

From: Elizabeth.Barker@gov.yk.ca
To: [Travis.Ritchie](mailto:Travis.Ritchie@yec.yk.ca)
Subject: RE: AEP 60-010 Amendment
Date: October 13, 2020 4:05:52 PM

Good Afternoon Travis,

We have determined that the information provided in YEC's previous Faro station YESAA assessments (2008-0230 and 2011-0246) is still valid for the proposed 2020 amendment of reinstalling capacity of approximately 5.65MW at the Faro generating station. YEC has authorization to reinstall previously relocated/de-rated capacity of up to 10.6MW, cumulative station capacity, without proceeding through the YESAA assessment process. As discussed, any additional capacity increase that will bring the Faro station's cumulative capacity above 10.6MW will need to proceed through the YESAA assessment process before being considered. As this amendment doesn't change the content of your current Air Emissions Permit 60-010, we will not be issuing an amended permit and you may continue to use permit 60-010 as is .

Cheers,

Liz

Elizabeth Barker
Environmental Protection Analyst
Department of Environment
Government of Yukon
(867) 667-5456

From: Travis Ritchie
Sent: September 28, 2020 1:30 PM
To: Elizabeth.Barker
Subject: RE: AEP 60-010 Amendment

*** External E-mail: Do not click on links or attachments except from trusted senders. ***

Hi Elizabeth,

Please see the revised request for approval to reinstall previously relocated and de-rated site capacity.

I have also attached the previous Faro GS project proposal supporting document listing the past site capacity, the YESAA Evaluation Report and the YG Decision Document all for easy reference.

Thank you for your time.

Regards,
Travis

From: Elizabeth.Barker@gov.yk.ca [<mailto:Elizabeth.Barker@gov.yk.ca>]

Sent: September 28, 2020 12:58 PM

To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>

Subject: RE: AEP 60-010 Amendment

Hi Travis,

My apologies for the late reply, I only reviewed the 2014 Faro YESAA assessment. Let me have a quick look through the 2008 and 2011 reports and get back to you.

From our end, it will definitely be easier if you to resubmit the amendment application and exclude YM23-YM25 as you have mentioned below.

I fly out of the territory tomorrow and will be away for one week but I will get back to you once I return.

Thanks for your patience,

Liz

From: Travis Ritchie <Travis.Ritchie@yec.yk.ca>

Sent: September 24, 2020 10:06 AM

To: Elizabeth.Barker <Elizabeth.Barker@gov.yk.ca>

Subject: RE: AEP 60-010 Amendment

Importance: High

Hi Elizabeth,

Thanks for your reply.

Given that the facility was assessed favourably under YESAA in both 2008 and 2011, prior to relocating units FD3 (1 MW) and FD5 (1.4 MW) and there have been no other changes to the facility since 2008, I was anticipating that either Decision Document 2008.0230 or 2011.0246 were technically still valid for the purposes of granting an approval to at least reinstall both the relocated and de-rated generating capacity at the site. Those were the only changes to the facility during its last assessment, so the activities remain the same across all assessments. I understand the need to assess the additional capacity (beyond what has been assessed historically) before it can be permitted, but I would ask for approval to reinstall the previously relocated and de-rated capacity

pursuant to the 2008/2011 assessment findings and related decision documents.

If you need, I can resubmit the amendment application for reinstallation of only the previously assessed capacity, removing reference to the 3 additional units (YM23-YM25). YEC can then work on getting a YESAA assessment completed for the additional capacity, which could be permitted afterward.

Does that sound reasonable? If it's helpful to speak on the phone please let me know and I will call you at a convenient time.

Thanks again.

Regards,

Travis

From: Elizabeth.Barker@gov.yk.ca [<mailto:Elizabeth.Barker@gov.yk.ca>]

Sent: September 23, 2020 5:03 PM

To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>

Subject: AEP 60-010 Amendment

Good Afternoon Travis,

According to the Assessable Activities Regulation under YESAA, Part 4, Item 2 (b) applies to your AEP 60-010 amendment application.

PART 4

Energy and Telecommunications

Column 1		Column 2
Item	Activity	Specific Exception
1	Construction, installation, operation, modification, decommissioning or abandonment of, or other activity in relation to, a power line or a telecommunications line	
2	Construction, operation, modification, decommissioning or abandonment of, or other activity in relation to, • (a) a hydroelectric generating station; • (b) a fossil fuel-fired electrical generating station; • (c) a wind-powered electrical generating station; • (d) a wood-fired electrical generating station; or • (e) a wood-fuelled heating facility for the commercial sale of heat	Construction, operation, modification, decommissioning or abandonment of, or other activity in relation to, a wind-powered electrical generating station if its production capacity is, and in the case of a modification remains, 50 kW or less

Specifically, the Faro generating station underwent a YESAA assessment in 2014. In the assessment, FD1 and FD7 were assessed with production capacities of 5.15MW and 3MW for a total of 8.15MW.

Currently, FD1 and FD7 have been derated to 2.4MW and 2.8MW however, with the addition of YM20-22 (5.4MW) and the addition of the YM23-25(5.4MW) as emergency backup, this brings the station capacity to a total of 16MW. This is 7.85MW greater than the capacity that was previously assessed in 2014. As the modification of production capacity is greater than 50kW, this project will need to proceed through YESAB before we can issue any permit amendments.

Please let me know if you would like to discuss this further.

Have a great day,

Liz



**Yukon Energy
Corporation**

P.O. Box 5920
Whitehorse
Yukon Y1A 6S7
Ph: (867) 393-5300
Fax: (867) 393-5322

September 28, 2020

File: 2515.03.01

Elizabeth Barker, Environmental Protection Analyst
Department of Environment, Standards & Approvals Section
Yukon Government
Box 2703
Whitehorse, Yukon Y1A 2C6

(Via email)

Dear Ms. Barker,

**RE: AIR EMISSIONS PERMIT NO. 60-010 – APPLICATION FOR APPROVAL TO INSTALL
PREVIOUSLY REPLOCATED AND DERATED GENERATING CAPACITY - FARO GENERATING STATION**

Please find an application and supporting documentation regarding the above referenced permit amendment request. Pursuant to permit Part 2, Item 5, we are seeking approval to reinstall site capacity that was relocated to other generating stations in recent years, as well derated site capacity with existing units.

Please contact me by telephone at 867.393.5350 or by email: travis.ritchie@yec.yk.ca if you have any questions, comments, or concerns with this submission.

Thank you for your time and consideration in this matter.

Yours Sincerely,

A handwritten signature in blue ink, appearing to read "Travis Ritchie", with a stylized flourish extending from the end.

Travis Ritchie, P.Biol.

Manager – Environment, Assessment, & Licensing

Attachment:

Air Emissions Permit Application and Supporting Attachments A-C



APPLICATION FOR RENEWAL, AMENDMENT OR
CANCELLATION OF *ENVIRONMENT ACT* PERMITS

Please complete the following and ensure that all information is legibly printed or typed:

Permittee: Yukon Energy Corporation
(Business or individual name)

Permit type: Air Emissions Permit
(e.g. pesticide, special waste, air emissions, solid waste, land treatment facility, relocation, ODS/OH)

Permit number: 60-010
(e.g. 4201-XX-XXX)

Please check (✓) appropriate box:

Renewal

☐ I have fully reviewed my permit and the information on my current permit is correct and complete and my business is operating as described therein.

Amendment

☒ I have fully reviewed my permit and the following changes or additions have occurred and should be taken into account when renewing my permit (attach additional information if necessary):

Ownership: Yukon Energy Corporation (no change)

Mailing Address: Box 5920

Whitehorse Yukon Y1A 6S7

Site Location(s): Faro Generating Station (XX, Faro, YT)

Telephone #: 867.393.5350 Fax #:

Email: travis.ritchie@yec.yk.ca

Products/Activities: Reinstall previously relocated/derated capacity (aprx. 5.65 MW)

Transport special wastes: yes: ☐ no: ☐

Other: See attached supporting documents.

Note: additional information may be required depending on the nature of the change.

Cancellation

☐ I am no longer undertaking the activities authorized by the above permit. I understand that I will be contacted by enforcement officials to confirm that a permit is no longer required, at the following coordinates:

Mailing Address:

Site Location(s):

Telephone #: Fax #:

Email:

Permitted Activities:

I, Travis Ritchie [print name clearly], certify that I am an authorized representative of Yukon Energy Corporation [business name], and hereby make application for the renewal, amendment or cancellation of the above-noted permit, as indicated, and certify that the information provided on this form is correct.

Signature of applicant

Sepetmber 28, 2020
Date

3 (Attachments A-C)
of attachments

This information is being collected under the authority of s.90 of the *Environment Act*. For further information contact the Environmental Programs Branch at (867) 667-5683.

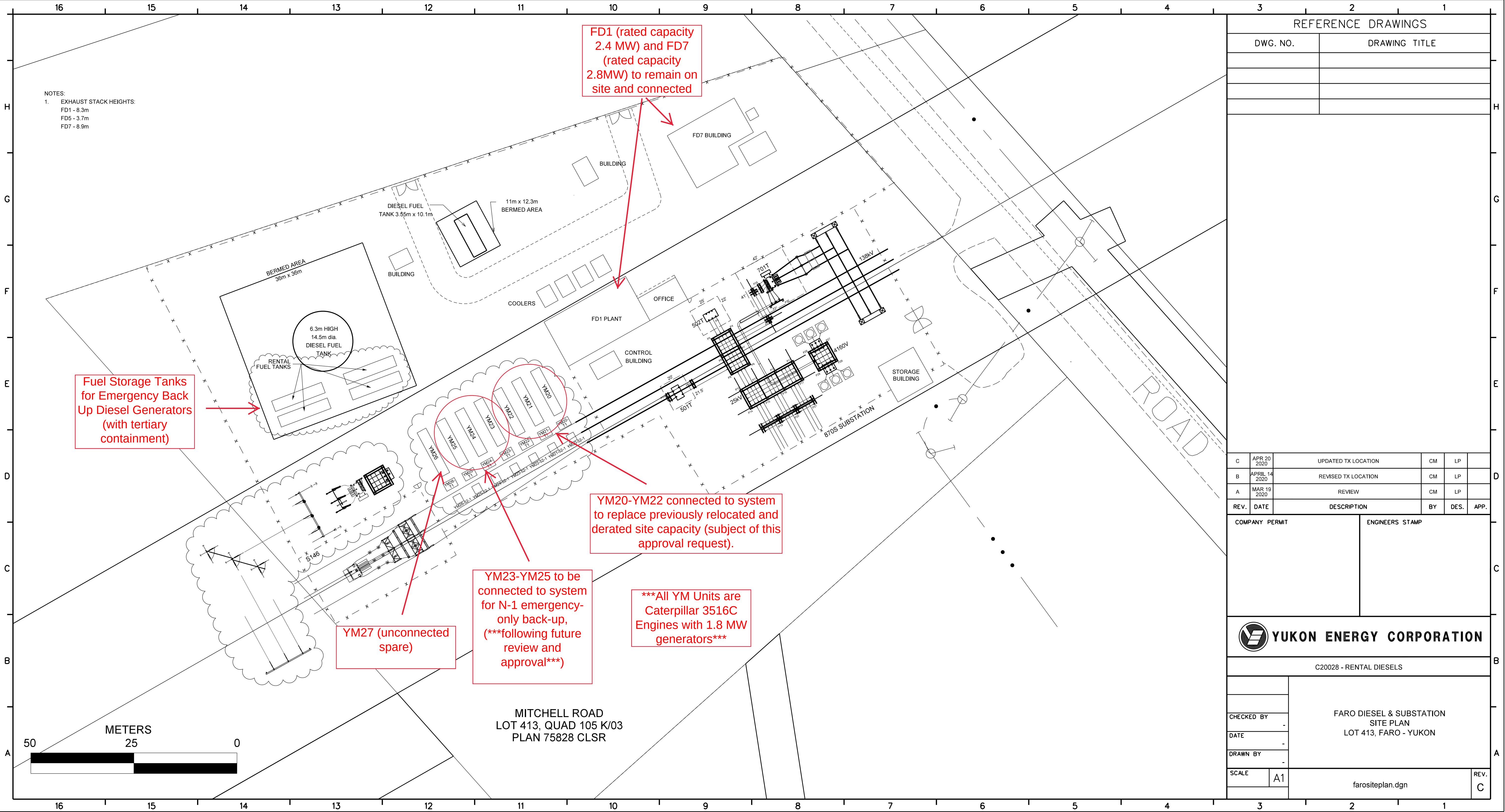
***AIR EMISSIONS PERMIT (NO. 60-010)
AMENDMENT APPLICATION
SUPPORTING DOCUMENT***

ATTACHMENT A

***FIGURE 1
INSTALLATION SITE LAYOUT***

September 2020





**AIR EMISSIONS PERMIT (NO. 60-010)
AMENDMENT APPLICATION
SUPPORTING DOCUMENT**

ATTACHMENT B

**EPA APPROVED TIER 2
3516C CATERPILLAR ENGINE
GENERATOR SPECIFICATIONS**

September 2020





Image shown may not reflect actual package

STANDBY 2000 kW PRIME 1825 kW POWER MODULE 50/60 Hz

Frequency	Voltage	Standby kW (kVA)	Prime kW (kVA)
60	480/277V	2000 (2500)	1825 (2281)
50	400V	1440 (1800)	1310 (1638)

FEATURES

EPA TIER 2 and CARB certified for non-road mobile applications. Factory designed, certified prototype tested with torsional analysis. Production tested and delivered in a package that is ready to be connected to your fuel and power lines. Supported 100% by your Caterpillar® dealer with warranty on parts and labor. Extended warranty available in some areas. The generator set is designed and manufactured in an ISO 9001:2000 compliant facility. Generator set and components meet or exceed the following specifications: AS1359, AS2789, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO3046/1, ISO8528, NEMA MG1-22

CATERPILLAR SR4B GENERATOR

Single bearing, wye-connected, static regulated, brushless permanent magnet excited generator designed to match the performance and output characteristics of the Caterpillar diesel engine driving it.

RELIABLE, FUEL EFFICIENT DIESEL ENGINE

The compact, four-stroke-cycle diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.

CATERPILLAR COOLING SYSTEM

Sized compatible to rating with energy efficient fan and core.

CATERPILLAR SWITCHGEAR

Provides single unit and/or multi-unit/utility paralleling components. Standby, load sense/load demand, import, export, and base load modes. Comes standard with Basler Utility Multi-function Relay IPS-100.

EXCLUSIVE CATERPILLAR DIGITAL VOLTAGE REGULATOR (CDVR)

Three-phase sensing and adjustable Volts-per-Hertz regulation give precise control, excellent block loading, and constant voltage in the normal operating range.

ENVIRONMENTALLY FRIENDLY

110% spill containment of onboard engine fluids.

SOUND ATTENUATED CONTAINER

For ease of transportation and protection. Meets 75 dB(A) at 50 ft or below per SAE J1074 measurement procedure at 110% prime load.

FACTORY INSTALLED STANDARD EQUIPMENT

SYSTEM	STANDARD EQUIPMENT
Engine	EPA approved Tier 2 3516C Caterpillar engine Heavy duty air cleaner with service indicator 60-Amp charging alternator Fuel filters – primary and duplex secondary with integral water separator and change-over valve Lubricating oil system with spin-on, full flow oil filters and water cooled oil cooler Oil drain lines routed to engine rail Jacket water heater Fuel cooler and priming pump Electronic ADEM™ A3 controls 24V electric starting motors with battery rack and cables
Generator	SR-4B brushless, permanent magnet excited, three-phase with Caterpillar digital voltage regulator (CDVR), space heater, 6-lead design, Class H insulation operating at Class F temperature for extended life, winding temperature detectors and anti-condensation space heaters (120/240V 1.2 kW)
Containerized Module	40' ISO high cube container, CSC certified 3-axle, 40' ISO container chassis Seven (7) sound attenuated air intake louvers and 4 lockable personnel doors with panic release Side bus bar access door, external access load connection bus bars Shore power connection via distribution block connections for jacket water heater, battery charger, space heaters, and generator condensate heaters Standard lighting 3 AC/4 DC, one (1) single duplex service receptacle, 2 external break-glass emergency stop push buttons 1,250 gal fuel tank, UL listed, double wall, 9 hr runtime @ prime rating Sound attenuated 75 dB(A) @ 50 ft Spill containment 110% of all engine fluids Four (4) oversized maintenance-free batteries, battery rack and 20-Amp battery charger Hospital grade, internally insulated, rectangular exhaust silencer with vertical discharge Vibration isolators, corrosion resistant hardware and hinges External drain access to standard fluids Fire extinguishers (Qty 2) Standard Cat rental decals and painted standard Cat power module white Interior walls and ceilings insulated with 100 mm of acoustic paneling Floor of container insulated with acoustic glass and covered with galvanized steel
Cooling	Standard cooling provides 43° C ambient capability (60 Hz) at prime +10% rating Vertically mounted, separate ATAAC and JW cores with vertical air discharge
Generator Paralleling Control	Custom switchgear control with EMCP 3.3 genset mounted controller and wall mounted paralleling controls Automatic start/stop with cool down timer Protections: 25, 27/59, 40, 32, 81 O/U Utility multi-function relay protections: 25,27/59, 32, 47, 50/51, 62, 67, 81 O/U UMR is IEEE1547-2003 compliant in most applications Reverse compatibility module provided for interface to legacy power modules Touch screen controls with event log Multi-mode operation (island, multi-island and utility parallel), load sharing (multi-unit only) Import & export control (utility parallel only), manual and automatic paralleling capability Touch screen display (status and alarms) Metering display: voltage, current, frequency, power factor, kW, WHM, kVAR, and synchroscope
Quality	Standard genset and package factory tested UL, NEMA, ISO and IEEE standards O&M manuals

SPECIFICATIONS

CAT SR4B GENERATOR

Frame Size 825
 Pitch 0.6667
 No. of poles 4
 Excitation Static regulated brushless PM excited
 Constructions Single bearing, close coupled
 Insulation Class H
 Enclosure Drip proof IP22
 Alignment Pilot shaft
 Overspeed capability – % of rated 125% of rated
 Voltage regulator 3 phase sensing with Volts-per-Hertz
 Voltage regulation Less than $\pm 1/2\%$ voltage gain
 Adjustable to compensate for engine speed droop and line loss
 Wave form deviation Less than 5% deviation
 Telephone Influence Factor (TIF) Less than 50
 Harmonic Distortion (THD) Less than 5%

CAT 3516C DIESEL ENGINE

3516C, 4-Stroke diesel
 Bore – mm (in) 170 (6.7)
 Stroke – mm (in) 190 (7.5)
 Displacement – L (cu in) 69 (4,210)
 Compression ratio 15:1
 Aspiration ATAAC
 Fuel system EUI
 Governor type Caterpillar ADEM™ A3 Control System

TECHNICAL DATA

Materials and specifications are subject to change without notice.

