ullman, 1989.
[54] Olbert. 1973.
[55] Cal EPA, 2007.

Once these toxic substances are in the atmospheric environment, they can result in poor ambient air quality. Values that may be affected by poor ambient air quality include the health and safety of individuals living and working in the area, plants, wildlife and even infrastructure[56].

According to the 2011 SENES Report (see section 5.1 above for results summary), there are several circumstances where the $PM_{2.5}$ concentrations are expected to exceed the Yukon Ambient Air Quality Standard. One scenario included in the report projects two days of the year under the worst case drought conditions where YEC's emissions alone would exceed the standard, prior to factoring in the background air quality.

The concentrations of NO_2 modelled using the Jensen method are potentially 2-4 times lower than if the methods prescribed by either the BC or Alberta air quality modelling guidelines had been implemented (see discussion in section 5.1 under subheading 'Consistency With Modelling Practices')[57]. Thus, the potential for exceedances of the Yukon Ambient Air Quality Standard for NO_2 exists to varying degrees at both the Max POI and the Millennium Trail bridge under Scenarios 2 and 3 and potentially significantly elevated NO_2 levels at all receptor sites[58].

In terms of the individual emissions from the project in comparison to the rest of Whitehorse, the 2008 SENES report and YEC's project supporting document from project #2008-0229 contained an estimated air emissions inventory. This attempted to inventory all the various point and non-point sources of air emissions in Whitehorse. The community inventory was estimated from 2006 levels of various activities contributing to air emissions, with diesel generation based on actual 2007 output from the Whitehorse diesel facility (approximately 0.368 GWh). However, as Table 6 shows, projected diesel energy use in Scenarios 2 and 3 over the permit renewal period is significantly higher than 2007 levels. $PM_{2.5}$ emissions from YEC for all years under Scenario 3 would exceed the combined emissions from all vehicle traffic and airport operations estimated in Whitehorse during 2006.

[56] WHO, 2010
[57] YOR Document 2011-0241-032
[58] Refer to YOR Document 2011-0241-005 p. 20 for descriptions of all receptor sites used in the modeling exercise

Emission source	YEC Annual Diesel Energy Generation		Estimated Annual $PM_{2.5}$ (t)
	GWh	% of 2007	
Actual diesel 2007	0.368	100 %	0.05
Estimated diesel in 2012 (Scenario 2)	11.52	3130 %	1.54
Estimated diesel in 2013 (Scenario 2)	15.02	4081 %	2.01
Estimated diesel in 2014 (Scenario 2)	19.47	5290 %	2.60
Estimated diesel in 2012 (Scenario 3)	72.96	19826 %	9.78
Estimated diesel in 2013 (Scenario 3)	74.47	20236 %	9.98
Estimated diesel in 2014 (Scenario 3)	75.83	20606 %	10.16
Whitehorse airport operations 2006	N/A	N/A	3.62
Local vehicle traffic 2006	N/A	N/A	4.58
Highway vehicle traffic 2006	N/A	N/A	0.49
All non-energy generation industrial point emissions combined 2006	N/A	N/A	14.83
Heating 2006	N/A	N/A	422.67

Table 6: Diesel generation and estimated $PM_{2.5}$ emissions 2012-2014 compared to selections from the 2006 Community Emissions Inventory. $PM_{2.5}$ emissions from diesel generators estimated using the measured rate of 0.134t / GWh[59]

HUMAN HEALTH AND SAFETY

The proponent, the regulator, the City of Whitehorse and the other interested parties all raised human health as a primary concern resulting from degraded air quality. As noted above, diesel combustion produces a variety of air contaminants known to cause adverse human health effects. In 2008, the Canadian Medical Association (CMA) released a study on air pollution entitled *No Breathing Room: National Illness Costs of Pollution*. The CMA estimated that in 2008, 21,000 Canadians would die from the effects of air pollution, mostly due to chronic exposure over a period of years, but 2,682 would die from acute short term exposure. By 2031, these numbers are predicted to total 710,000 and 90,000 for chronic and acute exposure respectively. The economic costs of air pollution in 2008 were predicted to top $8 billion dollars, accumulating to over $250 billion by 2031[60]. While these are national figures, they provide important context to the importance of good air quality on human health.