Generator Set Technical Data		50 Hz		60 Hz	
	Units	Prime	Standby	Prime	Standby
Performance Specification		DM8754		DM8264	
Power Rating	kW (kVA)	1310 (1637)	1440 (1800)	1825 (2281)	2000 (2500)
Lubricating System					
Oil pan capacity	L (gal)	401.3 (106)		401.3 (106)	
Fuel System					
Fuel Consumption					
100% load	L (gal)	350.1 (92.5)	372.9 (98.5)	483.2 (127.6)	525.7 (138.9)
75% load	L (gal)	281.9 (74.5)	302.8 (80)	380 (100.4)	408.2 (107.8)
50% load	L (gal)	205.5 (54.3)	350.1 (92.4)	270.5 (71.5)	294.2 (77.7)
Fuel tank capacity	L (gal)	4731 (1,250)		4731 (1,250)	
Running time @ 75% rating	Hours	16.7	15.6	12.5	11.5
Cooling System					
Radiator coolant capacity including engine	L (gal)	630 (166)		630 (166)	
Air Requirements					
Combustion air flow	m³/min (cfm)	114.8 (4052)	118.1 (4173)	174.7 (6169)	180.3 (6367)
Maximum air cleaner restriction	kPa (in H ₂ O)	6.2 (24.9)		6.2 (24.9)	
Generator cooling air	m³/min (cfm)	140 (5,933)		168 (4,995)	
Exhaust System					
Exhaust flow at rated kW	m³/min (cfm)	311.3 (10,993)	320.8 (11,335)	404 (14,260)	428.6 (15,137)
Exhaust stack temperature at rated kW – dry exhaust	°C (°F)	502.1 (935.8)	513.1 (955.6)	387 (728)	405 (762)
Noise Rating (with enclosure)					
@ 7 meters (23 feet)	dB(A)	77	78	78	79
@ 15 meters (50 feet)	dB(A)	73	74	74	75

Model	Length mm (in)	Width mm (in)	Height mm (in)	Weight	
				With Lube Oil and Coolant kg (lb)	With Fuel, Lube Oil and Coolant kg (lb)
XQ2000 w/o Chassis	12 192 (480)	2438 (96)	2896 (114)	34 019 (75,000)	38 102 (84,000)
XQ2000 w/Chassis	12 192 (480)	2438 (96)	4267 (168)	38 102 (84,000)	42 184 (93,000)

RATING DEFINITIONS

Standby – Applicable for supplying continuous electrical power (at variable load) in the event of a utility power failure. No overload is permitted on these ratings. The generator on the generator set is peak prime rated (as defined in ISO8528-3) at 30° C (86° F).

Prime – Applicable for supplying continuous electrical power (at variable load) in lieu of commercially purchased power. There is no limitation to the annual hours of operation and the generator set can supply 10% overload power for 1 hour in 12 hours.

STANDARD FEATURES

GENERATOR SET EMCP 3.3 LOCAL CONTROL PANEL

- Generator mounted EMCP 3.3 provides power metering, protective relaying and engine and generator control and monitoring.
- Provides MODBUS datalink to paralleling control for monitoring of engine parameters.
- Convenient service access for Caterpillar service tools (not included).
- Integration with the CDVR provides enhanced system monitoring.
- Ability to view and reset diagnostics of all controls networked on J1939 datalink.
- Network modules via the control panel removes the need for a separate service tool for troubleshooting.
- Real-time clock allows for date and time stamping of diagnostics and events.

EMCP 3.3 ENGINE OPERATOR INTERFACE

- Graphical display with positive image, transfective LCD, adjustable white backlight/contrast.
- Two LED status indicators (1 red, 1 amber).
- Three engine control keys and status indicators (Run/Auto/Stop).
- Lamp test key.
- Alarm acknowledgement key.
- Display navigation keys.
- Two shortcut keys: Engine Operating Parameters and Generator Operating Parameters.
- Fuel level monitoring and control.

CIRCUIT BREAKER

- 3000A fixed type, 3 poles, genset mounted, electrically operated, insulated case circuit breaker.
- Solid state trip unit for overload (time overcurrent) and fault (instantaneous) overcurrent protection.
- Includes DC shunt trip coil activated on any monitored engine or electrical fault, 100 KA-interrupting capacity at 480 VAC.

VOLTAGE REGULATION AND POWER FACTOR CONTROL CIRCUITRY

- Generator mounted automatic voltage regulator, microprocessor based.
- Manual raise/lower voltage adjust capability and VAR/power factor control circuitry for maintaining constant generator power factor while paralleled with the utility.
- Includes RFI suppression, exciter limiter and exciter diode monitoring.
- Voltage and power factor adjustments are performed on the setting screen of the HMI touch screen.

FUEL TANK

- UL Listed 1250 gallon double walled.
- Fuel transfer system

CURRENT TRANSFORMERS

- CT's rated 3000:5 with secondaries wired to shorting terminal strips.

POTENTIAL TRANSFORMERS

- 4:1 ratio with primary and secondary fuse protection.

BUS BARS

- Three phase, plus full rated neutral, bus bars are tin-plated copper with NEMA standard hole pattern for connection of customer load cables and generator cables.
- Bus bars are sized for full load capacity of the generator set at 0.8 power factor.
- Includes ground bus, tin-plated copper, for connection to the generator frame ground and field ground cable.

AC DISTRIBUTION

- Provides 240 VAC for all module accessories.
- Includes controls to de-energize jacket water heaters and generator space heater when the engine is running.

SHORE POWER TWO (2)

- One (1) shore power connection distribution block for jacket water heaters.
- One (1) for generator space, battery charger, and fuel pump.

INTERNAL LIGHTING

- Four (4) internal DC lights with one (1) timer and two switches installed at each side of the container door.
- Three (3) internal AC lights.
- One (1) single duplex service receptacle.

BATTERY CHARGER AND BATTERIES

- 24 VDC/20A battery charger with float/equalize modes and charging ammeter.
- Maintenance free batteries.

EMERGENCY STOP PUSHBUTTON

- Two external ESPs located near each access door.

MODES OF OPERATION

Caterpillar utility paralleling controls are intended for automatic or manual paralleling with a utility power source as a load management system, with provisions for standby operation feeding an isolated load network. Load management operation involves microprocessor-based automatic loading controls with soft loading, base load, Import/Export control and soft unloading. For Standby operation, the generator operates as an isochronous machine isolated from the utility supply. The controls allow for automatic operation, initiated locally or remotely by the customer's SCADA system. Detailed modes of operation are listed below:

SINGLE UNIT ISLAND AND MULTI-UNIT ISLAND OPERATION

1. Utility Standby Mode (Normal)
 - a. The utility is providing power for the plant loads.
 - b. The Power Module Generator breaker is open.
 - c. The pm is in automatic standby mode to respond to a utility failure.
2. Emergency Mode (Emergency)
 - a. Utility Failure
 - 1) The customer protective relaying senses a utility abnormal condition.
 - 2) A run request is sent to the Power Module Generator plant.
 - 3) The first Power Module Generator reach rated to voltage and frequency is closed to the bus.
 - 4) In Multi-Unit Island Mode, the remaining Power Module Generators are paralleled to the bus as they reach rated voltage and frequency. This function is performed via the ModBus Plus data link connected between the Power Modules.
 - 5) Plant load is transferred to the Power Modules, which share load equally via ModBus Plus data link.
 - 6) The system is now in Emergency Mode.

GENERATOR DEMAND PRIORITY CONTROL

The System Controls include a Generator Demand Priority Control function to automatically match the on-line Power Module Generator capacity to the loads in order to avoid unnecessary operation of all the Power Module Generators when the plant loads are low.

The following controls are provided for each Power Module Generator:

- a. User-settable Generator Priority Selector
- b. Status indicator for the Generator Priority selected
- c. Status indicator for Power Module Generator on-line or off-line
- d. Generator Demand Priority Control Switch (On/Off)
- e. User-settable Generator Remove Level (% as a function of single generator capacity)
- f. User-settable Generator Remove Time Delay
- g. User-settable Generator Add Level (% as a function of single generator capacity)
- h. User-settable Generator Add Time Delay

Upon entrance into Emergency Mode, all generators will be started and paralleled to the bus. After the Remove Time Delay, Power Module Generators will be removed from the bus as a function of the generator percentage loading. Generators will be removed from the bus in descending priority order.

Should the generator percentage loading increase to the user-selected Generator Add Level after the user-selected Generator Add Time Delay, the next priority generator will be started, synchronized and paralleled to the bus. Should the Power Module Generator plant ever reach 100% loading, the next priority generator will be started and added to the bus, bypassing the Generator Add Time Delay.

MODES OF OPERATION (continued)

SINGLE UNIT IMPORT, EXPORT OR BASE LOAD OPERATION

During periods of peak demand the system may be placed in operation using the operator interface panel on the front of the switchgear.

1. Entry – Local

- a. The operator places the System Control Switch into Load Management.
- b. The operator selects Import, Export or Base Load Operation.
- c. The Load Management Setpoint is the amount of power Imported, Exported or Base-Loaded. A 4-12-20mA signal is provided by the customer and is linearly proportional to the utility load, with 12mA equaling 0 kW. The 4-12-20mA utility load signal is wired to one and only one Power Module. If the Power Module selected for Load Management is not available, the 4-12-20mA signal will be routed to a different Power Module.
- d. The operator sets the Load Management Setpoint and Power Factor Setpoint.
- e. A Run request signal is received by the Single Unit Power Module.
- f. The Power Module Generator is started and will run for a predetermined warm-up time before it is synchronized and paralleled to the utility.

- g. When the generator is on the bus, it is soft-ramp-loaded until the generator output reaches the Load Management Setpoint.
 - h. The generator output is dynamically adjusted to maintain the Load Management Setpoint.
 - i. Should the utility fail during Load Management Operation, the Protective Relay will cause the Paralleling Circuit Breaker 52G to open and be locked out until the Lockout Relay is manually reset by an operator on site. The generator is allowed to run for the duration of the cooldown time.
- #### 2. Exit – Local
- a. The Run Request signal is removed from the power module.
 - b. The generator is soft-ramp-unloaded until the plant load is fully supported by the utility.
 - c. The Paralleling Circuit Breaker 52G is opened.
 - d. The generator is allowed to run for the duration of the cooldown time.

STANDARD PARALLELING CONTROL

GENERATOR PARALLELING CONTROLS

The switchgear includes:

- Single unit island mode.
- Multiple unit island mode.
 - Includes Load Sense/Load Demand control.
 - Load sharing capability is provided via network communication.
- Single unit utility parallel mode.
 - Selectable for Import/Export control.
 - If import or export control is selected a 4-12-20mA signal is required (provided by others) scalable to the utility contribution.
- 6 inch black and white HMI touch screen.
- Reverse compatibility module provided for interface to legacy designed Power Module Switchgear. Includes PLC, load share and voltage droop.

Incoming Utility Breaker Status Circuit – Circuit to accept customers contact from remote utility disconnect device. Customer to provide a normally open form 'a' contact to indicate when the local load network is connected to the utility grid.

Utility Transfer Trip Circuit – Circuit accepts input (normally open dry contact) from customer's system protective relay(s) or other controlling device. Operation of contacts causes tripping of the generator circuit breaker via the generator (software) 86 lock-out function and places the engine in cooldown mode. Circuit is disabled when operating in single unit or multiple unit island.

GENERATOR PARALLELING CONTROLS OPERATOR INTERFACE

Graphical mimic one line diagram that shows generator with its respective circuit breaker in a one-line representation of the system. The graphics utilize black and white indicators and bar graphs while actively displaying the following information:

- Utility CB Open/Closed. Input contacts provided by others.
- Utility kW 4-12-20mA signal required and provided by customer that is scalable to the utility contribution.
- Generator CB Open/Closed/Tripped.
- Generator Volts/Amps/kW/Frequency.
- Engine Stopped/Running/Cooldown/Pre-Alarm/Shutdown.
- Engine ECS Position Stop/Auto/Run.
- Utility Output kW.
- System Summary Alarm.

Event logging is also included with up to 500 stored events.

GENERATOR METERING AND PROTECTION

Generator metering that will graphically display 3Ø Voltage, 3Ø Current, Frequency, Power Factor, kW, kVAR and a Synchroscope Display of EMCP 3.3 faults, CDVR or ADEM 3 will be provided via Modbus RTU interface to EMCP 3.3.

Generator/Intertie Protective Relaying including:

- Device 27/59 – Under/Over Voltage.
- Device 81O/U – Under/Over Frequency.
- Device 40 – Loss of Excitation.
- Device 32 – Reverse Power.
- Device 25 – Synchronizing Check.
- Device 15 – Auto Synchronizer.
- Device 65 – Governor Load Sharing, Soft Loading Control.
- Device 90 – VAR/PF and Cross Current Compensation Controller.

PROGRAMMING AND DIAGNOSTICS

Includes field programmable set points for engine control and monitoring variables and self-diagnosis of the EMCP 3.3 system component and wiring failures.

ENGINE CONTROL SWITCH

Keypad selectable, four (4) positions – Off, Auto, Man, Cool:

- Off for engine shutdown and resetting faults.
- Auto for local or remote automatic operation when initiated by switch operation or contact closure.
- Man for local starting and manual paralleling.
- Cool for normal engine shutdown with timed cool-down cycle.

CIRCUIT BREAKER CONTROL SWITCH

Heavy duty, three- (3) position spring return to center with momentary trip and close position and slip contacts for automatic closing. Includes circuit breaker position indicating lamps.

EMERGENCY STOP PUSHBUTTON

- Mushroom head, twist to reset, causes engine shutdown and tripping of the generator circuit breaker. Prevents engine starting when depressed.

STANDARD PARALLELING CONTROL (continued)

ELECTRONIC LOAD SHARING GOVERNOR

- Includes speed adjustment, and auto load share capability when in parallel with legacy power modules.

ALARM MODULE

- Dedicates annunciator screens for warning and shutdown faults. Includes external mounted horn and acknowledge push-button.

AUTOMATIC/MANUAL PARALLELING

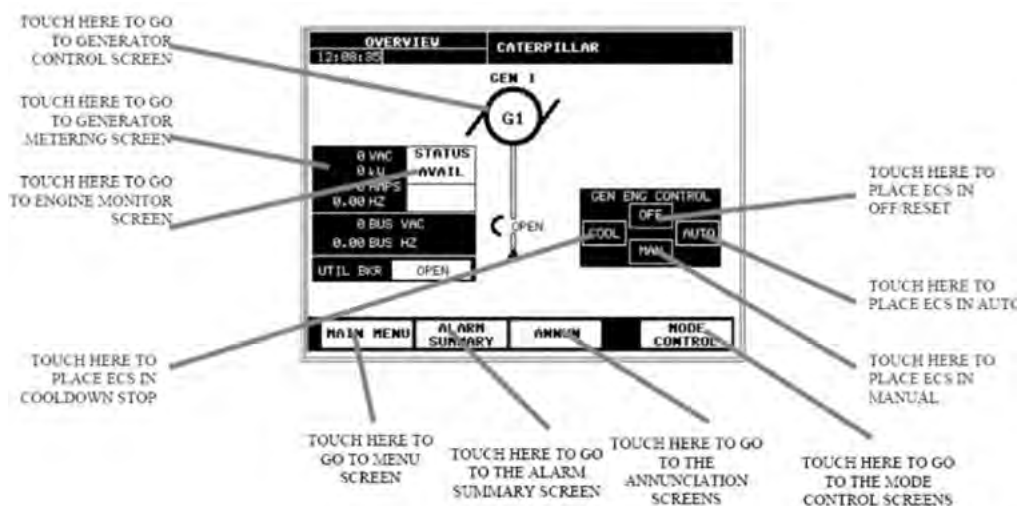
- Automatically synchronizes and parallels the generator with another power source.
- Includes provisions for manual permissive paralleling.

HUMAN MACHINE INTERFACE (HMI) HIGHLIGHTS

- Engine/Generator function is performed thru the 6" HMI touch screen interface.

Overview Screen (Typical)

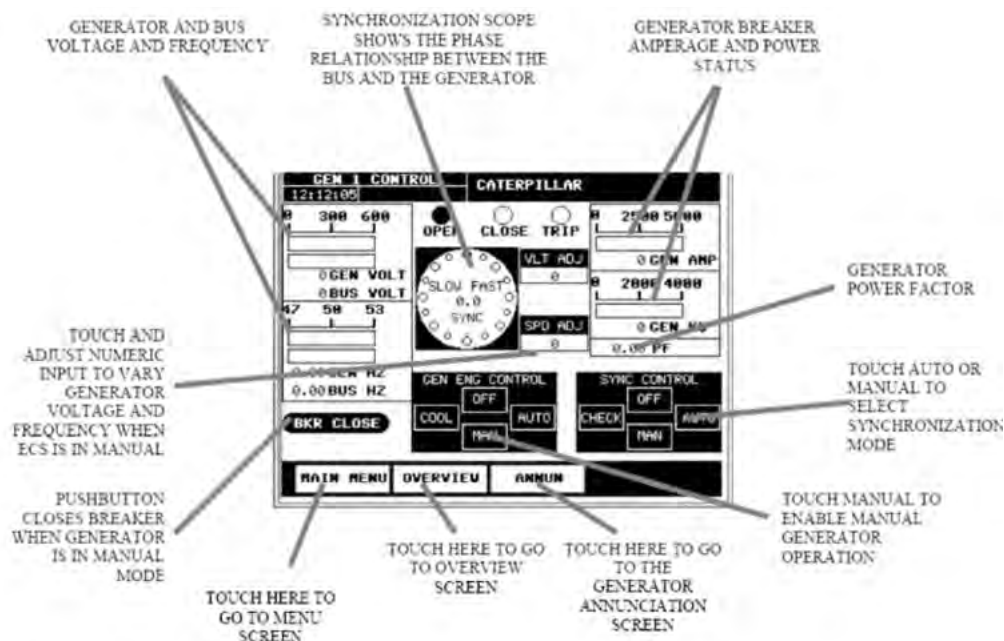
Shows the generator status, generator metering data, bus metering data, ECS position, and generator/utility breaker status.



STANDARD PARALLELING CONTROL (continued)

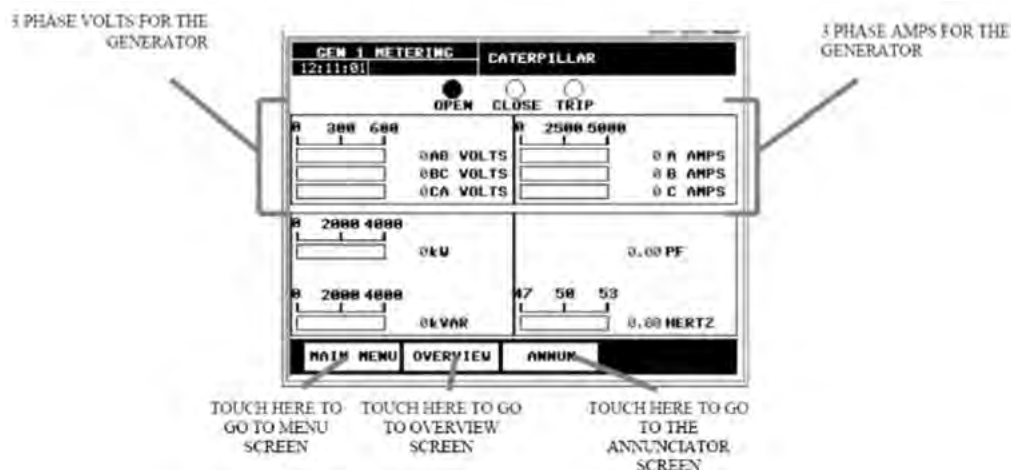
Generator Control Screen (Typical)

It allows the operator to observe the automatic synchronization and transfer of the load to and from the generator. Engine control allows the operator to run the engine in manual, or switch to automatic modes. Voltage and frequency offset adjustment allows the operator to control generator frequency and voltage.



Generator Metering Screen (Typical)

Allows the operator to view three phases of voltage and amperage for the bus and the generator.



STANDARD PARALLELING CONTROL (continued)

Engine Monitoring Screen (Typical)

Engine status is obtained directly from the EMCP 3. Engine starts and total hours can be used by the operator to determine when regular preventive maintenance is required. Other metering includes engine battery and oil filter health.

EMCP 3.3 ENGINE DATA

GEN 1 ENG MONITOR		CATERPILLAR	
15:42:12			
ENGINE OIL PRESSURE	0	kPa	▲
ENGINE COOLANT TEMP	0	°C	
BATTERY VOLTS	0.0	VOLTS	
ENGINE RPM	0	RPM	
ENGINE HOURS	0	HOUR	
AUTOMATIC START			
NUMBER OF CRANK ATTEMPTS	0		
NUMBER OF SUCCESS STARTS	0		
EXHAUST MANIFOLD 1 TEMP	0	°C	
EXHAUST MANIFOLD 2 TEMP	0	°C	
ENGINE OIL TEMPERATURE	0	°C	▼
MAIN MENU		OVERVIEW	ANNUN

GEN 1 ENG MONITOR		CATERPILLAR	
15:44:28			
CRANKCASE PRESSURE	0	kPa	▲
BOOST PRESSURE	0	kPa	
AIR FILTER DIFFERENTIAL	0	kPa	
TOTAL FUEL CONSUMPTION	0	L	
INSTANTANEOUS FUEL CONSUMPTION	0	L	
ATMOSPHERIC PRESSURE	0	kPa	
ENGINE OPERATING MODE	STOP		
ENGINE STATUS	NOT READY TO GO		
FUEL PRESSURE	0	kPa	
OIL FILTER DIFF PRESS	0	kPa	
FUEL FILTER DIFF PRESS	0	kPa	▼
MAIN MENU		OVERVIEW	ANNUN

TOUCH HERE TO GO TO MENU SCREEN

TOUCH HERE TO GO TO OVERVIEW SCREEN

TOUCH HERE TO VIEW ADDITIONAL ENGINE DATA

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***AIR EMISSIONS PERMIT (NO. 60-010)
AMENDMENT APPLICATION
SUPPORTING DOCUMENT***

ATTACHMENT C

***EMS
ENVIRONMENTAL WORK PRACTICES***

September 2020



ENVIRONMENTAL WORK PRACTICE

An Environmental Work Practice is a set of positive guidelines or "Do's and Don'ts" on how to control an aspect of the services, activities, or products of Yukon Energy that may have a negative effect on the environment.