As $PM_{2.5}$ is of the most concern for potential exceedances of the Yukon Ambient Air Quality Standards, the focus will be on the health effects of $PM_{2.5}$. Particulate matter, especially fine particles under 2.5 micrometres (µm) in diameter are one of the most important outdoor air pollutants from a human health perspective. Because of its small particle size, $PM_{2.5}$ can be inhaled deep into the lungs and lower respiratory tract where it can damage lung cells. The large surface area of these small particles allow them to absorb ash, organic carbon, organic compounds and sulphates which can be metabolized via the respiratory system and transported throughout the body. Of the absorbed organic compounds, polycyclic aromatic hydrocarbons (PAHs) and nitro-PAHs are the most dangerous and are known to have mutagenic and carcinogenic properties.[61]

$PM_{2.5}$ exposure is linked to a range of health impacts including inflammation of the airways, more frequent use of medications, decreased lung function, exacerbation of asthma, increased emergency room visits,

[59] YOR Documents # 2008-0229-002 and # 2011-0241-004
[60] Canadian Medical Association, 2008.
[61] Sharp, 2003.

hospitalizations and premature mortality. A 2002 study by the American Cancer Society concluded that each 10 µg/m^3 increase in the long-term average ambient $PM_{2.5}$ concentrations in the air was associated with 4%, 6% and 8% increased risk of all-cause, cardiopulmonary and lung cancer mortality, respectively[62]. A separate 2002 study in California found that each 10% increase in $PM_{2.5}$ was associated with a 4.1% increase in acute respiratory hospitalizations, a 7.5% increase in chronic respiratory hospitalizations, a 5.2% increase in acute respiratory emergency room visits and a 6.5% increase in chronic respiratory emergency room visits[63].

It is important to note that no safe thresholds for $PM_{2.5}$ have been identified. The Health Canada and Environment Canada's *National Ambient Air Quality Objectives for Particulate Matter* state that:

> "...there is no clear evidence of a threshold level for the positive associations between particulate matter and both daily mortality and hospitalization rates. That is, any increase in ambient particulate matter is associated with a statistical increase in mortality and hospitalization rates, and thus, any Reference Level identified is acknowledged to lie within the 'effects range.'"[64]

In British Columbia, air quality advisories are triggered when forecast or measured running 24-hour mean concentrations of $PM_{2.5}$ reach a threshold of 25 µg/m^3. These advisories serve to inform the public of degraded air quality, decrease exposure of vulnerable persons to poor air quality and encourage the reduction or avoidance of emissions. [65]

Children face both increased exposure to and risk from $PM_{2.5}$ and air contaminants in general. They spend more time outside; are more active and so their higher ventilation rate increases quantity of contaminants they inhale; they breathe proportionally more air than adults, and their organs, respiratory system and immune system are still developing and thus more susceptible to adverse effects from air contaminants[66].

While modelled concentrations of $PM_{2.5}$ for Scenario 3 at the sensitive receptor sites are low aside from the Max POI and at the Millennium Trail bridge, the relative difference to what was modelled for 2010 actual operations, range from 16 to 90 times higher depending on the site[67]. F.H. Collins Secondary School has the greatest difference with a maximum $PM_{2.5}$ concentration of 0.03 µg/m^3 modelled for actual 2010 operations, while under Scenario 3 it has a maximum concentration of 2.7 µg/m^3 or 90 times higher. At the Max POI where exceedances were projected to occur under Scenario 3, the maximum concentration for 2010 actual operations was 1.3 µg/m^3 and for Scenario 3 was 33.5 µg/m^3 or 26 times higher. If the conclusions of Health Canada/ Environment Canada and the Van Den Eeden (2002) study regarding impacts to health from $PM_{2.5}$ are assumed to represent the Whitehorse region, this would mean

[62] Pope et al. 2002. As cited in Sharp, 2003.
[63] Van Den Eeden et. al.2002. As cited in Sharp, 2003.
[64] Health Canada and Environment Canada. 1998.
[65] Province of British Columbia, 2009 (b).
[66] Sharp, 2003
[67] YOR Document # 2011-0241-005. Table 5.1

an increased potential for respiratory related hospitalizations under Scenario 3 directly related to YEC's incremental increase in $PM_{2.5}$ emissions.