DIESEL GENERATOR EMISSIONS

EMS-EWP-002

1.0 Introduction

1.1 Purpose

Provide steps to use Yukon Energy Diesel generators efficiently and with the fewest air emissions and least pollution emitted into the environment, as well as to minimize the impact of such air emissions where they are unavoidable.

1.2 Requirements

- A copy of the Air Emissions Permit, from Environment Yukon, is kept at each site.

1.2.1 Operation and Maintenance

- Except for maintenance purposes (e.g., exercise, run after repair) SCC and Plant Operators must use the generators at each site **in order of highest efficiency** under the circumstances. In the rare event that is not possible the operator and SCC must keep a record of why this was done.
- Whenever possible schedule maintenance with surplus hydroelectricity availability so diesel generation is not needed to meet electrical demand.
- Follow manufacturers maintenance prescriptions and conduct all necessary maintenance for generators and environmental emissions controls so the units are as efficient as possible. Monthly run-ups are currently done as scheduled maintenance.
- All particulates collected by emissions control equipment shall be contained such that they are not released to the environment.
- All inspections carried out on the diesel generators shall be documented and retained and will include the name of inspector, date, observations, and actions taken and date of actions and the date each action was taken.

2.0 Monitoring, Reporting and Record Keeping

1. Keep all records for a minimum of three years and make them available upon request for inspection by a Yukon Government Environmental Protection Officer.
2. Records will be kept at Records Management
3. The unit operating authority (i.e., SCC, by way of YEC Environment Department) must obtain approval from an Environmental Protection Officer with YG prior to:
 - a. any addition, modification, removal or replacement of any equipment or components related to the release, abatement, control or treatment of air emissions; or
 - b. any change in the location of the source(s) (i.e., if there is a plan to move a generator).

3.0 Applicable Legislation and Other Requirements

4. *Yukon Environment Act Yukon Air Emissions Regulations*
5. *Yukon Air Emissions Permit No. 60-010*

4.0 Other Related Information

Yukon Energy Safe Work Practices

SWP's can be found on the Health and Safety Sharepoint site.

ENVIRONMENTAL WORK PRACTICE

An Environmental Work Practice is a set of positive guidelines or "Do's and Don'ts" on how to control an aspect of the services, activities, or products of Yukon Energy that may have a negative effect on the environment.



FUELS, LUBRICANTS AND COOLANTS

EMS-EWP-005

1.1 Purpose

The purpose of the **Environmental Work Practice for Fuels, Lubricants and Coolants** is to provide the steps required to purchase, store, use, products in compliance with applicable laws and otherwise in an environmentally responsible manner.

2.0 Fuels, Lubricants and Coolants

Spills and leaks of oils, coolants, liquids and fuels can harm soil and water and human health. Spills need to be documented, reported, and cleaned up immediately.

2.1 Requirements

- All fuel storage containers should have secondary containment and ideally include integral leak detection and recovery capabilities.
- In addition to absorbent material required to cleanup drips, leaks and minor spills, a fully stocked spill kit shall be available where substances are stored and/or where oil filled equipment will be working.
- Once a spill kit is used, any materials taken out shall be replaced as soon as possible.
- Replacement materials can be obtained through the supplier.
- Lead hands will be responsible for storing spill response equipment in their areas of responsibility.
- All service vehicles transporting hazardous materials and all heavy equipment, must maintain suitable spill response equipment with the vehicle/equipment at all times.
- Staff and contractors on site will be familiar with the contents of onsite spill kits and will be trained in the proper use of spill kits.
- Use external secondary containment for single-walled tanks, for double-walled tanks with capacities more than 4,000 litres, or when storing more than twenty-four 45-gallon drums in one group.
- For 45-gallon drums, use drip pans or similar containers.
- For single walled tanks or double walled tanks over 4,000L, use an approved liner or a curbed concrete pad surrounding the tank, and a spill containment device attached to the intake valve.

The liner or pad and spill containment device must be made of materials that are compatible with the stored materials.

Records Maintenance

- Spill Contingency Plans will be located at each facility. Project managers, lead hands and the site supervisors shall have a copy of the spill contingency plan available on site at a central location.
- Spill contingency plans will also be located in T&D service vehicles.
- Monthly summaries of fuel inventories must be maintained on site as well as records of anytime fuel is added to the system

Reporting

- If a fuel system fails a leak test, it must be reported to the Yukon Energy Department of Environment
- Reporting to the Yukon Spill Report line by the YEC Dept of Environment is necessary if;
 - There is a shortage of 1.0% on monthly tank capacity or tank throughput,
 - if there are 4 shortages of 50 litres or more;
 - or consecutive losses totaling 200 litres or more
 - Any loss to water

Fuelling

- Ensure personnel is present during fuelling
- Do not refuel equipment within 30m of a watercourse or waterbody. Exceptions to this requirement include equipment refueled within secondary containment (e.g., water pump contained within spill tray).
- Ensure written standard operating procedures, work practices or guidelines (this EWP) are in place during fuelling activities.
- Keep adequate quantities of spill response equipment near fuelling areas
- Use secondary containment at all times when refueling.

Transportation

- All fuels, lubricants, coolants and other hazardous substances must be transported under applicable Transportation of Dangerous Goods Act and Regulation. When transporting any hazardous materials, refer to TDG regulations and the MSDS sheet for the product.
- Contractors hauling hazardous goods for YEC must have Transportation of Dangerous Goods training and certification as well as MSDS sheets for the product in the vehicle.

Waste Handling

WHITEHORSE PLANTS: PUT OILY WASTE INTO RED METAL CONTAINERS.

- Put all contaminated absorbent pads, spent oil filters and contaminated rags into the red oily waste bins in the Whitehorse Hydro and Diesel plants. Oily waste bins will get emptied into a larger dumpster for oily waste outside the WH Diesel plant.
- Do not line red bins with plastic bags as it could cause a fire.
- Waste oil/fuel/solvents/coolants must be stored in clearly labeled and sealed containers, located upright and out of the elements (i.e., not exposed to precipitation or excessive ultraviolet light), and ideally will be stored in outdoor shelters, or indoors on pallets, with integral leak containment
- Keep storage sites secure
- Keep containers at least 30m away from surface waters, catch basins (stormwater), private and public water supply wells.

Waste Records Collection & Retention

- Leadhands are responsible for storing this material and coordinating with waste collection contractor for regular pick-ups.
- Properly completed and signed records and waste manifests must be completed for all waste disposal events and must be retained and regularly provided to Yukon Energy Records Management for filing.

3.0 Applicable Legislation

- Yukon Environment Act, *Spills Regulations*, Yukon Territorial Government
- The storage of hazardous substances is regulated under the *Yukon's Storage Tank Regulations*
- Oil and Gas Act, *Gas Processing Plant Regulations*, Yukon Territorial Government

4.0 Additional Information

YEC Spill Contingency Plans

Can be found on the EMS SharePoint site under Environmental Documents.

ENVIRONMENTAL WORK PRACTICE

An Environmental Work Practice is a set of positive guidelines or "Do's and Don'ts" on how to control an aspect of the services, activities, or products of Yukon Energy that may have a negative effect on the environment.



SPECIAL WASTES

EMS-EWP-008

1.0 Introduction

1.1 Purpose

The purpose of this **Work Practice** for **Special Wastes** (commonly known as hazardous wastes) is to provide the steps required to purchase, store, use and dispose of hazardous wastes in an environmentally responsible manner and according to the YEC Special Waste Permit **41-120**.

2.0 Special Wastes

Yukon Energy is permitted to generate and store the following:

- Waste oil
- Waste solvent
- Waste anti-freeze
- Waste lead based paint chips

Other examples of special wastes include waste batteries, SF6 and asbestos. In addition, any waste dangerous goods are considered special wastes.

2.1 Requirements

If the contractor or employee works with special waste in any way, they need to understand the YEC Special Waste Permit. The following are requirements under the permit:

Documentation

- Keep the Special Waste Permit posted at each site
- Keep a waste manifest everytime you transport or get rid of special wastes, send to YEC Environment Department
- Maintain records of the types of special wastes in and out of your storage areas, volume, origin and storage location. File with YEC Records Management on a yearly basis.

- Submit inspection reports of weekly, monthly and annual inspections (see below requirements) to YEC Environment Department

Storage

- Prevent contamination and leaks by ensuring containers are:
 - properly labelled,
 - sealed, covered and
 - stored within secondary containment.
- Never mix or dilute special wastes.
- Routinely remove special wastes from site to an approved facility

Inspection

- Weekly - inspect for leaks of special waste storage weekly
- Monthly - Inspect storage containers for change in volume
- Annually – check container integrity, check for cracks or other issues

The Yukon *Special Waste Regulations* and the *Gas Processing Plant Regulations* state that a person who possesses or controls a special waste at the time of a release (spill), or who causes a release, **must report the incident** to the Yukon Spill Report Line (667-7244) and the Chief Operating Officer of the Oil and Gas Branch (334-3112, if LNG). The Manager of Environment or Environmental Analyst will make this report.

Containment and clean-up action should begin as soon as possible to protect human health and the environment.

Note that for all but very small quantities of special waste, most placarding, shipping documentation, and transporter certification requirements consistent with the *Transportation of Dangerous Goods Regulations* apply to the transport of special waste.

3.0 Other Special Wastes not included in the Special Waste Permit 41-120

3.1 Pest Control Products

3.1.1 Requirements

Pest control products include herbicides (e.g., weeds, other undesirable vegetation) and pesticides (e.g., insects, rodents). One must ensure that the certified applicator or his/her assistant performs the work as specified in the permit.

The applicator must have a **Pesticide Service Permit** (see separate Fact Sheet) to apply commercial or restricted pesticides. A **Pesticide Applicator Certificate** is required to purchase any commercial or restricted pesticides.

3.2 Mercaptan

Mercaptan is used to add smell to natural gas and has the ability to leach through soil or the sediment at a moderate rate. Accumulates very little in the bodies of living organisms. Highly volatile from water.

3.2.1 Requirements

- Store and handle in accordance with federal and territorial regulations. Grounding and bonding required. Keep separated from incompatible substances.

3.3 Used Batteries and Aerosol Cans

- Batteries contain sulfuric acid and lead. Both of these materials can damage the environment and pose a safety hazard if handled improperly.
- Under the *Yukon Special Waste Regulations*, you must have a Special Waste Permit if you handle more than five kilograms of lead-acid batteries per month.
- Keep used batteries in a bin and call KBL environmental when the bin is full for disposal.

3.3.1 Requirements

When storing batteries, or preparing them for shipment, follow the steps outlined below to help prevent leaks and spills and to avoid contamination of the storage site:

- Batteries and aerosol cans should be collected and stored in a leak-proof container out of direct sunlight and exposure to precipitation (rain/snow).
- Leadhands shall ensure the proper storage and disposal of such materials. They are also responsible for coordinating the collection and disposal of the material in cooperation with the Environmental Coordinator on an annual or more frequent basis, as required.
- Larger batteries can be placed on wooden pallets. Do not make stacks of batteries more than **three layers thick**. Separate each layer with a sheet of plywood or other suitable material.
- **Layers of pallets** should not be stacked more than **two** high.
- Enclose batteries on the pallet with thick plastic to prevent leaks. All sides must be wrapped to protect the batteries from the weather and to prevent any acid from being discharged into the environment.
- After wrapping the batteries in plastic, strap the stack of batteries to the pallet to prevent the batteries from shifting.

4.0 Disposal methods

- **Collection by a Permitted Facility**

There are several facilities in Yukon that have permits in place for treating and/or disposing of special waste.

- Liquid natural gas, natural gas
In the event of a spill, allow to vapourize and disperse to the atmosphere
- Mercaptan: Contain in leak proof container and dispose at permitted special waste handling facility.

5.0 Applicable Legislation

- Environment Act, *Pesticides Regulation*, Yukon Territorial Government
- Environment Act, *Spills Regulations*, Yukon Territorial Government
- Environment Act, *Solid Waste Regulations*, Yukon Territorial Government
- Environment Act, *Special Waste Regulations*, Yukon Territorial Government
- Canadian Environmental Protection Act. *Ozone Depleting Substances Regulations*, Environment Canada
- Oil and Gas Act, *Gas Processing Plant Regulations*, Yukon Territorial Government
- Transportation of Dangerous Goods Act, Government of Canada

6.0 Additional Information

YEC Safe Work Practices (SWP)

SWP's can be found on the Health and Safety Departments SharePoint site.

YEC Spill Contingency Plans

Can be found on the Environmental Management System (EMS) Sharepoint site under the Environment Department.

YUKON
ENERGY



*Air Emissions Permit (No. 4201-60-010)
Renewal Application Supporting Document*

Appendix A

Application for Air Emissions Permit

Travis Ritchie

From: Travis Ritchie
Sent: 29 September 2011 10:23
To: 'Janine.Kostelnik@gov.yk.ca'
Subject: Application to Renew Permit 4201-60-010
Attachments: Permit Renewal Application 4201.60.010.pdf

Hello Janine,

In follow up to the letter from Bethany Peters regarding renewal of Yukon Energy's Air Emissions Permit please see the attached completed application. At this time the Corporation is not requesting any amendments to the permit.

As you may be aware, Yukon Energy will be submitting a project proposal to the YESAB Designated Offices in October for an assessment of the power generating activities authorized by the permit so that YG can issue a Decision Document in order to formally renew the permit by the end of the year.

In the meantime, if you have any questions, comments or concerns about the application please let me know.

Thank you.

Regards,

Travis

Travis Ritchie, P.Biol., CCEP

Manager - Environment, Assessment, & Licensing
Yukon Energy Corporation

Ph: (867) 393-5350
Fax: (867) 393-5322

www.yukonenergy.ca

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APPLICATION FOR RENEWAL, AMENDMENT OR CANCELLATION OF ENVIRONMENT ACT PERMITS

Please complete the following and ensure that all information is legibly printed or typed:

Permittee: YUKON ENERGY CORPORATION
(business name)

Permit type: AIR EMISSIONS
(eg. pesticide, special waste, air emissions, solid waste, land treatment facility, relocation, ODS)

Permit number: 4201-60-010

Please check (✓) appropriate box:

Renewal

☒ I have fully reviewed my permit and the information on my current permit is correct and complete and my business is operating as described therein.

Amendment

☐ I have fully reviewed my permit and the following changes or additions have occurred and should be taken into account when renewing my permit (attach additional information if necessary):

Ownership: _____

Mailing Address: _____

Site Location(s): _____

Telephone #: _____ Fax #: _____

Email: _____

Products/Activities: _____

Transport special wastes: yes: ☐ no: ☐

Other: _____

Note: additional information may be required depending on the nature of the change.

Cancellation

☐ I am no longer undertaking the activities authorized by the above permit. I understand that I will be contacted by enforcement officials to confirm that a permit is no longer required, at the following coordinates:

Mailing Address: _____

Site Location(s): _____

Telephone #: _____ Fax #: _____

Email: _____

Permitted Activities: _____

I, TRAVIS RITCHIE [print name clearly], certify that I am an authorized representative of YUKON ENERGY CORP. [business name], hereby make application for the renewal, amendment or cancellation of the above-noted permit, and certify that the information provided on this form is correct.



Signature of applicant

Sept. 28/11

Date

of attachments

YUKON
ENERGY



*Air Emissions Permit (No. 4201-60-010)
Renewal Application Supporting Document*

Appendix B

***Report on Updated Air Quality Assessment
for Yukon Energy Diesel Generator Operations
Prepared by SENES Consultants Ltd.***

Air Quality Assessment Update in Support of Permit Renewal for Diesel Generator Operations

Prepared for:

Yukon Energy Corporation

#2 Miles Canyon Road
Whitehorse, Yukon Y1A 6S7

Prepared by:

SENES Consultants Limited

1338 West Broadway, Suite 303
Vancouver, BC V6H 1H2

October 20, 2011

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**Air Quality Assessment Update
In Support of Permit Renewal
For Diesel Generator Operations**

Prepared for:

Yukon Energy Corporation

#2 Miles Canyon Road
Whitehorse, Yukon Y1A 6S7

Prepared by:

SENES Consultants Limited

1338 West Broadway, Suite 303
Vancouver, B.C. V6H 1H2

21 October 2011

TABLE OF CONTENTS

	<u>Page No.</u>
EXECUTIVE SUMMARY	IV
1.0 INTRODUCTION	1
2.0 PROCESS DESCRIPTION	4
2.1 Diesel Engine Emissions.....	4
2.2 Engine Emissions During Start-up.....	7
2.3 Scenario Emission Levels	8
3.0 DISPERSION MODELLING ANALYSIS	11
3.1 METEOROLOGY	11
3.2 Dispersion	17
3.3 Predicted Air Quality Concentrations.....	20
3.3.1 Scenario 1 (Actual Power Generation in 2010)	23
3.3.2 Scenario 2 (Average Power Generation to 2014)	26
3.3.3 Scenario 3 (Worst-case Power Generation).....	30
4.0 OBSERVED AIR QUALITY IN WHITEHORSE.....	34
4.1 Ambient Air Quality Standards	34
4.2 Background Air Quality Levels	34
5.0 DISCUSSION OF RESULTS	39
6.0 CONCLUSIONS.....	44

LIST OF TABLES

	<u>Page No.</u>
1.1	Estimated Annual Community Emissions in 2007 3
2.1	YEC Diesel Engine Characteristics 5
2.2	Measured Emission Rates for YEC Diesel Engines 5
2.3	Average Emission Rates at YEC Whitehorse Generating Station.....6
2.4	Annual YEC Power Generation and Associated CAC Emissions.....7
2.5	Whitehorse YEC Average and Worst-case Diesel Power Generation Forecast 2014 9
3.1	CALMET Configuration.....12
3.2	YEC Emission Configuration for CALPUFF 18
3.3	NO ₂ /NO _x Ratios for Modelling.....19
4.1	Yukon Ambient Air Quality Standards.....34
4.2	Air Quality Monitoring Data Summary for Whitehorse.....35
5.1	Summary of Predicted Incremental Concentrations Due to YEC Emissions 40
5.2	Summary of Predicted Concentrations at Maximum Point of Impingement Due to YEC Power Generation.....42

LIST OF FIGURES

	<u>Page No.</u>
1.1	YEC Diesel Engine Power Generation 2008-2011.....1
2.1	Daily Power Demand Profile WAF-MD - Winter Period (Nov. 1 to March 31) 10
3.1	Windrose Diagram: EC Whitehorse Surface Station - 2010 12
3.2	CALMET Terrain Heights.....14
3.3	CALMET Landuse Categorization.....15
3.4	CALMET Surface Winds, January 5, 17:00.....16
3.5	Windrose Diagram, EC Whitehorse Surface Station 2010 vs. CALMET Grid Point (75,75).....17
3.6	Modelling Domain, Max POI and Discrete Receptor Locations.....21
3.7	Receptor Grid for CALPUFF Modelling.....22
3.8	Maximum Predicted Incremental 1-hour Average NO ₂ Concentrations - Scenario 1.....24
3.9	Maximum Predicted Incremental 1-hour Average PM _{2.5} Concentrations - Scenario 1.....25
3.10	Maximum Predicted Incremental 1-hour Average NO ₂ Concentrations - Scenario 2.....27
3.11	Maximum Predicted Incremental 24-hour Average NO ₂ Concentrations - Scenario 2.....28
3.12	Maximum Predicted Incremental 24-hour Average PM _{2.5} Concentrations - Scenario 2...29
3.13	Maximum Predicted Incremental 1-hour Average NO ₂ Concentrations - Scenario 3.....31

*Air Quality Assessment Update in Support of Permit Renewal
for Diesel Generator Operations*

3.14	Maximum Predicted Incremental 24-hour Average NO ₂ Concentrations - Scenario 3.....	32
3.15	Maximum Predicted Incremental 24-hour Average PM _{2.5} Concentrations - Scenario 3334.1 Whitehorse 2001-2005.....	36
4.2	Frequency Distributions for 24-Hour Average NO ₂ Concentrations Whitehorse 2001-2005.....	36
4.3	Frequency Distributions for 24-Hour Average PM _{2.5} Concentrations Whitehorse 2001-2005.....	37
5.1	Frequency Distribution of Predicted 24-hour Average PM _{2.5} Concentrations - Scenarios 2 and 3.....	43

Frequency

EXECUTIVE SUMMARY

An air quality assessment was completed in support of the air emissions permit renewal application by the Yukon Energy Corporation (YEC) for diesel-powered generators in Whitehorse, Dawson City, Faro and Mayo. The assessment is an update of an assessment completed in 2008 as part of the previous permit renewal application. Whereas the assessment in 2008 relied on emission factors derived from published literature sources for similar type engines, the current assessment is based on measured emission factors from a stack sampling program completed in July 2011 at the Whitehorse facility.

The assessment includes air dispersion modelling of emissions of Common Air Contaminants (CAC) from the YEC plant in Whitehorse based on three operational scenarios:

- Scenario 1 - actual operations in 2010;
- Scenario 2 - a projected average operating scenario to 2014, taking into account projected increases in power demand in the Yukon; and
- Scenario 3 - a projected hypothetical, worst-case, and extreme operating scenario for extra-ordinarily severe drought conditions.

The four CACs considered in this assessment include carbon monoxide (CO), nitrogen oxides (NO_x) and their product nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and fine particulate matter (PM_{2.5}).

Dispersion modelling was completed for emissions from the YEC facility in Whitehorse, where there was suitable meteorological data to conduct the modelling and ambient monitoring data to provide some measure of background concentrations to compare against the predicted impacts from YEC operations. The available National Air Pollutant Surveillance (NAPS) monitoring data in Whitehorse only cover the period 2001-2005. More recent data are not available from Environment Canada. The data indicate that CO and NO₂ levels are well below the ambient air quality standards **adopted by Yukon Environment in 2010**. SO₂ levels are not monitored in Whitehorse and are presumed to be low. For the available record of PM_{2.5} monitoring data, ambient concentrations in three of the five years (2001-2003) were low and well within the Yukon standard. However, forest fires in the region in 2004 and 2005 resulted in much higher concentrations of both PM_{2.5} and NO₂. Although levels in both years remained within the acceptable limits for the NO₂ standards, the standard was exceeded for PM_{2.5} in both years due to smoke from the forest fires.

The dispersion modelling analysis for Whitehorse shows that the highest ambient air quality impacts for most contaminants are confined to the immediate vicinity of the power plant, along

the western edge of the property line. The dispersion analysis of actual YEC operations in 2010 (Scenario 1) indicates that, when combined with background contaminant concentrations from other sources, the emissions from YEC in Whitehorse would not have exceeded the Yukon standards for CO, NO₂, SO₂ or PM_{2.5}.

The analysis also shows that predicted concentrations for the three gaseous contaminants (CO, NO₂ and SO₂) would remain within the limits set by the Yukon ambient air quality standards both under projected average operations to 2014, and even under worst-case operations to 2014.

Similarly, YEC's emissions alone would remain within the limits of the Yukon standards for PM_{2.5} in all locations in Whitehorse under projected average operations YEC to 2014 (Scenario 2). The cumulative effect of YEC's emissions, combined with an assumed background PM_{2.5} concentration of 8.0 µg/m³, would also remain within the limits of the Yukon standards everywhere in Whitehorse, except at the Maximum Point of Impingement (Max POI) along the western edge of the facility property line, for one day of the year only, due to building downwash effects on the plumes from the YEC facility.

Even for the hypothetical worst-case demand operations under extra-ordinarily severe drought conditions (Scenario 3), the Yukon PM_{2.5} standard still would not be exceeded except at the Max POI on two days of the year due to YEC emissions alone, and up to seven days due to the cumulative effect of YEC emissions in combination with an assumed background PM_{2.5} concentration of 8.0 µg/m³. However, PM_{2.5} concentrations at all other locations in Whitehorse would remain within the limits of the Yukon standard, at all times, even in the worst-case scenario. In fact, the incremental contribution of YEC emissions to ambient air quality levels in most areas of Whitehorse would remain at or below about 2 µg/m³ (less than 7% of the standard), even for the maximum demand power generation scenario forecast for extraordinarily severe drought conditions when hydro-power generation would need to be supplemented substantially with diesel power generation.

The implications of the modelling analysis for Whitehorse can be used to determine what the likely impacts may be in the other three communities, since the YEC engine configuration (engine size, exhaust stack height, etc.) in the other Yukon communities is similar to that in Whitehorse. Although modelling could be conducted in the other Yukon communities of Faro, Mayo and Dawson City, the results would have to be considered as having a higher degree of uncertainty, since surface and upper air data are not available at these locations.

It is also important to note that the forecasted and typical generation profiles for YEC's diesel facilities in the three other communities are measurably lower than for the Whitehorse plant, as Whitehorse has the greatest number of units higher in the stacking order (i.e., more energy can

*Air Quality Assessment Update in Support of Permit Renewal
for Diesel Generator Operations*

be, and is predicted to be, generated in Whitehorse than in the smaller plants in the other communities). Lower generation in those communities means the contributions to ambient air quality from those diesels would be lower than in Whitehorse. In addition, the smaller populations in the other three communities have lower overall emissions from other sources as was shown in the compilation of emission inventories for the four communities in 2008. Therefore, the overall concentration of common air contaminants in these communities is likely to be lower than in Whitehorse. Although the higher tourist traffic levels in Dawson City contribute substantially to overall background air quality in this community, these emissions primarily occur in the summertime, while the operation of the YEC diesel generators in Dawson occurs in the winter. With similar or lower impacts on local air quality from YEC power generation and lower overall background levels of air contaminants, the likelihood of any of the Yukon standards being exceeded in these three communities due to YEC operations is lower than in Whitehorse.

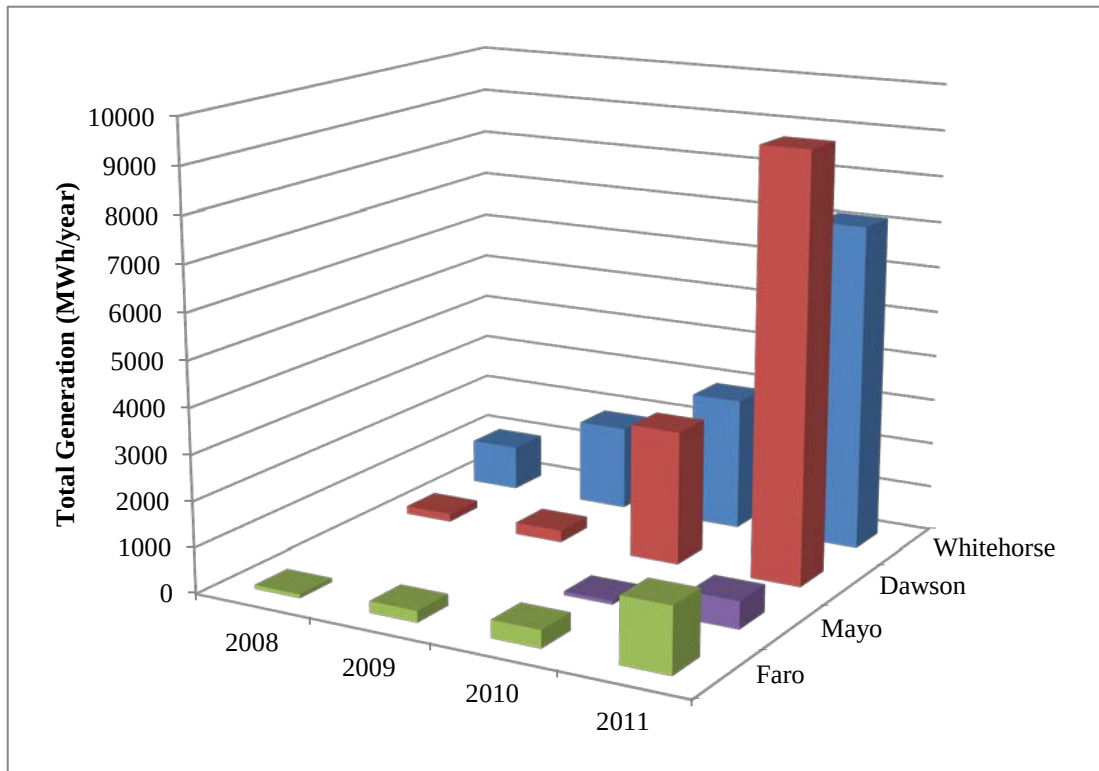
1.0 INTRODUCTION

The Yukon Energy Corporation (YEC) operates a total of 19 diesel-powered generators in four communities:

- eight in Whitehorse (including one very small, mobile unit);
- six in Dawson City (including one mobile unit);
- three in Faro; and,
- two in Mayo.

Figure 1.1 shows the total number of hours of diesel engine run times at the four locations during the period 2008 to mid-October 2011.

Figure 1.1
YEC Diesel Engine Power Generation 2008-2011



Year-to-year power generation from diesel engines is quite variable between the four sites, with most of the generation occurring at Whitehorse and Dawson, and only minor power generation at

Air Quality Assessment Update in Support of Permit Renewal for Diesel Generator Operations

Faro and Mayo. However, all four sites show a trend to increased power generation over this 4-year period. It should be noted that in 2011, as the result of two major construction projects at the Aishihik and Mayo Hydroelectric facilities, and the associated need to temporarily suspend generation at these facilities, diesel generation in Dawson City and Whitehorse were abnormally high during the summer of 2011. These conditions prompting diesel generation (i.e., 2 major hydro construction projects) would not be repeated in 2012-2014.

In 2008, SENES Consultants Limited (SENES) was retained by YEC to prepare an air quality assessment¹ in support of YEC's previous air emissions permit renewal application. The community emission inventories compiled for that assessment indicated that YEC operations in all four communities generally contribute relatively small-to-insignificant amounts of emissions for both the common air contaminants and greenhouse gases. Most emissions in these communities are dominated by mobile sources and heating using either fuel oil or wood stoves. With the exception of NO_x emissions, the contribution of YEC operations in 2007 to total community emissions of common air contaminants was less than 1%.

The assessment presented in this report provides an update to the previous 2008 assessment which included air dispersion modelling of emissions from the YEC facility in Whitehorse. Whitehorse was considered an ideal modelling situation since both surface and upper air data were available to use as input to the atmospheric model. The Whitehorse modelling was conducted to get a good sense of what the effect of the YEC diesel engine emissions may be on the air quality in the Whitehorse community. Since Whitehorse has 'good' meteorological data available, it was appropriate to conduct the modelling in this airshed instead of any other. For this reason, the modelling simulation for Whitehorse was considered to be superior to simulations that could have been conducted in the other three airsheds where YEC units are operated.

The implications of this modelling can be used to determine what the likely impacts may be in the other three communities, since the YEC engine configuration (engine size, exhaust stack height, etc.) in the other Yukon communities is similar to that in Whitehorse. Although modelling could be conducted in the other Yukon communities of Faro, Mayo and Dawson City, the results would have to be considered as having a higher degree of uncertainty, since surface and upper air data are not available at these locations. There are methods that could be used that would allow dispersion modelling to be conducted in those communities such as use of a weather forecasting model, however this additional level of effort was considered to be excessive for the YEC emission sources.

¹ SENES Consultants Ltd. 2008. *Air Quality Assessment for Yukon Energy Corporation Diesel Generator Operations*. Prepared for Yukon Energy Corporation, Whitehorse, Yukon.

*Air Quality Assessment Update in Support of Permit Renewal
for Diesel Generator Operations*

It is also important to note that the forecasted and typical generation profiles for YEC's diesel facilities in the three other communities are measurably lower than for the Whitehorse plant, as Whitehorse has the greatest number of units higher in the stacking order (i.e., more energy can be, and is predicted to be, generated in Whitehorse than in the smaller plants in the other communities). Lower generation in those communities means the contributions to ambient air quality from those diesels would be lower than in Whitehorse. In addition, the smaller populations in the other three communities have lower overall emissions from other sources as was shown in the compilation of emission inventories for the four communities in 2008. For example, Table 1.1 lists the estimated Common Air Contaminant (CAC) emissions in the four communities estimated for 2007. With similar or lower impacts on local air quality from YEC power generation and lower overall background levels of air contaminants, the likelihood of any of the Yukon standards being exceeded in these three communities due to YEC operations is lower than in Whitehorse.

Table 1.1
Estimated Annual Community Emissions in 2007
(SENES 2008)

CAC	Estimated Annual Emissions (tonnes/year)			
	Whitehorse	Dawson City	Mayo	Faro
CO	6253.3	726.08	124.30	98.08
NO _x	540.12	72.24	8.70	9.66
SO ₂	278.6	21.88	4.67	3.72
PM _{2.5}	503.29	53.41	9.29	7.30

Whereas the previous assessment was based on emission factors for diesel powered generation derived from published sources for similar type engines, the updated analysis is based on actual measured emission rates for each of the seven stationary units at the Whitehorse facility.

The updated analysis also takes into account projected increased power demand in the Yukon through to 2014.

2.0 PROCESS DESCRIPTION

A diesel generator can be defined as a diesel engine linked to an electrical generator for the purposes of generating electricity. Diesel generators can be used to provide emergency power, or to supplement power for a utility grid that normally relies on alternate sources of energy. The seven stationary YEC generators in Whitehorse serve both functions and are used on an as-needed basis. For the majority of the time, the diesel generators do not operate.

The impact that the YEC diesel generators may have on community air quality in Whitehorse was assessed by simulating the engine emissions for the 2010 year (based on actual operations), the projected average power generation operating scenario to 2014, taking into account projected increases in power demand in the Yukon, and a maximum worst-case scenario based on projections for potential operations in 2014 as the result of a series of successive drought years culminating in the most extreme conditions occurring in 2014. These simulations are referred to as Scenario 1, Scenario 2 and Scenario 3, respectively.

Four air contaminants that are produced from the diesel generators were assessed: nitrogen dioxide (NO₂), sulphur dioxide (SO₂), carbon monoxide (CO) and particulate matter (PM). Ambient PM is measured as both ‘inhalable’ particulate matter, which is the fraction of suspended particles with diameters of 10 micrometres (µm) or less and ‘respirable’ particulate matter, which have diameters of 2.5 µm or less. These fractions are denoted as PM₁₀ and PM_{2.5} respectively. PM_{2.5} is the smallest size fraction of suspended particulate matter (2.5 microns or less in diameter), and typically makes up about 95% of PM emissions from diesel engines. These four air contaminants (NO₂, SO₂, CO and PM_{2.5}) were chosen based on concerns expressed in other Canadian communities and not necessarily from an expectation that the YEC engine emissions would be problematic.

2.1 DIESEL ENGINE EMISSIONS

SENES was provided with the diesel engine characteristics for the seven stationary engines in the Whitehorse diesel generating plant by YEC. These are listed in Table 2.1.

The engines listed in Table 2.1 are ‘uncontrolled’, meaning that there are no devices that treat the exhaust before being vented to the atmosphere. In terms of emission standards established by the U.S. Environmental Protection Agency (USEPA) (and which are commonly referenced in Canada), the engines can be further classified as ‘pre-Tier’. Pre-Tier engines were not subject to the USEPA emissions standards since such standards were not developed prior to 2000.

*Air Quality Assessment Update in Support of Permit Renewal
for Diesel Generator Operations*

Table 2.1
YEC Diesel Engine Characteristics

Unit No.	Prime Mover Manufacturer	Model	Name Plate Capacity (kW)	MCR Rating (kW)	RPM	In-service Date
WD1	Mirrlees	KV16	3,920	4,000	514	1968
WD2	Mirrlees	KV16	5,150	5,000	514	1968
WD3	Mirrlees	KV16	5,150	5,000	514	1970
WD4	EMD	20C	2,500	2,500	900	1975
WD5	EMD	20C	2,500	2,500	900	1975
WD6	EMD	20C	2,500	2,700	900	1990
WD7	Caterpillar	3612	3,300	3,300	900	1991

YEC generally operates the diesel generators as a backup power system to the hydroelectric power system. When used, the YEC Whitehorse diesel plant rarely operates the older WD1 – WD3 units and more commonly operates WD4 – WD7. All seven diesel units may be used to a greater extent in drought years or when otherwise necessary.

Table 2.2 lists the emission rates for the seven diesel generator units as determined through stack testing that was completed in July 2011 (Levelton 2011).²

Table 2.2
Measured Emission Rates for YEC Diesel Engines

YEC Unit	Average Emissions (g/h)				
	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
WD1	656.3	15817.8	40.0	272.7	238.0
WD2	4942.9	24388.1	43.0	429.4	380.7
WD3	4132.0	21680.9	37.4	384.4	299.9
WD4	1821.0	33108.8	52.7	536.2	496.5
WD5	521.3	30040.9	54.5	924.1	821.8
WD6	284.1	30530.0	48.7	871.8	812.4
WD7	686.4	23512.7	12.8	197.1	174.8

² Levelton Consultants Ltd. 2011. *Emissions Testing at Yukon Energy's Whitehorse Rapids Generating Station (WRGS)*. Submitted to M. Sills, Yukon Energy Corporation, September 6, 2011.

*Air Quality Assessment Update in Support of Permit Renewal
for Diesel Generator Operations*

The measured PM₁₀ emission rates include both the filterable and condensable portions of PM emission rates. The measured PM_{2.5} emission rates include the filterable PM_{2.5} plus the condensable portion of PM emissions. Only the PM_{2.5} emissions were evaluated for this study since there are no ambient air quality standards for PM₁₀ in the Yukon.

Table 2.3 lists average measured emission rates for the seven units at the Whitehorse facility. Using these average emission rates and the total power generation for each facility in Figure 1.1, Table 2.4 lists the total annual power generation and CAC emissions estimated for each of the four locations in 2008, 2009, 2010 and up to October 12, 2011.

Table 2.3
Average Emission Rates at YEC Whitehorse Generating Station

CAC	Emission Rate (g/kWh)	
	Estimated in 2008	Measured in 2011
NO _x	15.0	8.824
CO	4.0	0.516
SO ₂	0.0246	0.014
PM	0.25	0.183
PM _{2.5}	0.208	0.134

Table 2.4
Annual YEC Diesel Power Generation and Associated CAC Emissions

YEC Station	2008	2009	2010	2011	2008	2009	2010	2011
	Power Generation (MWh/year)				Estimated SO ₂ Emissions (tonnes/year)			
Whitehorse	988.6	1860.5	2921.8	7157.2	0.014	0.026	0.041	0.101
Dawson	174.1	259.7	2933.3	9256.4	0.002	0.004	0.041	0.131
Faro	83.8	252.1	387.2	1427.1	0.001	0.004	0.005	0.020
Mayo	0	0	79.54	601.16	0.000	0.000	0.001	0.008
	Estimated NO _x Emissions (tonnes/year)				Estimated CO Emissions (tonnes/year)			
Whitehorse	8.72	16.42	25.78	63.15	0.51	0.96	1.51	3.69
Dawson	1.54	2.29	25.88	81.68	0.09	0.13	1.51	4.77
Faro	0.74	2.22	3.42	12.59	0.04	0.13	0.20	0.74
Mayo	0.00	0.00	0.70	5.30	0.00	0.00	0.04	0.31
	Estimated PM Emissions (tonnes/year)				Estimated PM _{2.5} Emissions (tonnes/year)			
Whitehorse	0.18	0.34	0.54	1.31	0.13	0.25	0.39	0.96
Dawson	0.03	0.05	0.54	1.70	0.02	0.03	0.39	1.24
Faro	0.02	0.05	0.07	0.26	0.01	0.03	0.05	0.19
Mayo	0.00	0.00	0.01	0.11	0.00	0.00	0.01	0.08

Note:

2011 power generation and emissions January 1 to October 12, 2011

2.2 ENGINE EMISSIONS DURING START-UP

It is important to note that the emissions presented in Table 2.2 assume that each unit is operating in its prime or steady-state mode. For most of the time that the diesel generators operate, this is a reasonable assumption. However, during times of start-up, shut-down or periods of operation outside the steady state, higher emissions may occur for a brief period.