The proximity of the Robert Service Campground to the Max POI as discussed in previous sections raises a particular concern if diesel operations are ongoing during the camping season as there are short and long-term campers living essentially outdoors that would be exposed to the highest potential level of air contaminants from YEC's facilities.

AESTHETIC VALUES

Whitehorse has been identified by the World Health Organization as being the city with the cleanest air in the world according to their Urban Outdoor Air Pollution Database released in September 2011. The ranking was based on the 2008 annual average $PM_{2.5}$ level of 1.7µg/m^3.[68] This report has received significant media attention including in the *National Post*[69], on the CBC[70] and even overseas[71]. This ranking fits with the branding of Whitehorse as 'The Wilderness City' and helps to enhance tourism and business marketing in regards to the quality of life and recreational experiences available in and around Whitehorse.

YEC's facility is highly visible to all motorists entering Whitehorse via Robert Service Way and when diesel units are operating emissions are visible. The Millennium Trail runs adjacent to the YEC property and is an accessible trail used year-round for recreation activities by both residents and visitors alike. Whitehorse has an extensive trail network, several outdoor hockey rinks in Riverdale alone and many outdoor recreation activities occurring in the city year round. This includes during cold periods in the winter when diesel generation is likely to be at its highest level. Degradation of air quality including the persistent odour of diesel emissions would be a negative impact on tourism related economic development within Whitehorse as well as quality of life for residents.

In addition, comment submissions by the City of Whitehorse and residents of the Riverdale subdivision directly across the river from the YEC facility have voiced concerns in regards to the level of noise created by the operation of the diesel facilities. The Riverdale Community Association noted that this is particularly an issue for the areas in south Riverdale, including the social housing complex adjacent to the river. Specifically, disruption to sleep from use of the diesel generators at night will have a negative impact on the quality of life and health of Riverdale residents.

Any requirement to run diesel in the summer season when the Robert Service Campground is operating would also be a major noise disruption and have significant adverse impacts on the quality of visitor experience to campers

[68] Available online at http://www.who.int/phe/health_topics/outdoorair/databases/en/index.html
[69] The National Post. Sept 26, 2011.
[70] CBC News. Sept. 29 2011.
[71] The Local. Sept 27 2011.

5.3 NON-DISCRETIONARY LEGISLATION

The Designated Office has considered the requirements of the following non-discretionary legislation:

- *Environment Act (*RSY 2002, c76), Air Emissions Regulations (Y.O.I.C. 1998/207), specifically:
    - Section 3 regulates a 40% maximum opacity of visible emissions from a source not regulated by the terms and conditions of a permit under the regulations. (Part 1 Section 2 of the YEC Air Emissions Permit #4201-60-010 stipulated a 20% maximum opacity as a term and condition of the permit.)
    - Section 4 prohibits the use of fuel that has a sulphur content in excess of 1.1% except as authorized by a permit under the regulations. (Part 1 Section 3 of the YEC Air Emissions Permit restricts fuel use to that which conforms to the Canadian *Sulphur in Diesel Fuel Regulations* for off-road applications).
    - Section 6 prohibits the release of any air contaminant to such extent or degree as (a) may cause or be likely to cause irreparable damage to the natural environment; or (b) in the opinion of a health officer, cause actual or imminent harm to public health or safety.
- Occupational Health Regulations which stipulate exposure limits for air contaminants, usually based on an 8 hr permissible exposure limit;
- *Canadian Environmental Protection Act*, 1999 which speaks to the reporting requirements of the National Pollutant Release Inventory (NPRI).

5.4 SIGNIFICANCE DETERMINATION

APPLICABILITY OF NON-DISCRETIONARY LEGISLATION

Non-discretionary legislation applicable to the project has been considered in determining the significance of project effects to Air Quality. While it is acknowledged that the above-noted legislation speaks to Air Quality and emissions, the Whitehorse DO feels that additional mitigation measures are required to mitigate against the project having significant adverse effects to Air Quality.