Emissions during such brief periods occur during one of three phases:

During **Phase 1** (i.e., the initial cranking and fuel injector pressure stabilization), the engine experiences significant change in the combustion chamber and creates a broad range of emissions. The engine may experience a series of misfires, lean-fires, overly rich conditions and uneven gas mixing which cause the exhaust concentrations to significantly alter during this phase. At times when no combustion occurs, very little pollutants exit the exhaust stack as the unburned fuel condenses in the exhaust system. At other times,

the fuel delivery rate is too extreme or timed incorrectly causing unnecessarily high peaks in cylinder pressure which drives the NO_x emissions relatively high. In part due to the large variations in fuel injector pressure and in turn spray pattern within the combustion chamber, the formation of particulate emissions (PM) can be significant.

During **Phase 2** (i.e., combustion stabilization), the combustion kernel experiences stable in-cylinder conditions and generates exhaust emissions in a predictable manner. Over the initial 300 seconds of start-up, both the NO_x and CO emissions rise and then stabilize at idle emission rates.

During **Phase 3** (i.e., warm up) the emissions can vary based on how the engine was operated previous to the start-up and the current weather conditions. Any residue, either fuel or moisture from rain or condensation, will start to cook off as the exhaust system increases in temperature. Many times, these ‘cook off’ emissions can be clearly seen from the exhaust stack during this phase, and while they are of concern, their relative significance to the overall emissions from the engine operations is small, and their contribution to ambient air concentrations is equivalently low. It should also be noted that the increased moisture in the exhaust plume gives the appearance of greater overall emissions. The duration of the third phase is influenced by the outside temperature and the ramp up rate of the engine speed and load.

While it is true that diesel engine emission rates during engine start-up can be greater than during running conditions, the contributions from the start-up period are expected to be quite small in the context of total hourly emissions for the YEC engines. As previously indicated, this is due to the fact that normal operation of the engines involves usage under load, with a much higher rate of fuel consumption when compared to idling. The emissions from Phases 1 through 3 are therefore expected not to be significant compared to the emissions during steady state operations as such emissions will only occur for several minutes a year. As such, they were excluded from the modelling analysis. The formal inclusion of start-up emission rates in the dispersion modelling analysis would not change the overall estimates of predicted CAC concentrations in the ambient air.

2.3 SCENARIO EMISSION LEVELS

Hour-by-hour engine emission estimates in grams of pollutant per second (g/s) were calculated by using YEC Whitehorse generation records for 2010 (Scenario 1). A total of 2466.9 MWh were generated by the YEC Whitehorse diesel plant in 2010. SENES was provided with the hour-by-hour power production records for the year, with a maximum generation rate of 12.9

MW produced during one hour in December. The maximum energy generated in a full day was 141.4 MWh, developed over a continuous 18-hour period in December.

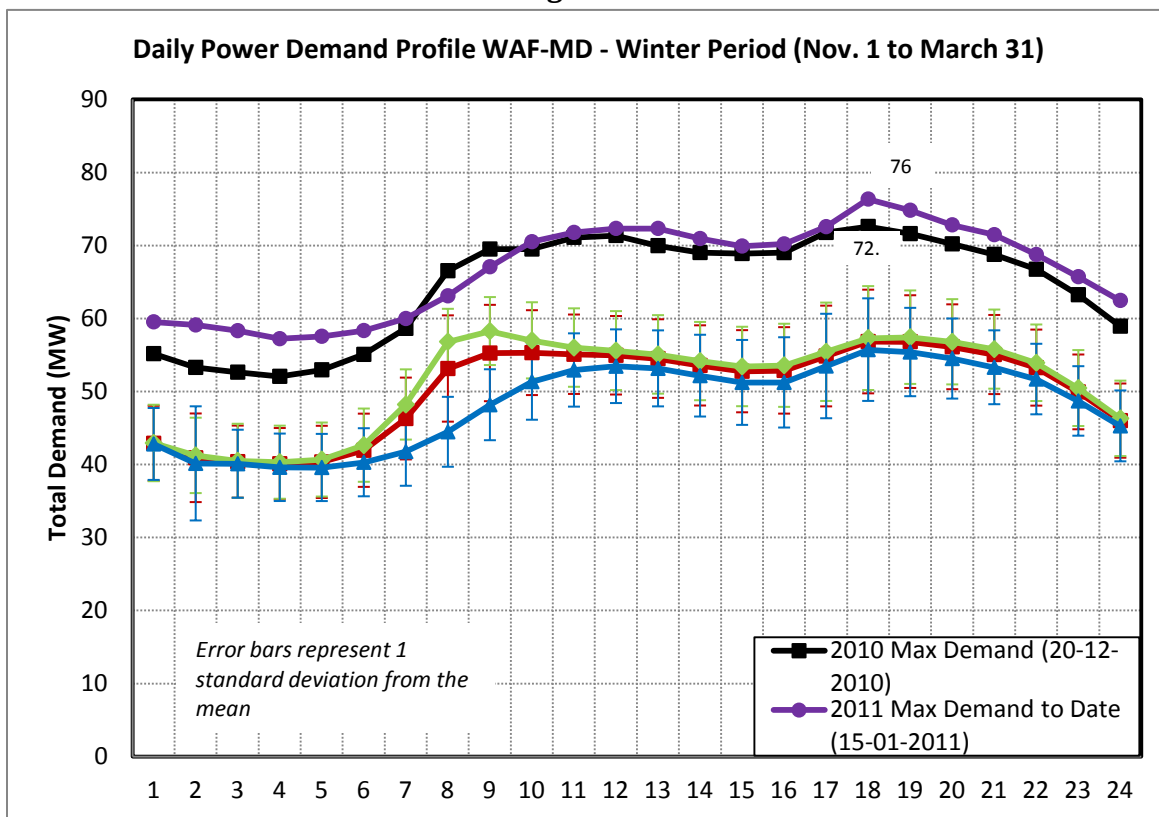
A projection of the anticipated average power generation scenario to 2014 was evaluated as Scenario 2. This scenario represents an increase in generation over recent historical generation at the Whitehorse plant, reflective of increased power demand in the Yukon in recent years. The average power generation rate is estimated at 19,472.9 MWh by 2014.

For Scenario 3, YEC provided a projection of worst-case monthly power generation for each of the seven units at the Whitehorse plant in 2014 in the event of a drought year. Table 2.5 lists the projected power generation for each unit, for a total power generation of 75.8 GWh. The daily power generation profiles for Scenarios 2 and 3 were determined by dividing the total projected power generation by the number of days per month to obtain average daily power generation for each unit. The average daily generation profile was then allocated to specific hours of the day based on the daily peak demand profiles for power generation in winter in 2010-2011 as described in Figure 2.1.

Table 2.5
Whitehorse YEC Average and Worst-case Diesel Power Generation Forecast 2014

Unit Stacking Order	Power Generation (MWh/year)	
	Scenario 2	Scenario 3
WD6	9936.1	11631.8
WD4	5494.8	9730.8
WD5	3061.9	9730.8
WD7	980.1	12974.4
WD2	0	12321.6
WD3	0	10874.7
WD1	0	8568.0
Total	19472.9	75832.2

Figure 2.1



3.0 DISPERSION MODELLING ANALYSIS

Emissions from the YEC diesel generators at Whitehorse were modelled using a refined dispersion model called the California Puff Model (CALPUFF)³. CALPUFF is a recommended model in the B.C. Dispersion Modelling Guidelines⁴ and the modelling guidelines for other Canadian provinces for situations involving complex circulation patterns that can influence the advection and dispersion of air pollutants. Due to the fact that Whitehorse is situated in a valley and experiences stagnant conditions each year that can inhibit the movement of air, the CALPUFF model was considered appropriate to determine the effect of YEC emissions on community air quality.

3.1 METEOROLOGY

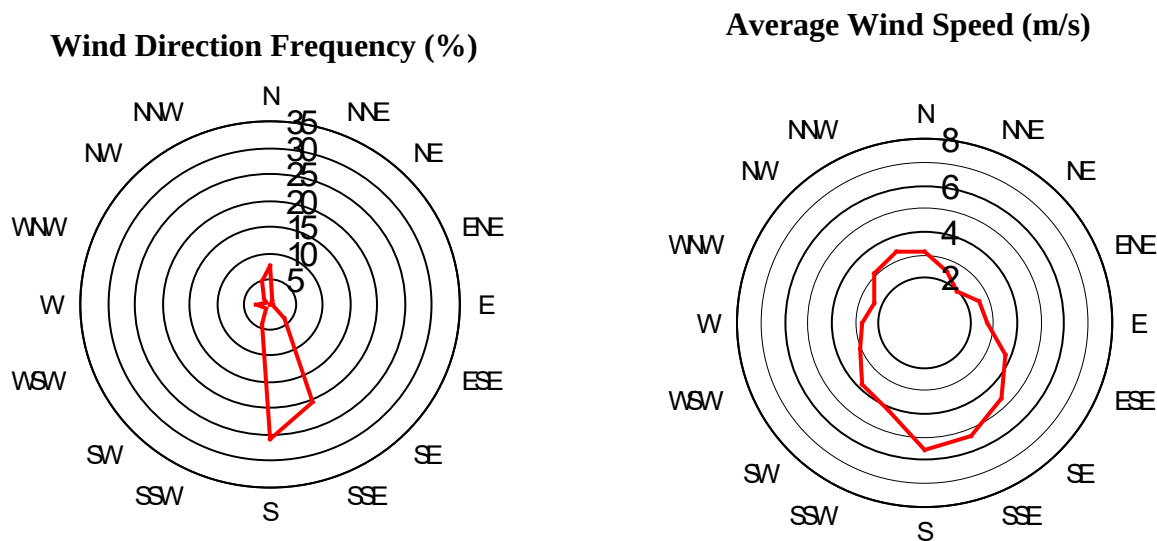
The CALPUFF modelling system includes a meteorological processor called CALMET. CALMET is used to produce a three-dimensional simulation of the atmosphere, based on available meteorological monitoring data, and/or output from a larger scale weather model. The resultant CALMET fields govern the advection and dispersion of emissions in the CALPUFF dispersion model itself.

The following meteorological inputs were used to drive CALMET: Whitehorse surface observations at the airport (Environment Canada station 2101300, Surface) and Whitehorse upper air observations at the airport (Environment Canada station 71964, Upper Air). A wind rose diagram for the Whitehorse surface winds is provided in Figure 3.1. A wind rose diagram shows the distribution of winds by direction (direction *from* which the wind blows) and speed class. Figure 3.1 shows that the wind in Whitehorse is commonly from the South, following the orientation of the valley. Also noteworthy, calm conditions (zero or near-zero wind speeds) are experienced over 19.6% of the time.

³ <http://www.src.com/calpuff/calpuff1.htm>

⁴ http://www.env.gov.bc.ca/air/airquality/pdfs/air_disp_model_08.pdf

Figure 3.1
Wind Rose Diagram, EC Whitehorse Surface Station - 2010



Note: This is direction wind blows from

Percentage Calms = 19.6%

In addition to meteorological data, CALMET requires a number of settings and additional datasets to configure the modelling domain (listed in Table 3.1).

Table 3.1
CALMET Configuration

Size of Modelling Domain	30 km by 30 km, centered on YEC diesel plant
Grid Horizontal Resolution	200 m by 200 m
Grid Vertical Resolution	12 levels (0 to 3300 m)
Input Terrain (elevation)	30 m DEM from Geomatics Canada
Input Vegetation (land use)	Whitehorse Municipal Planning Maps
Input Precipitation Levels	EC YXY daily precipitation records
Wind Field Model	On, with model defaults
Wind Interpolation	RMAX1,2 = 5,10km
Terrain Influence on winds	TERRAD = 5 km

Hourly precipitation records could not be acquired for Whitehorse (only daily total amounts were available from EC). However, hourly precipitation *indicators* were available in the station records. These indicators show whether or not precipitation occurred in a particular hour and the relative magnitude (low, medium or high). For each day, SENES matched the daily total precipitation amounts (and types) with the hourly indicators to achieve estimates for hourly precipitation levels in a linear fashion. This approach is not ideal, but was necessary given the constraints of the available data. However, due to the relatively low precipitation levels in Whitehorse, this methodology likely does not have a significant impact on the dispersion model outcomes.

Surface energy fluxes and wind flow are influenced by local terrain and vegetation. Figures 3.2 and 3.3 provide a visualization of terrain and landuse characterization at the modelling resolution of 200 metres. The terrain was categorized by 30 metre digital elevation model (DEM) files from Geomatics Canada and landuse category was configured by extracting information from the Whitehorse Official Community Plan 'Area Landuse Designations' map, available from the city website.⁵

⁵ <http://ww3.whitehorse.ca/Features/OCP/OCP-TableofContents.pdf>

Figure 3.2
CALMET Terrain Heights

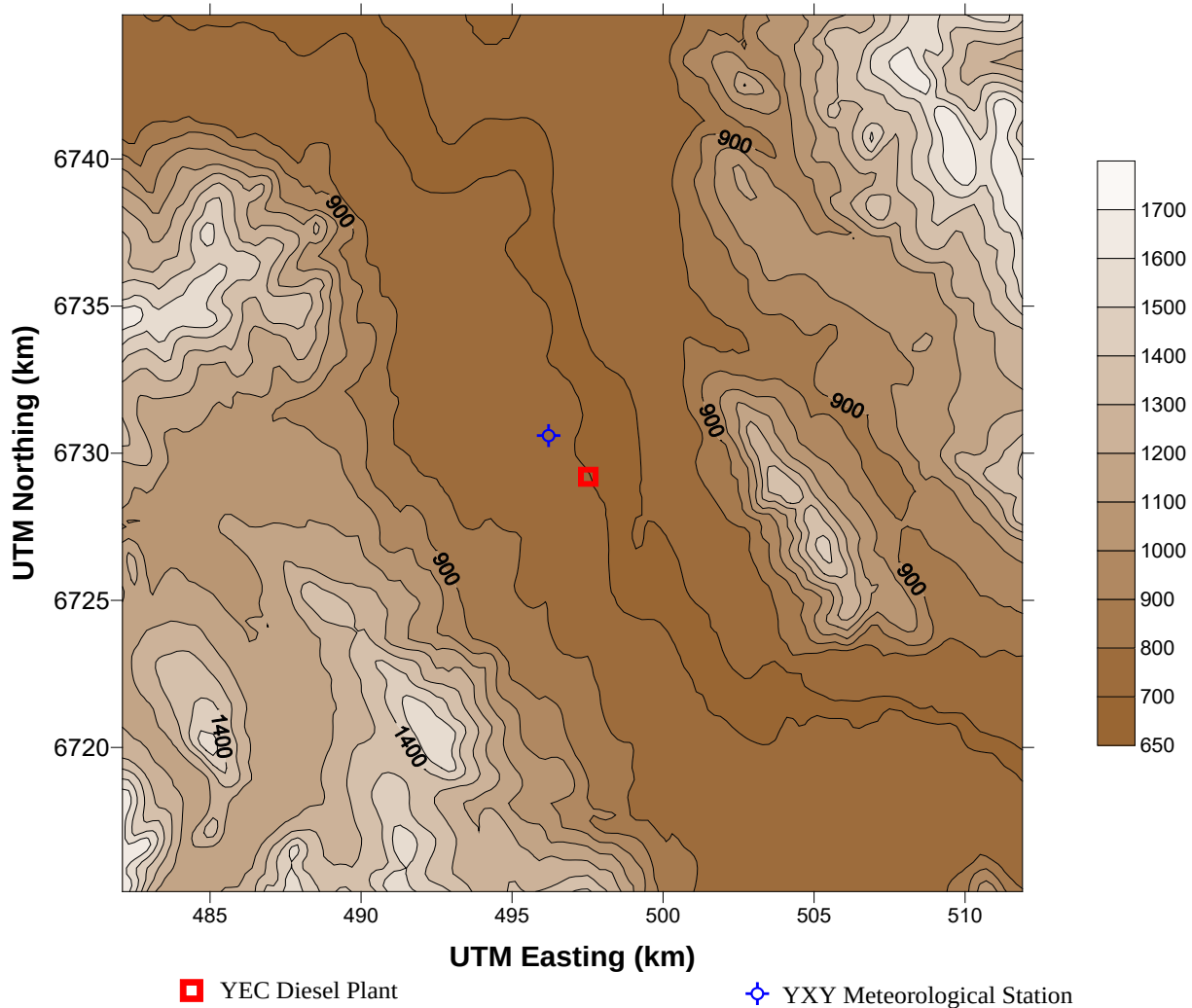


Figure 3.3
CALMET Landuse Categorization

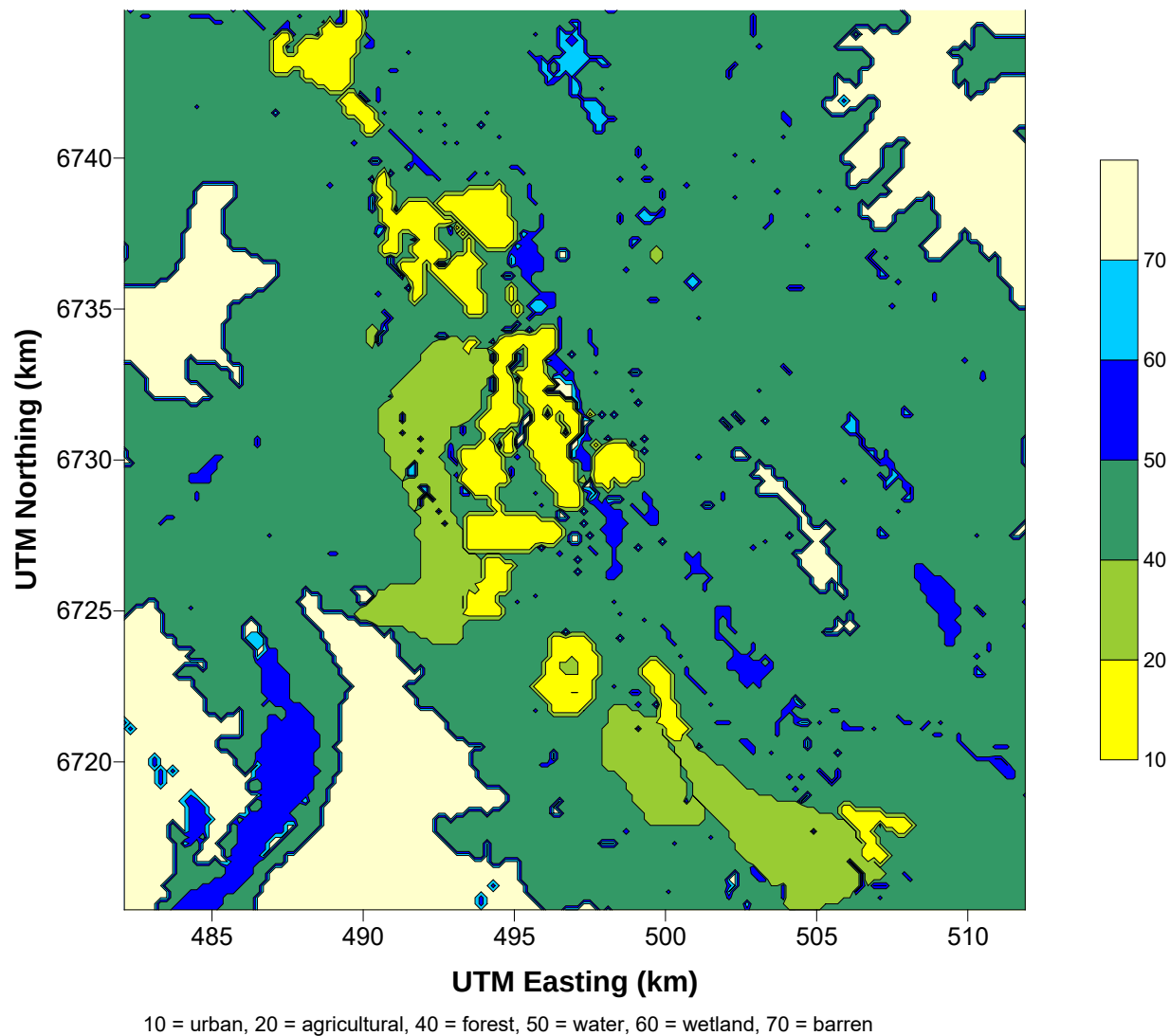


Figure 3.4 provides an example of the surface winds on January 5 in the late afternoon (5 pm). The plot illustrates the meteorological modelling approach reasonably well: the surface station winds were given broad influence over wind flow in the valley (e.g., through most of the city) and the model algorithms account for the expected terrain steering at higher elevation and at a distance from the city core. This particular example should not be interpreted to be representative of the ‘normal’ surface wind flow in Whitehorse (winds from the south would occur far more often). However, the surface winds are almost always flowing either up the valley or down the valley and this pattern largely dictates the general advection of pollutants when the YEC diesels are operating.

Figure 3.4
CALMET Surface Winds, January 5, 17:00

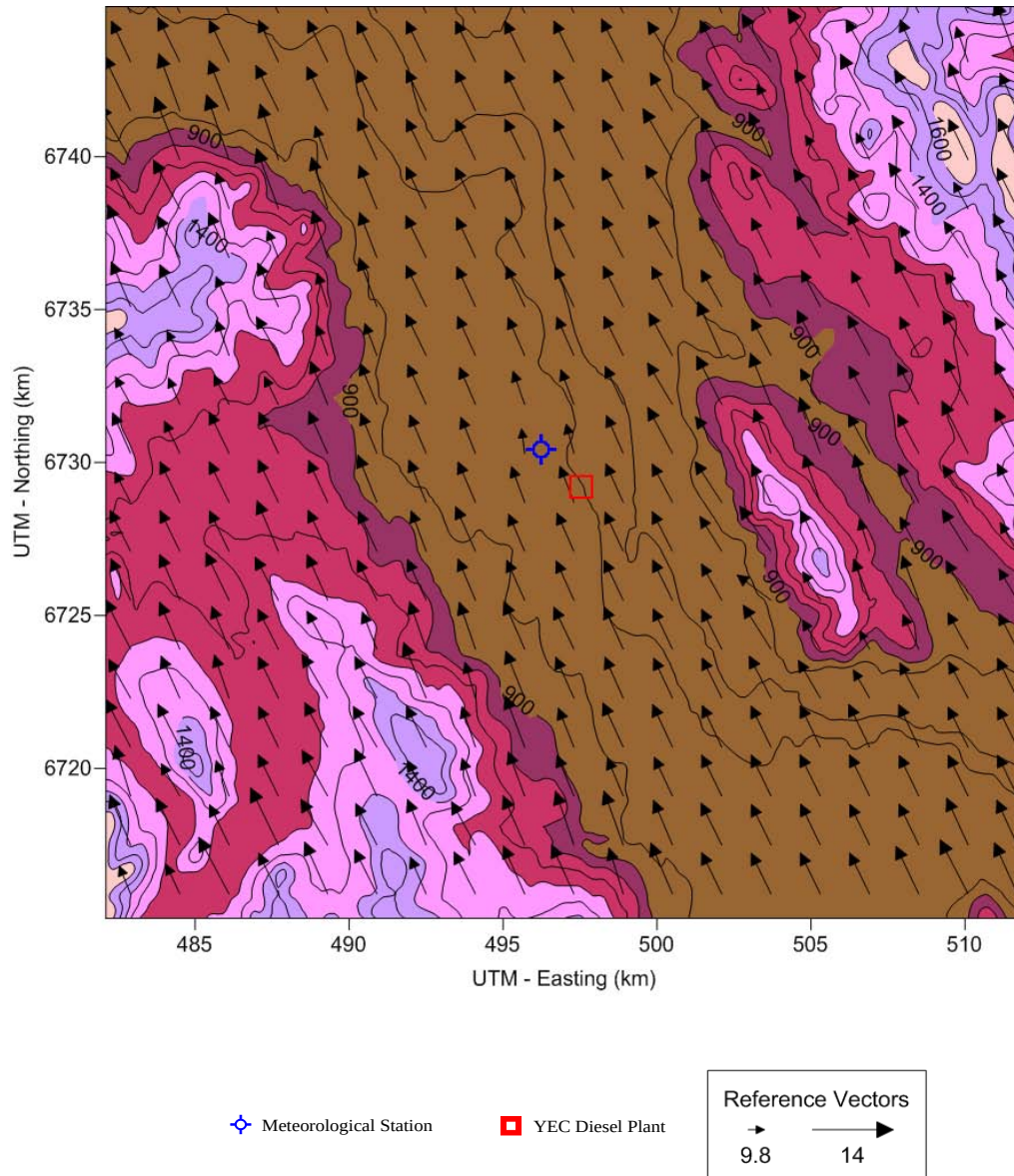
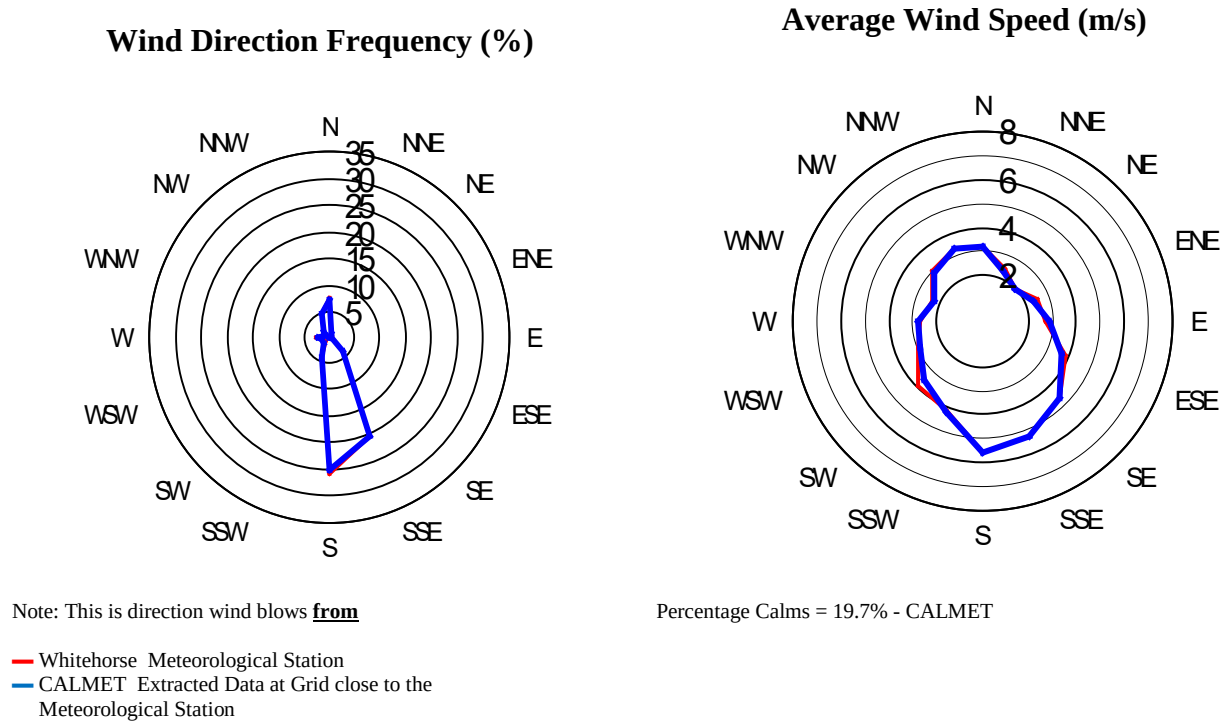


Figure 3.5 provides the wind rose comparison between observations of wind flow and the results of wind flow simulations using CALMET at the location of the meteorological station (Whitehorse Airport). As presented in Figure 3.5, there is almost complete agreement between observations and simulated data.

Figure 3.5
Windrose Diagram, EC Whitehorse Surface Station – 2010 vs. CALMET Grid Point (75,75)



3.2 DISPERSION

Emissions from the seven YEC engines were modelled as individual point sources with the characteristics defined in Table 2.2. Exhaust temperature and velocity for each unit were all based on the results of the stack sampling program completed in July 2011. The units were turned ‘on’ in the model based on the rate of power generation for each hour and the preferential order of firing for newer units over older units. An emissions input file was constructed for each of the scenarios, which the CALPUFF model read in during each hour of the simulations.

Table 3.2
YEC Emission Configuration for CALPUFF

YEC Unit	UTM Northing (km)	UTM Easting (km)	Stack Height (m)	Stack Diameter (m)	Exhaust Exit Velocity (m/s)	Exhaust Temperature (°C)
WD1	497.551	6729.204	12.0	0.66	20.39	338.5
WD2	497.553	6729.207	12.0	0.76	18.02	388.4
WD3	497.555	6729.210	12.0	0.76	15.28	384.6
WD4	497.560	6729.217	12.0	0.53	40.14	358.4
WD5	497.564	6729.223	12.0	0.53	40.72	333.6
WD6	497.568	6729.229	12.0	0.53	35.92	306.1
WD7	497.571	6729.234	12.0	0.43	35.69	430.8

Several Canadian provinces publish dispersion modelling guidelines that are used to indicate the level of assessment that should be applied to an air quality simulation of industrial or commercial emission sources. The guidance may indicate appropriate model configuration, degree of spatial resolution for model predictions, or both. SENES consulted the Dispersion Modelling Guidelines⁶ developed by the British Columbia Ministry of the Environment for recommended CALPUFF configuration and receptor spacing. Receptor spacing denotes the specific spacing at which the model is set to estimate ground level concentrations.

The CALPUFF modelling configuration chosen for the YEC simulations is consistent with the BC guidelines, which in general follow the default USEPA choices (which are clearly indicated in the model guidance support). Chemical transformation of pollutants was not modelled since very little transformation of the primary contaminants released from the engines is expected within the city confines (exception NO_x/NO₂).

To determine ambient NO₂ concentration estimates, concentrations of nitrogen oxides (NO_x) from the CALPUFF simulations were converted to NO₂ using an external method. This general

⁶ BC MoE, 2008. *Guidelines for Air Quality Dispersion Modelling in British Columbia, March 2008*. Available from the Ministry webpage.

approach is consistent with the BC Modelling Guidelines (and guidelines from other Canadian jurisdictions), which reflects the issue that current air quality models such as CALPUFF cannot yield realistic estimates of NO₂ based on NO_x emission levels. External methods involve applying conversion rates (portion of emitted NO that forms NO₂) based on the ratio of NO_x and NO₂ in the ambient air, or distance from source (greater distance implies more conversion). Janssen (1988) developed empirically-derived NO_x/NO₂ ratios based on direct measurements in stack plumes from Dutch power plants between 1975 and 1985⁷. The ratios were determined through 60 measurement flights conducted under varying atmospheric conditions. Practical application of the ratios to estimate NO₂ concentrations from ambient NO_x concentrations can be referred to as the *Janssen Method*, which requires determination of the distance of a particular point (receptor) from the emission source. The method has been practically applied and tested in another study⁸, and was previously applied to the analysis of YEC emissions for Whitehorse in 2008. This external conversion method was chosen for Whitehorse; the conversion ratios applied to the modelled NO_x concentrations are listed in Table 3.3.

Table 3.3
NO₂/NO_x Ratios Assumed for Modelling

Distance from Source (km)	NO ₂ /NO _x Ratio
0 – 1	0.05
1 – 2	0.14
2 – 3	0.19
3 – 4	0.25
4 – 5	0.29
5 – 6	0.33
6 – 7	0.37

In reality, the actual conversion ratios depend on time of day, temperature, wind speed and amount of solar radiation. The ratios in Table 3.3 used for the modelling assessment are representative of daytime conditions in warmer months (late spring, summer). During cooler months, or evening hours, these ratios would likely be very conservative. The *Janssen Method* additionally indicates wintertime ratios that should be considered in more refined assessments.

⁷ Janssen et al. 1988. A classification of NO oxidation rates in power plant plumes based on atmospheric conditions. *Atmospheric Environment*, 22(1), 43-53.

⁸ De Oliveira and Simonsen. 2003. Utilization of a method to estimate NO₂ concentrations from a NO_x simulation for thermal power plants. *Air & Waste Management Association Conference and Exhibition* (96th : 2003: San Diego, California).

CALPUFF was additionally configured to represent wet removal of pollutants due to precipitation and building downwash. The latter mechanism is particularly important since the engine stacks at the YEC diesel plant are not high enough to escape building wake effects in the wind flow. The physical dimensions of the stacks and the building were used to determine downwash parameters for the model⁹, which are internally accessed depending on the characteristics of the wind flow on any particular hour.

3.3 PREDICTED AIR QUALITY CONCENTRATIONS

Estimates of ambient air quality concentrations were produced on a regular grid every 20 m within 200 m of the YEC diesel plant, every 50 m between 200 and 500 m from the plant and then every 200 m for the remainder of the domain. This approach surpasses the recommendations as set out in the BC guidelines, which call for 20 m spacing at the fenceline only. A number of discrete receptor locations were additionally used. Discrete receptors are commonly used in air quality assessments to look at the full distribution of predicted ambient concentrations at locations considered particularly sensitive to air contaminants, such as homes, schools and hospitals. The six sensitive receptors chosen were as follows (approximate distance from YEC stacks shown in brackets):

- R1 - nearest residence to the power plant located on the east side of the Yukon River (240 m);
- R2 - Christ the King Elementary School (840 m);
- R3 - Grey Mountain Primary School (1.3 km);
- R4 - Frederick Collins Secondary School (1.4 km);
- R5 - the Whitehorse General Hospital (2.2 km); and,
- R6 - located at the plant property fenceline on the western river bank at the foot bridge over the Yukon River (75 m).

Figure 3.6 shows the location of the six discrete receptors chosen for the modelling, superimposed on a 10 km by 10 km map referred to as the inner domain. The inner domain was defined to display the predicted air concentrations since concentrations beyond 5 km from the YEC diesel plant were found to be very low. Figure 3.6 also shows the location of the Maximum Point of Impingement (Max POI). This is the location at which the CALPUFF model predicts the highest concentrations of contaminants to occur from YEC emissions. It is located at the western edge of the facility property line.

Figure 3.7 provides a visualization of the regular receptor grid. This grid is used to determine the maximum ambient off-site concentrations from the model.

⁹ These parameters were determined using the EPA *Building Profile Input Program* (BPIP) model.

Figure 3.6

Modelling Domain, Max POI and Discrete Receptor Locations

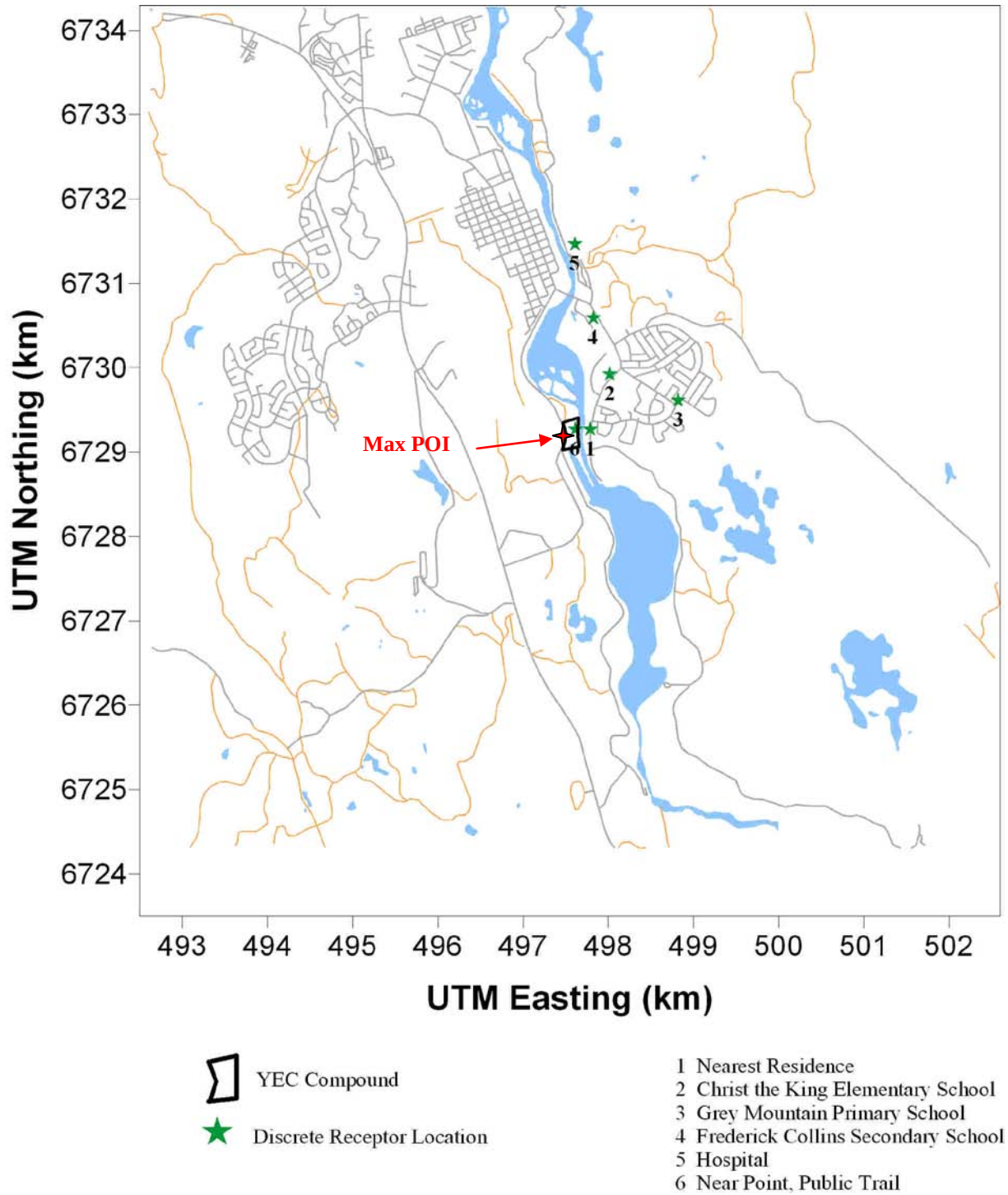
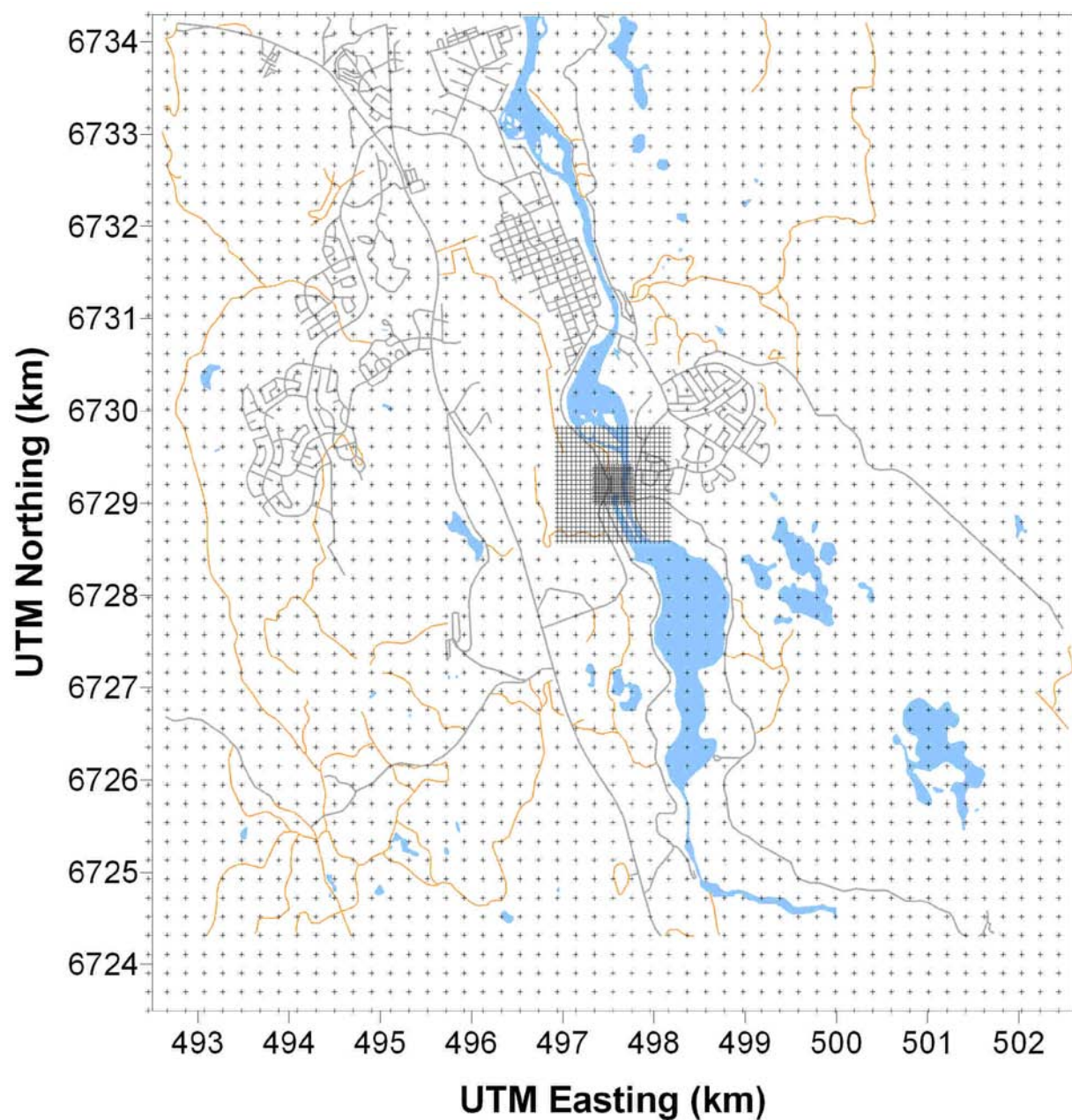