CONCLUSIONS OF SIGNIFICANCE DETERMINATION

While all elements of the project effects discussion in Section 5.2 are critical to the determination of effects significance in regards to this project, there are several key points to emphasize from Section 5.2 and 5.4 concerning the applicability of non-discretionary legislation. In summary, they are:

- The proponent's air dispersion modelling which predicts exceedances of the Yukon Ambient Air Quality Standards from their own incremental air emissions, potentially outside of YEC plant boundaries, under a scenario which does not represent close to 100% of their available and licensed capacity to emit.
- The rationale provided by BC that air quality objectives or standards should not be viewed as levels we can 'pollute up to' but levels to stay well below.

- The projected increase in the use of diesel over the proposed permit renewal period is significantly higher than over the past decade and would result in emissions levels equivalent to all of the major transportation infrastructure in Whitehorse as per the emissions inventory done in 2006 (airport and vehicle traffic). This is particularly relevant in light of public comments received with concerns about not only future levels of diesel use but present and past levels.
- Evidence that $PM_{2.5}$, has significant adverse effects to human health. These effects are such that the Canadian *National Ambient Air Quality Objectives for Particulate Matter* outlines that any increased exposure leads to a statistical increase in mortality and hospitalizations.
- That quality of life, aesthetic values, outdoor recreation and tourism promotion all rely in part on good air quality. The proximity of YEC's diesel facilities to residential areas, outdoor recreation facilities and its exposure to visitors contribute to negative impacts on all of those areas.
- The non-discretionary legislation applicable to air emissions does not fully mitigate the adverse effects of the project.

In consideration of the above project effects assessment, comments provided during the Seeking Views and Information period and the non-discretionary legislation, the Designated Office has determined that the project will result in significant adverse effects to Air Quality. These effects can be eliminated, reduced or controlled by the application of the mitigation measures as discussed in Section 5.5.

5.5 MITIGATION

The Designated Office has considered three main elements that lend to mitigating the significant adverse effects of this project:

(a) Ensuring that appropriate and timely information exists to know when and where significant adverse effects are occurring or will occur;

(b) Ensuring that appropriate measures are taken to prevent significant adverse effects from occurring in response to the information obtained in (a);

(c) Reducing the overall need for the proposed activity (diesel power generation in proximity to a significant population base) and thus reducing the likelihood of significant adverse effects.

It is recognized that the proponent is actively investigating renewable energy sources, demand-side management programs and other initiatives related to element (c) over the medium and long term. However, during the period of the proposed permit renewal these will have limited to no effect on the need for diesel power generation.

There are a number of recommendations provided in comment submissions from the City of Whitehorse, the Yukon Conservation Society and the Riverdale Community Association that while outside of the scope of this assessment, could assist the proponent in identifying further measures to be taken to address element (c).

The following mitigation measures are therefore specified to eliminate, reduce or control significant adverse effects of the project relating to Air Quality.

1. Upon permit renewal, the proponent shall develop and implement an air quality monitoring program for the criteria air contaminants (CO, NO_x, SO_2, PM, $PM_{2.5}$). The purpose of the monitoring will be to validate the projections of the October 20, 2011 *Air Quality Assessment Update in Support of Permit Renewal for Diesel Generator Operations* prepared for proponent by SENES Consultants Limited and guide the implementation of measures to prevent the occurrence of significant adverse effects from the project on air quality.

   This program shall be developed in consultation with and to the satisfaction of Yukon Government.

   RATIONALE

   The modelling prepared on behalf of the proponent has identified situations where Yukon Ambient Air Quality Standards would be approached or exceeded potentially outside of the YEC property boundary. This was based on scenarios which did not approach the maximum ability for YEC to emit and unless otherwise limited by the permit conditions there is nothing to prevent YEC's emissions from exceeding those projected in the model. In addition, the model is a predictive model, not actual in-situ conditions and several areas of uncertainty with regards to accuracy have been identified. As the model predicts occurrences where standards would be approached or exceeded it is necessary to validate these findings.