Figure 3.7
Receptor Grid for CALPUFF Modelling



For Scenarios 1, 2 and 3, ambient air quality estimates are provided in tabular format for maximum predicted 1-hour, 24-hour and annual average concentrations in the modelling domain, for each air contaminant modelled. The maximum predicted concentrations occur at the Maximum Point of Impingement (Max POI) close to the western edge of the facility property line as depicted in Figure 3.6. In addition, a number of example isopleth plots are provided for maximum predicted NO₂ and PM_{2.5} concentrations because these two contaminants are of greater significance with respect to the ambient air quality standards adopted by Yukon Environment.

3.3.1 Scenario 1 (Actual Power Generation in 2010)

A plot of maximum estimated 1-hour average NO₂ concentrations is shown in Figure 3.8. The maximum concentrations are those predicted by the model over the year and each concentration value could occur in any given hour. In other words, the plot is not a snapshot in time, but instead represents the greatest potential impact over the entire year. The prevalence of the north-south wind flow in Whitehorse is obvious, as locations to the east and west of the generating station do not experience maximum concentrations in excess of 20 µg/m³.

A plot of 1-hour average PM_{2.5} concentrations is provided in Figure 3.9. The plot shows a similar pattern to that of 1-hour average NO₂ concentrations. Higher maximum concentrations are found to the north and south of the generating station. Maximum 24-hour average or annual average PM_{2.5} concentrations are not depicted for Scenario 1 since the community levels are very low (i.e., <1µg/m³) for all air contaminants modelled.

Figure 3.8
Maximum Predicted Incremental 1-hour Average NO₂ Concentrations - Scenario 1
(excluding background air quality)

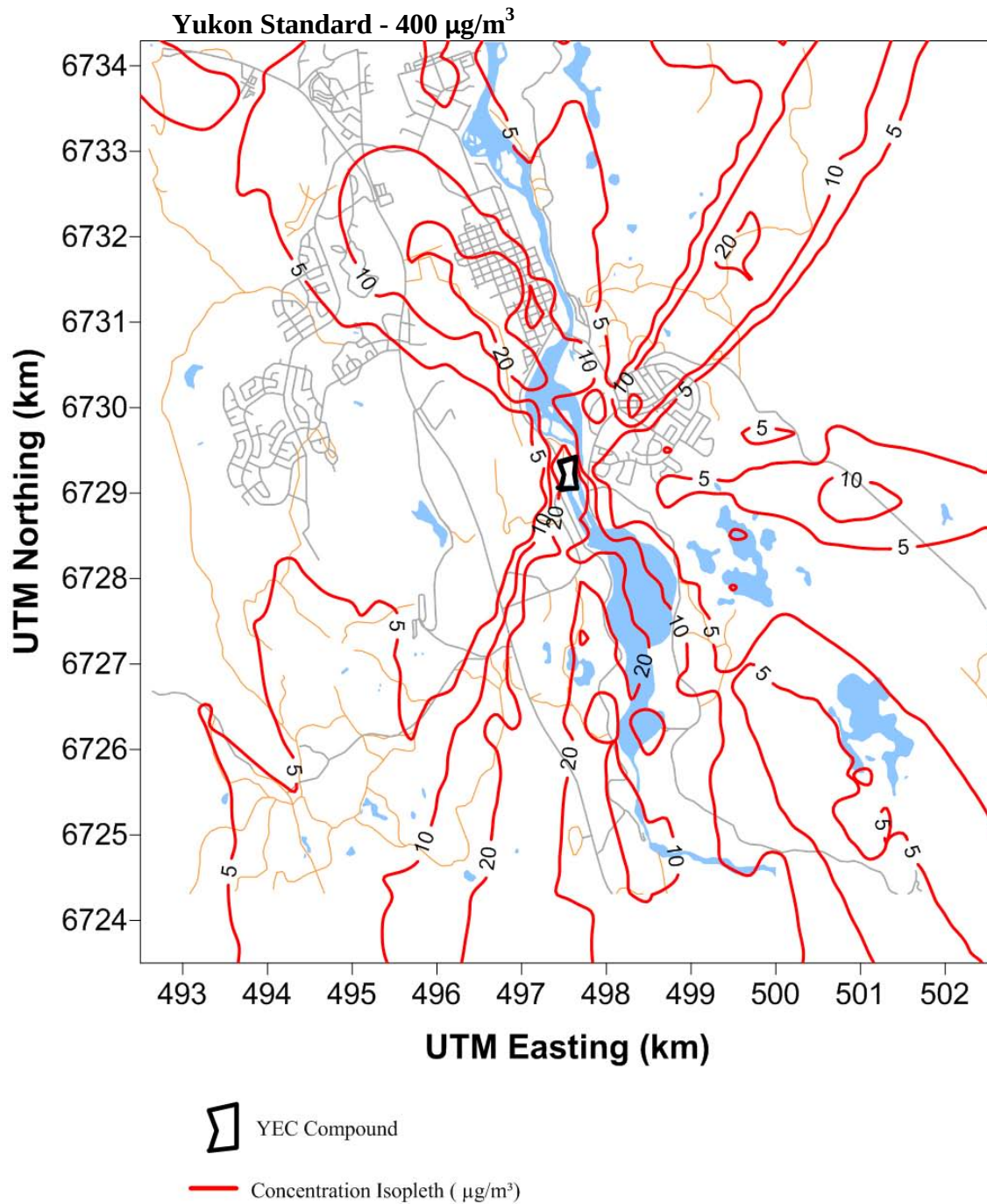
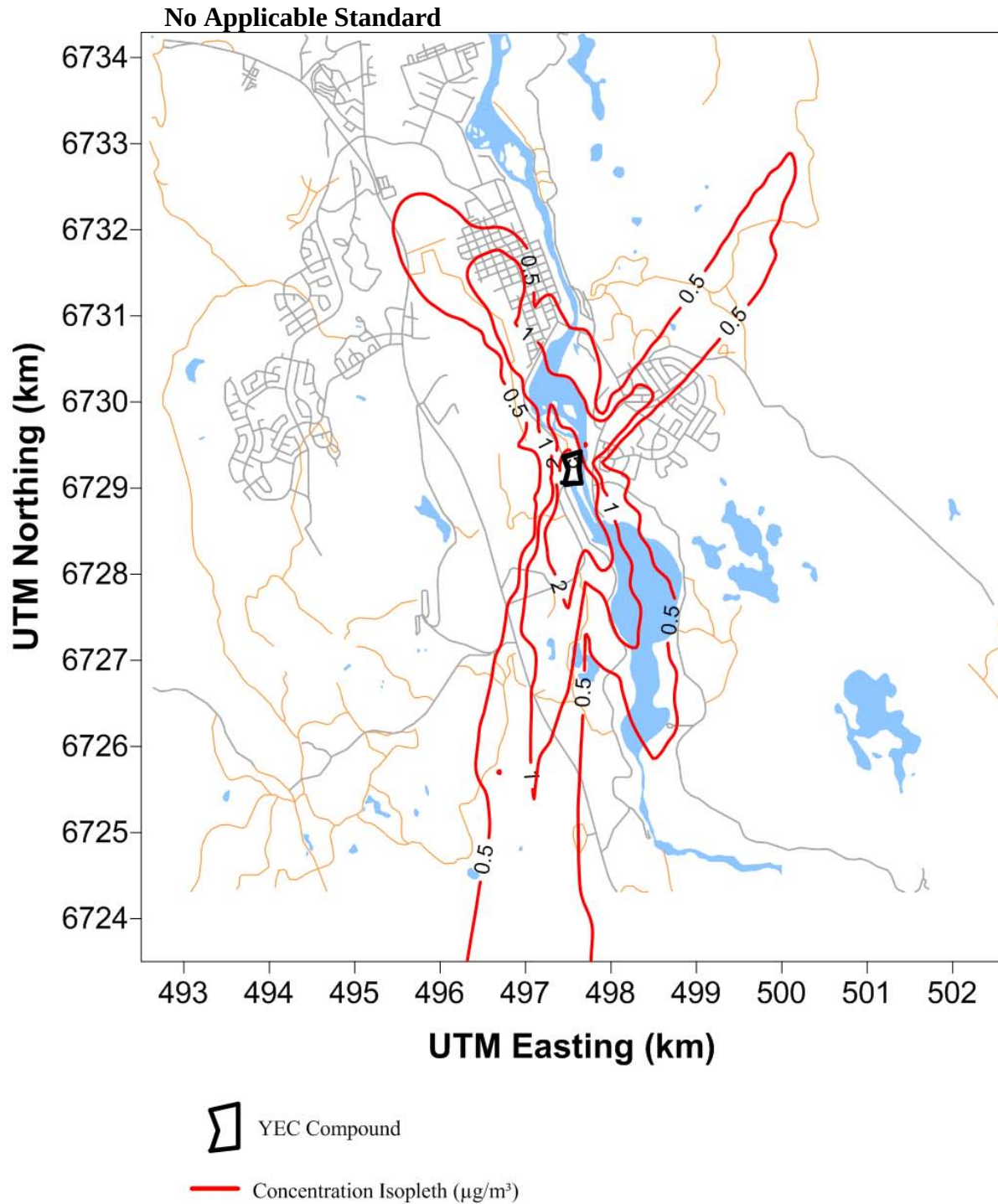


Figure 3.9
Maximum Predicted Incremental 1-hour Average PM_{2.5} Concentrations - Scenario 1
(excluding background air quality)



3.3.2 Scenario 2 (Average Power Generation to 2014)

The maximum ambient concentrations predicted for Scenario 2 are higher than those estimated for Scenario 1. This is a result of higher assumed emissions due to longer periods of power generation, the simultaneous operation of up to four units at certain times and more frequent operation under a greater number of atmospheric conditions which can include stagnant conditions where dispersion of air contaminants is hindered.

Isopleth plots of 1-hour and 24-hour average maximum predicted NO₂ concentrations are provided in Figures 3.10 and 3.11, respectively. Similarly, isopleth plots for maximum predicted 24-hour average PM_{2.5} concentrations are shown in Figure 3.12.

The highest 1-hour average NO₂ concentration is predicted to occur immediately adjacent to the YEC compound. Due to a gradual conversion of NO to NO₂ with distance, several pockets of elevated NO₂ concentrations of between 25 and 50 µg/m³ are predicted to occur several kilometres from the point of release. The highest 24-hour average NO₂ concentration is also predicted to occur adjacent to the YEC compound due to the effects of building downwash from the short stacks of the diesel generators. Predicted 24-hour concentrations in the community are generally low at 5-10 µg/m³.

Similarly, elevated 1-hour average PM_{2.5} concentrations are predicted to occur very near the diesel plant due to building downwash, but predicted concentrations further from the plant are generally low. The maximum predicted 24-hour average PM_{2.5} concentrations are less than 1 µg/m³ in almost all areas of the community.

Figure 3.10
Maximum Predicted Incremental 1-hour Average NO₂ Concentrations - Scenario 2
(excluding Background air quality)

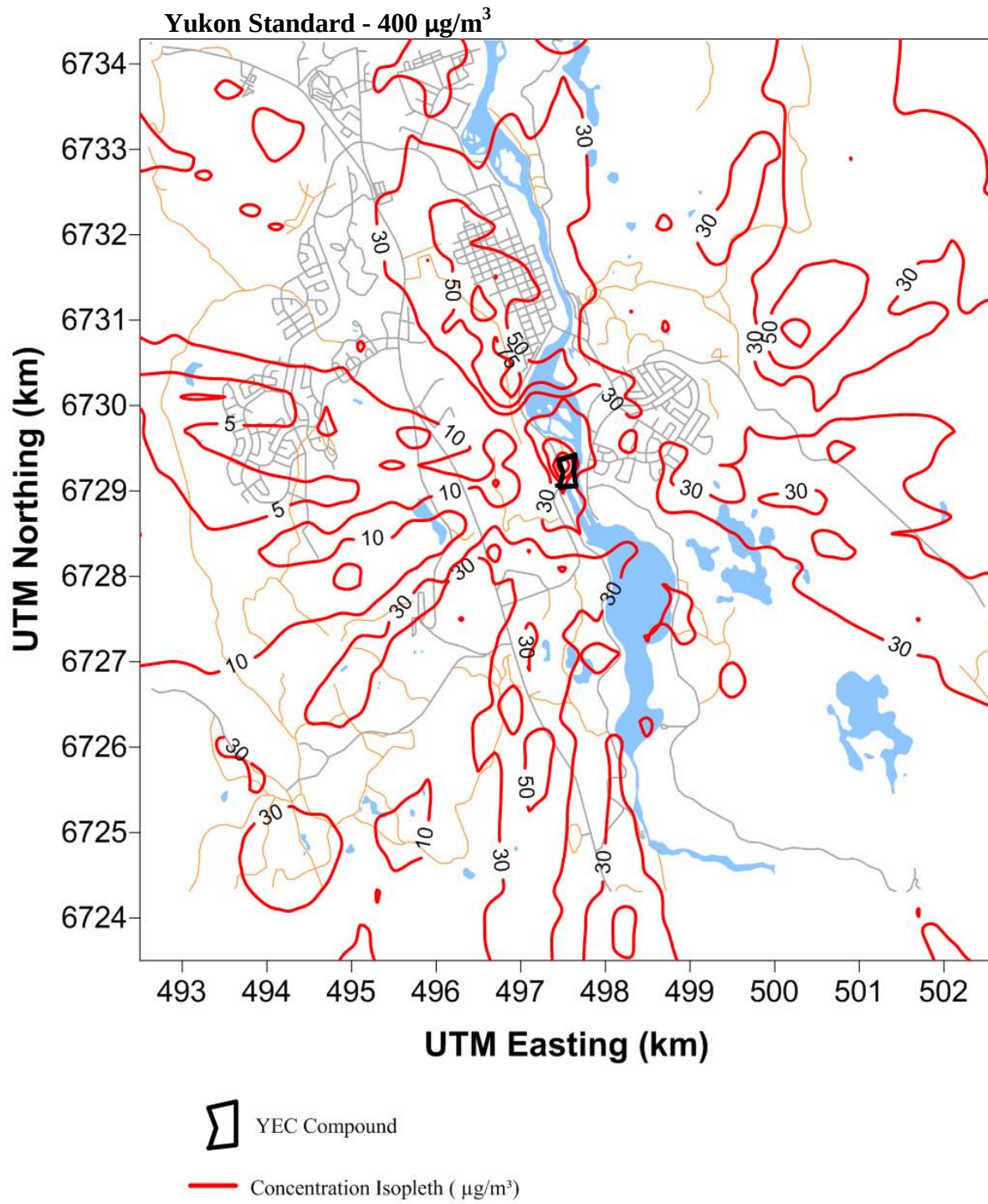


Figure 3.11
Maximum Predicted 24-hour Average NO₂ Concentrations - Scenario 2
(excluding background air quality)