   Informing the proponent, regulators and the public of poor air quality situations after the fact does nothing to prevent or mitigate significant adverse effects to air quality and the corresponding effects on human health. This is the current situation based on the available NAPS monitoring data. Ongoing monitoring to validate the findings of the modelling report can serve a second purpose to inform air emissions reduction measures by both the proponent and other emitters in a timely fashion to prevent significant adverse effects to air quality.

2. Upon permit renewal, the proponent shall develop and implement a plan to reduce the level of diesel energy production at the Whitehorse Rapids facility when:

   a. hydroelectric generation is insufficient to meet energy demands; and

   b. results of the ongoing monitoring set out in Mitigation 1 indicate that levels of the criteria air contaminants reach 83% of the values identified in the Yukon Ambient Air Quality Standards.

   Diesel use in Whitehorse shall be reduced to a level of energy production and associated emissions that will ensure the Yukon Ambient Air Quality Standards will not be exceeded.

   This plan shall include avoidance, where possible of timing planned maintenance or "exercising" of diesel units during periods outlined in b.

   This plan will be developed in consultation with and to the satisfaction of Yukon Government.

   RATIONALE

   Implementing a reduction in the use of diesel when monitoring indicates that levels of air contaminants are approaching the Yukon Ambient Air Quality Standards will serve to ensure that the incremental emissions from the proponent's facilities do not result in exceedances of

those standards. The 83% of standard threshold is consistent with the British Columbia standard for $PM_{2.5}$ of 25 µg/m^3 (the BC standard is 83% of the Yukon standard) and implementing preventative measures at that level would serve to prevent exceeding the Yukon standard for $PM_{2.5}$ of 30 µg/m^3.

This mitigation is specifically structured so as not to impact the proponent's obligations under the *Public Utilities Act* to provide a reliable source of power to consumers and to avoid inconvenient and potentially dangerous power interruptions. The intent is to reduce diesel use in Whitehorse during periods of peak demand exceeding hydroelectric capacity when those periods occur simultaneously with periods of degraded air quality.

If the proponent's modelling exercises prove accurate, the necessity of these measures should be relatively infrequent, be for short duration, and therefore not represent a significant operational burden to the proponent.

The intent of the mitigation is not to bind the proponent into a situation where diesel generation cannot be used at all in Whitehorse under impaired air quality conditions, but rather to disperse a portion of diesel generation to other locations as necessary to keep emissions below the Yukon Ambient Air Quality Standards.

How the proponent approaches these reductions has been left intentionally flexible, including allowing them to modify the stacking order of their diesel resources, exploring agreements with individual energy users to reduce demand or produce their own power on site, and/or other options that the proponent believes would meet the intent of the mitigation. YEC's existing diesel resources outside of Whitehorse do have the capacity to absorb a portion of the demand during these periods – total generation rating for the diesel facilities at Faro, for example, have equivalent generation capacity to the first four Whitehorse diesel units in the stacking order[72]. Although there could be "line losses" (i.e. producing power in Faro for Whitehorse), there is potential for improved efficiency if individual energy users remote from Whitehorse generate needed power on site during those periods.

5.6 RESIDUAL EFFECTS

Despite the above-mentioned mitigation measures and legislation, it is assumed that the proposed project will have residual effects on air quality. Residual effects are considered to include the release of air pollutants into the atmospheric environment from the combustion of diesel fuel.

[72] See Table 2

5.7 CUMULATIVE EFFECTS

Vehicle emissions, forest fires, home heating, other industrial sources and long-range atmospheric transport of pollutants can all play a role in overall air quality. In this context, air quality can be considered cumulative and can be impacted by the various emissions sources, atmospheric processes, plant and animal respiration, circulation patterns and local weather.

SCOPE OF CUMULATIVE EFFECTS

The potential for cumulative effects on air quality has been considered within the City of Whitehorse for the duration of the renewed Air Emission Permit (3 years).

The proposed project occurs within the City of Whitehorse. The YEC generating facilities are located in close proximity to the Riverdale, the Robert Service Campground, the Millennium Trail, and other outdoor recreational trails and facilities such as seasonal hockey rinks. Existing activities in the area include heating of homes with fuel and wood, vehicle use both for local traffic and on the Alaska Highway, the Whitehorse airport, the Schwatka Lake aerodrome, and a variety of commercial and industrial activities,

CUMULATIVE EFFECTS IN CONSIDERATION OF THE SENES MODELLING

According to the 2011 SENES Report (see section 5.1 above for results summary), there are several circumstances where the $PM_{2.5}$ concentrations are expected to exceed the Yukon Ambient Air Quality Standard when emissions from YEC are combined with estimated background pollutant levels.

In Scenario 3, with the background ambient air quality factored in the model standards for $PM_{2.5}$ would be exceeded for 7 days of the year, all of which would be in March/April.

Similarly, in Scenario 2 the $PM_{2.5}$ standard would be exceeded one day per year when background ambient air quality is factored in.

The cumulative effects projected exceedances are greater in number than those examined in the project effects section. The cumulative effects exceedances include two of the modelled scenarios and are a more realistic indicator of air quality impacts than the project effects because of the cumulative nature of the air.

The most recent Yukon State of the Environment Report – 2008 shows that annual average (not 24-hour average as referenced in the standards) $PM_{2.5}$ levels have been relatively low over the 2002-2008 period. Recorded $PM_{2.5}$ concentrations exceeded national standards of 30 $\mu g/m^3$ only 16 days during the entire 2002-2008 monitoring period. Table 7 shows the mean annual $PM_{2.5}$ concentration and the number of days the 30$\mu g/m^3$ standard was exceeded in Whitehorse between 2001 and 2008.

Year	Mean Annual $PM_{2.5}$ ($\mu g/m^3$)	Number days $PM_{2.5}$ ($\mu g/m^3$) Exceeded National Standard
2001	Began monitoring in August	Began monitoring in August
2002	2.4	0
2003	2.4	0
2004	4.8	12
2005	2.8	4
2006	Not Available	Not Available
2007	1.8	0
2008	1.9	0

Table 7. Mean annual PM2.5 concentration and number of days Yukon Ambient Air Quality Standard for PM2.5 were exceeded 2001-2008[73].

The Yukon State of the Environment Report clarifies the 2004 $PM_{2.5}$ levels and days exceeding the standard as being a result of an exceptional forest fire season. The area burned in 2004 was over 1.7 million hectares, vs. only 13,000 hectares in 2008. Data for 2006 was not available due to technical problems[74]. Good annual average indicators do not necessarily mean that air quality is acceptable year-round as the effects of poor air quality days are averaged with good air quality days. The comment submission by Mr. McNeill, a Riverdale resident since 1994, notes that his family has

> "... noticed poor air quality and the smell of diesel emissions from Yukon Energy over the past year. It has been consistent throughout the year and we have even noticed it in the summer months when local residents are not burning wood for heat. In the fall/winter months air quality in Riverdale is particularly poor under certain conditions due to the combined effects of wood smoke and diesel emissions.[75]"

Spatially, the model indicates that these exceedances would occur at a theoretical location called the Max POI (see Figure 2) due in large part to short stack heights and building downwash effects at the YEC facility. The model has a spatial resolution of 20m, and the resulting Max POI crosses over the west side of the YEC facility fence line onto Robert Service Drive.

Also of note is that the west end of the Millennium Trial footbridge over the Yukon River incurs maximum $PM_{2.5}$ concentrations over double the averaged background concentration of 8 $\mu g/m^3$ used in the model. These values are 19.43 $\mu g/m^3$ for Scenario 2 and 25.1 $\mu g/m^3$ in Scenario 3. This value for Scenario 3 exceeds 25 $\mu g/m^3$ standard set for air quality in BC and closely approaches the 30 $\mu g/m^3$ standard set in the Yukon in an area of relatively high use for outdoor recreation.

If one were to apply the same reasoning as the BC Ministry of Environment when examining ambient air quality standards not as being ceilings to pollute up to but levels to stay well below, even one day of

[73] Yukon Government, 2008
[74] Yukon Government, 2008
[75] YOR Document #2011-0241-0021

exceedance is a significant adverse effect to air quality in Whitehorse. Multiple days during times of the year not affected by forest fires represents a significant predicted change in air quality given the context of the monitoring data from 2001-2008.

CONSIDERATION OF PROJECT EFFECTS MITIGATIONS

The intent of the mitigations recommended in section 5.5 is to address the project specific impacts on air quality. It is recognized, however, that air as a medium is derived from cumulative sources, point and non-point. As a result, monitoring of air quality for the purposes set out in Mitigation 1 will result in monitoring of ambient, cumulative air quality as well. Therefore, Mitigation 2 if enacted as proposed and in a timely fashion should serve to mitigate against the project's cumulative contribution to exceeding Yukon Ambient Air Quality Standards and thus causing significant adverse effects. Under limited emergency conditions it is recognized that diesel power may be required irrespective of current contaminant levels identified by air quality monitoring and that such emergency operations may result in significant adverse cumulative effects to air quality. However, impeding the ability of YEC to operate diesel power in emergencies may lead to significant adverse effects in other areas including damage to infrastructure, human health and safety and economic activity. Mitigation 2 is specifically worded to avoid constraining the proponent in this way.

CONCLUSIONS OF SIGNIFICANCE DETERMINATION

The Designated Office concludes that the project will result in significant adverse cumulative effects to air quality. This is in consideration of how residual effects of this project interact with the effects of other projects (for which proposals have been submitted) or other existing or proposed activities. Under the majority of circumstances, the mitigations recommended in section 5.5 will eliminate, reduce or control significant adverse cumulative effects of the project relating to Air Quality. It is recognized however, that during limited emergency circumstances it may be necessary to operate the Whitehorse diesel generation facilities coinciding with times of impaired air quality that may result in significant adverse cumulative effects on air quality by exceeding the Yukon Ambient Air Quality Standards. The alternative would otherwise be to prohibit the use of the generators under such circumstances which raises the spectre of an alternate set of significant adverse effects resulting from loss of electrical supply to residential, commercial, industrial and institutional consumers in the City of Whitehorse.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse cumulative effects of the project relating to Air Quality.

3. During emergency circumstances when diesel generation is required and when Yukon Air Quality Standards are or are likely to be exceeded, the proponent shall notify the public via television, radio, internet and any other means deemed appropriate with regards to:
    a. measures they can take to limit their exposure to impaired air quality and reduce their own activities that may contribute to cumulative air quality; and
    b. when the impaired air quality conditions have ended.

RATIONALE

As it is not possible to mitigate the potentially significant adverse effects of emergency diesel generation under circumstances of impaired air quality at the source, the most reasonable option is to take measures to reduce human exposure and cumulative inputs to the air during such periods. Informing the public so that they may take individual measures to reduce their exposure and emissions is a reasonable and prudent action which will serve to minimize the significant adverse cumulative effects upon air quality, specifically the human health component.

6.0 ENVIRONMENTAL QUALITY

6.1 OVERVIEW

Project activities including the management of special waste produced at the station generated during operation of the diesel generator, have the potential to affect environmental quality.

Potential effects of the projects to environmental quality considered in this report include:

- release of special waste produced at the generating station into the environment.

The assessor has determined that the proposed project will not result in significant adverse effects to environmental quality. The following sections will provide the rational used to determine the effects and significance of the Whitehorse diesel facilities on this valued component.

6.2 PROJECT EFFECTS: WASTE MANAGEMENT

Operation of the Whitehorse diesel facilities will result in the generation of special waste such as waste antifreeze, engine oil, and batteries. If incorrectly stored or disposed of, special wastes may enter into and contaminate the local environment. Improper disposal may also result in environmental contamination at the receiving location.

Deleterious substances, specifically chemical contaminants, can cause immediate death of vegetation, fish, and wildlife if a lethal dose is received. Chemical contaminants in a sub-lethal dose can affect the long-term survival and/or reproductive success of organisms. Biomagnification of chemical contaminants can result in effects that may take a long time to be observed and affect organisms throughout the food web, including humans.

The assessor has considered relevant non-discretionary legislation (Section 6.3). The assessor has determined that the effects to environmental quality due to improper waste management are not significant. The rationale for significance determination can be found in Section 6.4.

6.3 NON-DISCRETIONARY LEGISLATION

The assessor has considered the requirements of the following non-discretionary legislation:

- *Environment Act (*RSY 2002, c76);

- Special Waste Regulations (Y.O.I.C. 1995/47);
- *Public Utilities Act* (RSY 2002, c 186) , specifically Section 106 which speaks to the duty of the company to supply utility services; and
- Sulphur in Diesel Fuel Regulations (S.O.R./2002-254), specifically for off-road applications.

6.4 SIGNIFICANCE DETERMINATION

The Designated Office has considered the information in section 6.2 and the non-discretionary legislation (Section 6.4). The assessor is satisfied that the application of the non-discretionary legislation will satisfactorily eliminate, reduce or control significant adverse effects to environmental quality due to waste.

6.5 MITIGATION

No further mitigation is required.

6.6 RESIDUAL EFFECTS

In consideration of the above-mentioned legislation, it is unlikely that the proposed project will have significantly adverse residual effects on environmental quality. As such, it is the conclusion of this assessment that the proposed project will not result in residual effects that, in combination with the effects of other projects for which proposals have been submitted or existing/and proposed activities, cause significant adverse cumulative (environmental or socio-economic) effects.

CONCLUSION OF THE ASSESSMENT

The Designated Office has given full and fair consideration to information received during this assessment, as per section 39 of *YESAA*. The Designated Office has also taken into consideration the matters referred to in section 42(1) of *YESAA*.

In conclusion, the Designated Office has recommended to the decision bodies that the project be allowed to proceed, subject to specified terms and conditions, as the project will have significant adverse environmental or socio-economic effects in or outside Yukon that can be mitigated by those terms and conditions.

Appendix A LIST OF KEY MITIGATIONS THE PROPONENT HAS COMMITTED TO UNDERTAKE

The following is a compilation of the key mitigations proposed by the proponent and noted in this report and/or the proponent's Air Emissions Permit Renewal Supporting Document[76]. These mitigations are important because they help to mitigate significant adverse effects of the project. I have confidence that the proponent will implement these mitigations and I expect that the decision body and regulators will ensure that these activities are undertaken as proposed.

1. Generators will be operated and maintained regularly as per manufacturer's specifications to provide a reliable and efficient source of electricity.
2. Visual opacity limits and monitoring.
3. Use of ultra-low sulphur fuel only.

[76] YOR Document # 2011-0241-004

Appendix B LIST OF RELEVANT NON-DISCRETIONARY LEGISLATION APPLICABLE TO THE PROJECT

The following is a notation of the key legislation and associated sections that I believe are relevant to this project. These provisions help to ensure that significant adverse effects do not occur. Note that this list is not intended to be a comprehensive list of all the relevant legislation that applies to this project. Rather it is a reflection of the legislation that was discussed in this report. I have confidence that the proponent will adhere to this legislation, and I expect that the decision body and regulators will enforce the legislation.

Legislation	Key Provisions (by part or section number)
Environment Act (RSY 2002, c76), Air Emissions Regulations (Y.O.I.C. 1998/207)	Specifically sections 3, 4, and 6
Special Waste Regulations (Y.O.I.C. 1995/47)	
Public Utilities Act (RSY 2002, c 186)	Specifically section 106
Sulphur in Diesel Fuel Regulations (S.O.R./2002-254)	Specifically for off-road applications.
Occupational Health Regulations	

Appendix C LIST OF SUBMISSIONS MADE BY INTERESTED PERSONS AND OTHERS DURING THE ASSESSMENT

Name of Person or Party	Type of Submission	YOR Document Number	Date Submitted
Mr. Chris McNeill	Comments	2011-0241-021	Nov 29 2011
Riverdale Community Association	Comments	2011-0241-023	Dec 2 2011
City of Whitehorse	Comments	2011-0241-024	Dec 2 2011
Yukon Government	Comments	2011-0241-025	Dec 2 2011
Yukon Conservation Society	Comments	2011-0241-026	Dec 2 2011

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