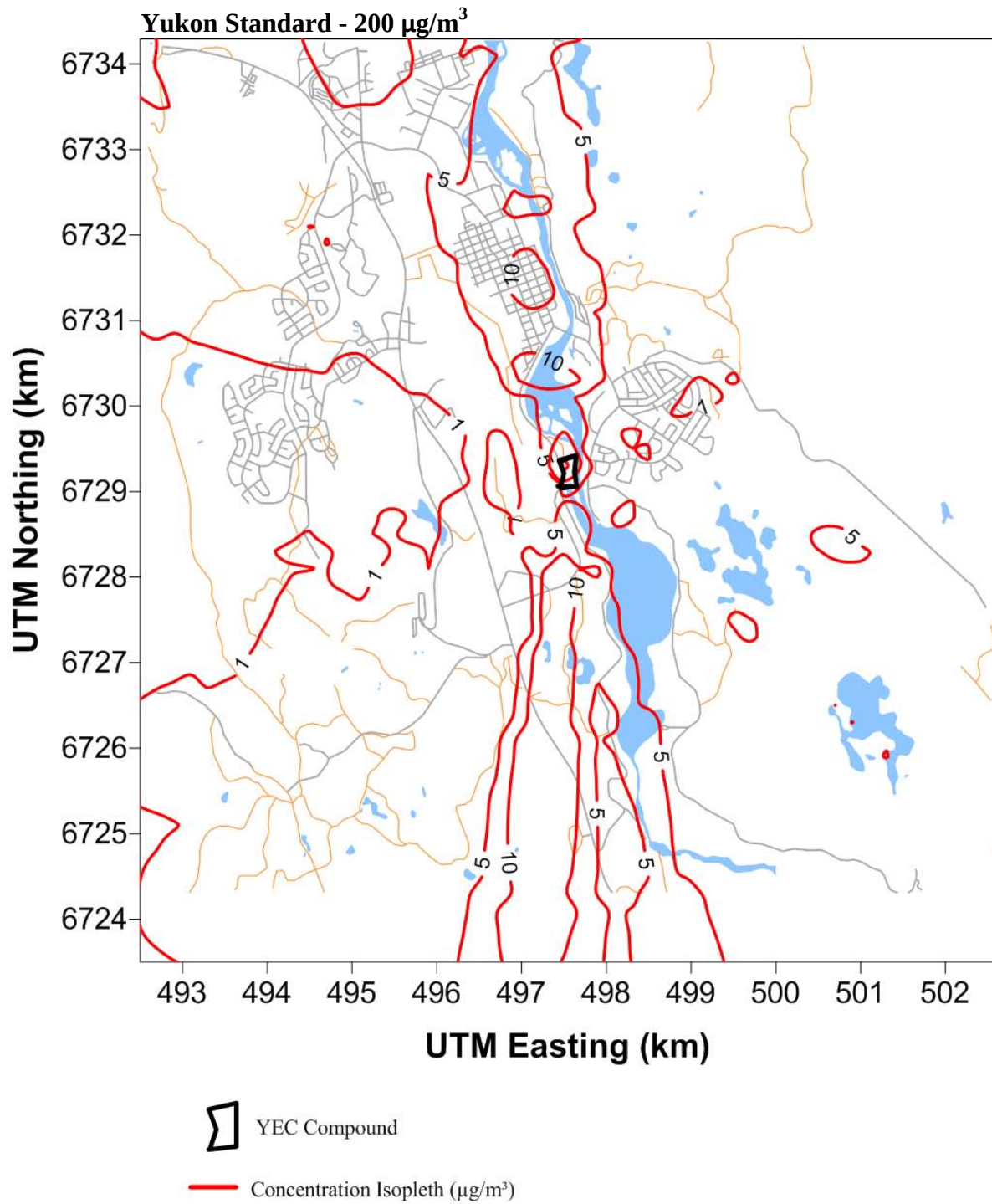
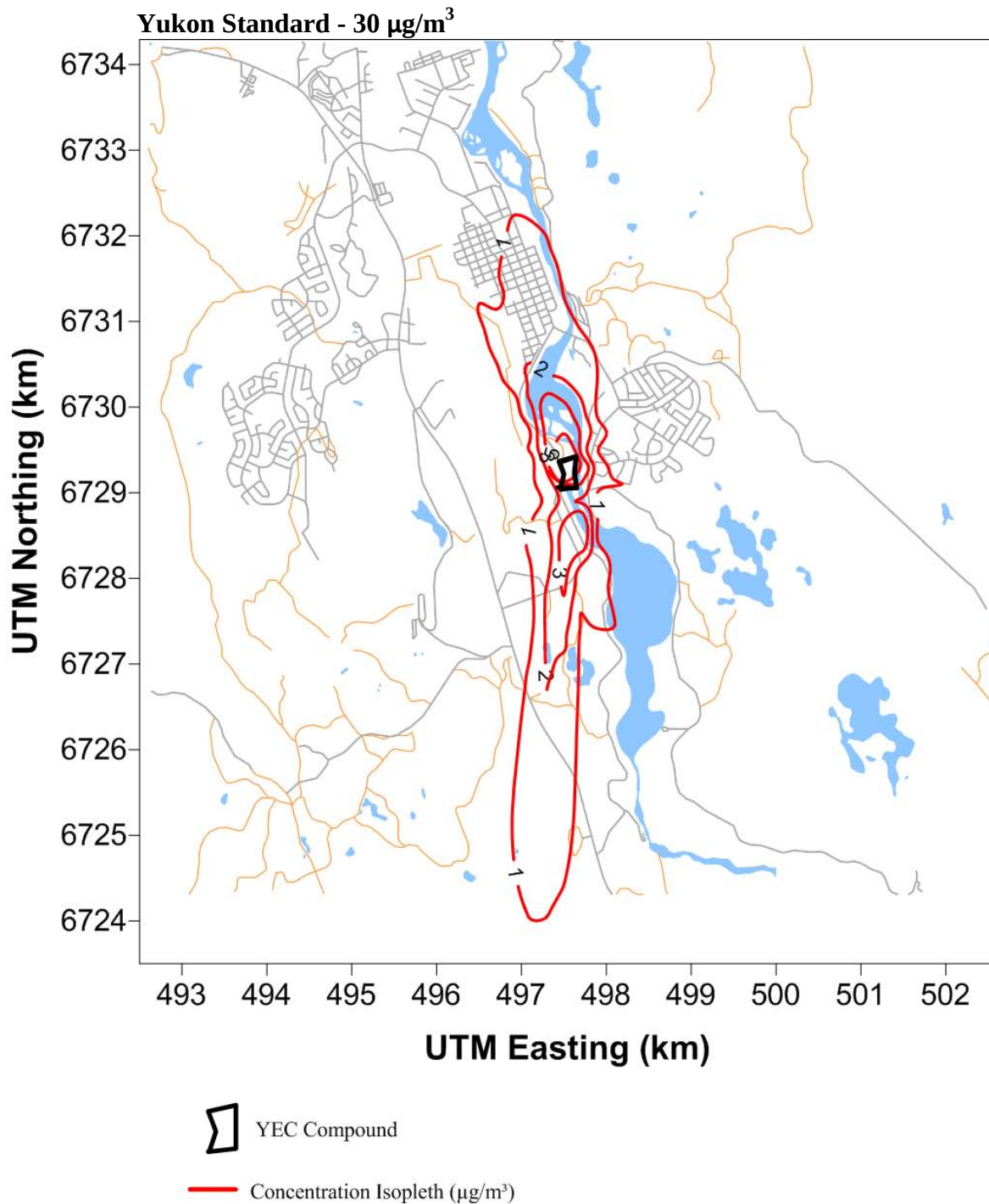


Figure 3.12
Maximum Predicted Incremental 24-hour Average PM_{2.5} Concentrations - Scenario 2
(excluding background air quality)



3.3.3 Scenario 3 (Worst-case Power Generation)

The maximum ambient concentrations predicted for Scenario 3 are considerably higher than those estimated for Scenarios 1 and 2. This is a result of higher assumed emissions due to longer periods of power generation, the simultaneous operation of up to five units at certain times and more frequent operation under a greater number of atmospheric conditions which can include stagnant conditions where dispersion of air contaminants is hindered.

Isopleth plots of 1-hour and 24-hour average maximum predicted NO₂ concentrations are provided in Figures 3.13 and 3.14, respectively. Similarly, isopleths plots for maximum predicted 24-hour average PM_{2.5} concentrations are shown in Figure 3.15.

The highest predicted 1-hour average NO₂ concentration is predicted to occur immediately adjacent to the YEC compound. Due to a gradual conversion of NO to NO₂ with distance, several pockets of elevated NO₂ concentrations of between 100 and 150 µg/m³ are predicted to occur several kilometres from the point of release. The highest 24-hour average NO₂ concentration is also predicted to occur adjacent to the YEC compound due to the effects of building downwash from the short stacks of the diesel generators. Predicted 24-hour concentrations in the community are generally low at 5-10 µg/m³.

Similarly, elevated 1-hour average PM_{2.5} concentrations are predicted to occur very near the diesel plant due to building downwash, but predicted concentrations further from the plant are generally low. The maximum predicted 24-hour average PM_{2.5} concentrations are less than 2 µg/m³ in almost all areas of the community.

Figure 3.13
Maximum Predicted Incremental 1-hour Average NO₂ Concentrations - Scenario 3
(excluding background air quality)

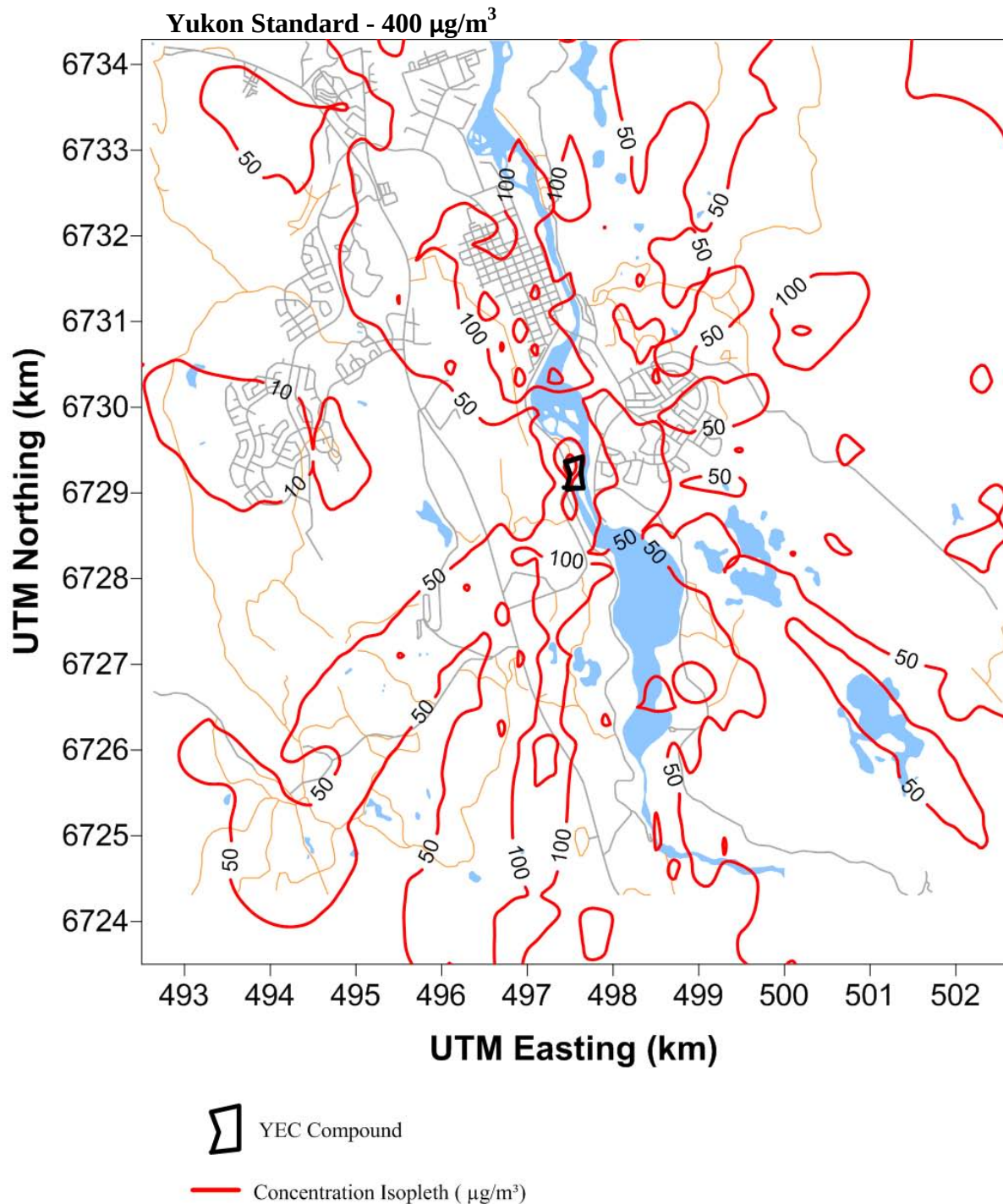


Figure 3.14
Maximum Predicted 24-hour Average NO₂ Concentrations - Scenario 3
(excluding background air quality)

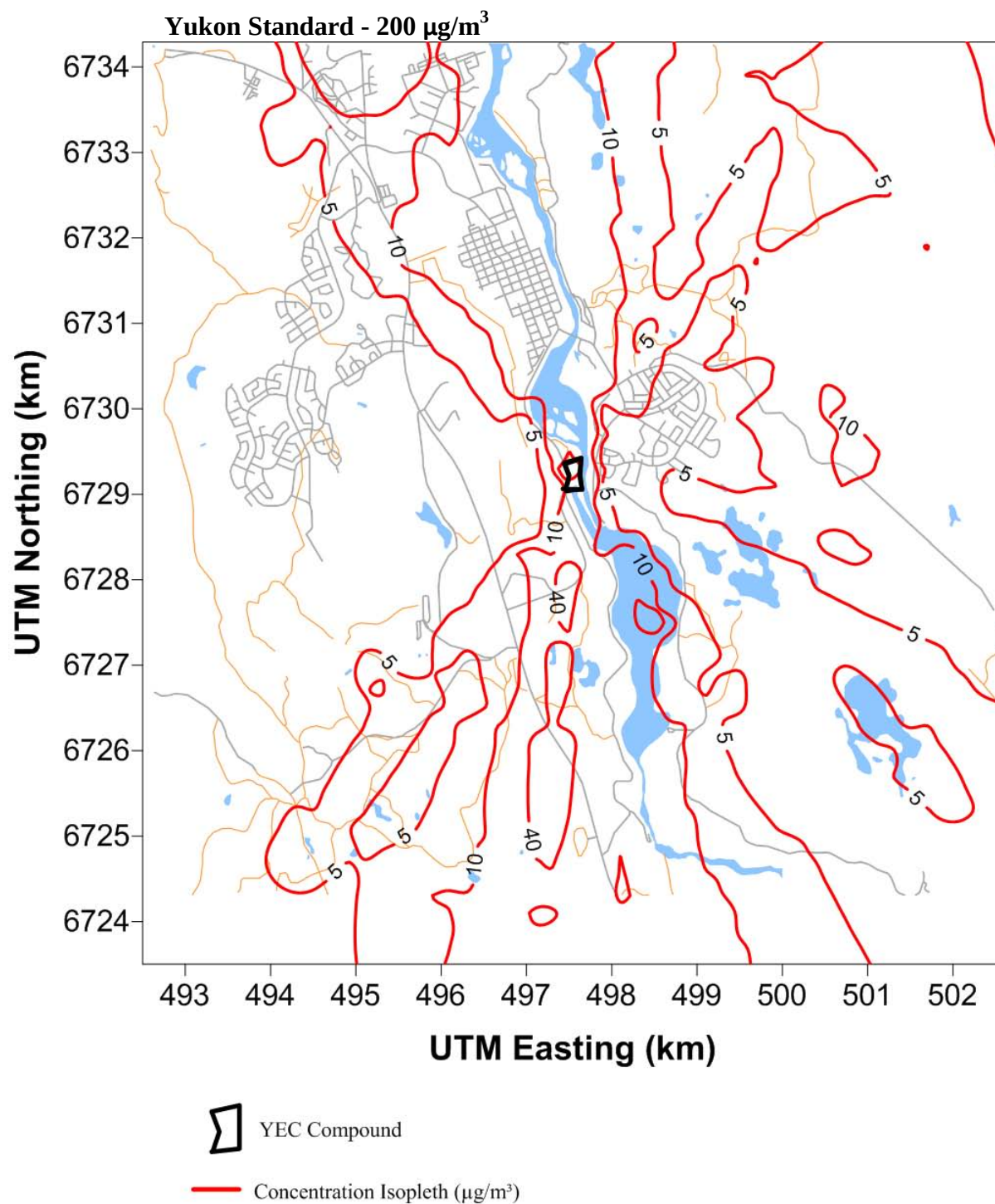
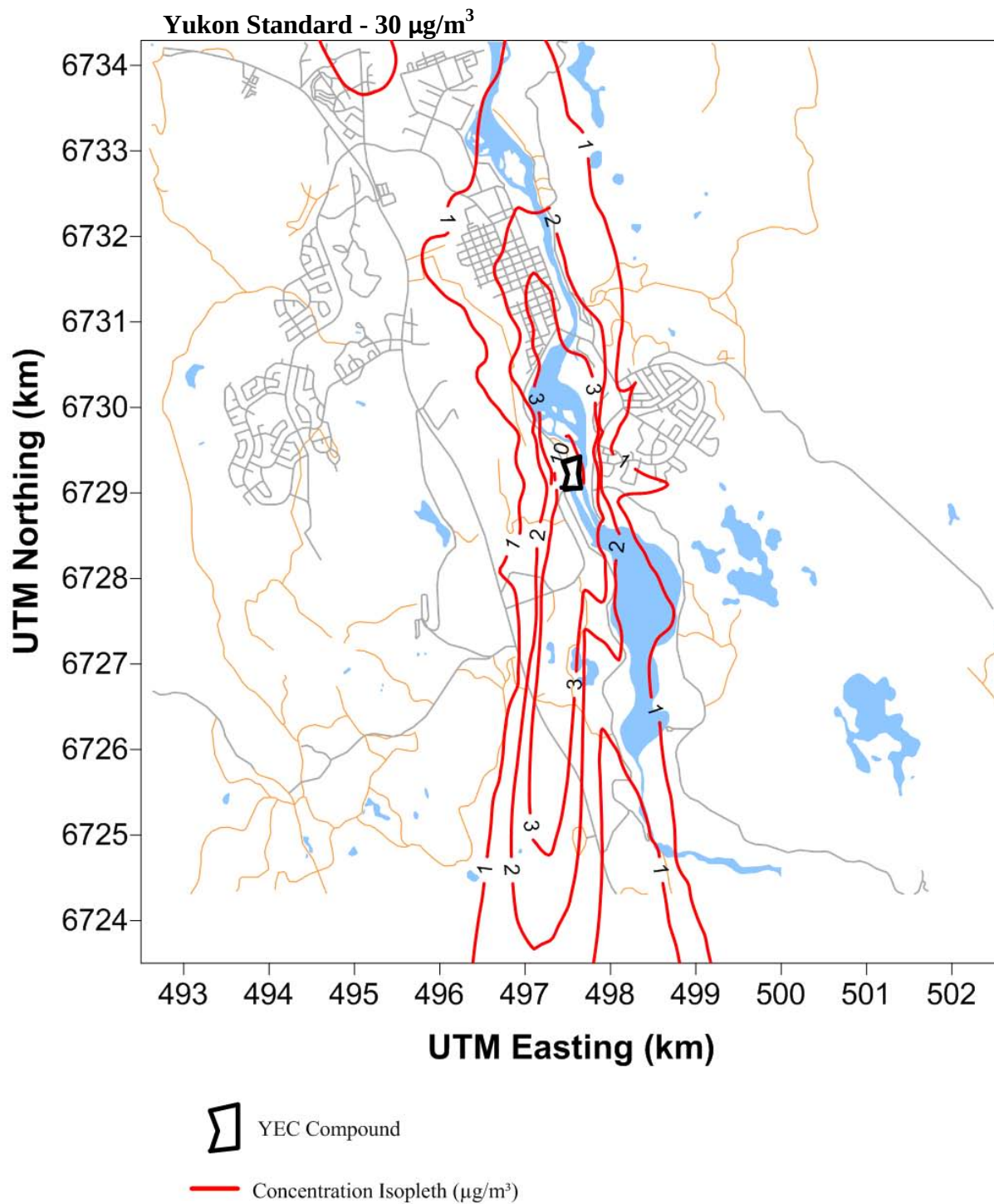


Figure 3.15
Maximum Predicted Incremental 24-hour Average PM_{2.5} Concentrations - Scenario 3
(excluding background air quality)



4.0 OBSERVED AIR QUALITY IN WHITEHORSE

4.1 AMBIENT AIR QUALITY STANDARDS

Table 4.1 presents the ambient air quality standards adopted by the Yukon Territory in 2010 for regulating air quality. These standards represent the maximum acceptable concentrations of pollutants in ambient air and are used to determine the acceptability of emissions from proposed and existing emission sources.

TABLE 4.1
Yukon Ambient Air Quality Standards

Pollutant	Time Frame	Yukon Air Quality Standards		
		$\mu\text{g}/\text{m}^3$	ppm	ppbv
Sulphur Dioxide(SO_2)	Annual	30		11
	24 Hour	150		57
	1 Hour	450		172
Nitrogen Dioxide (NO_2)	Annual	60		32
	24 Hour	200		106
	1 Hour	400		213
Carbon Monoxide (CO)	8 Hour	5800	5	
	1 Hour	15000	13	
Particulate Matter ($\text{PM}_{2.5}$)	24 Hour	30		

4.2 BACKGROUND AIR QUALITY LEVELS

Table 4.2 provides a summary of the available air quality monitoring data for Whitehorse. The monitoring station in Whitehorse, located at 1091 - 1st Avenue, is part of the National Air Pollution Surveillance (NAPS) network operated by Environment Canada. The most recent 5-year data record includes monitoring for CO, NO_2 and $\text{PM}_{2.5}$ for the period 2001-2005.

The data in Table 4.2 indicate that the maximum levels of these three contaminants in Whitehorse are well below ambient air quality standards adopted by Yukon Environment in 2010. In fact, in September 2011, the World Health Organization rated Whitehorse as the cleanest city in Canada on the basis of annual average $\text{PM}_{2.5}$ level of only $3 \mu\text{g}/\text{m}^3$. The data for NO_2 and $\text{PM}_{2.5}$ in 2004 and 2005 are anomalously high due to forest fires in the area, and as such are not representative of typical levels of these contaminants in Whitehorse.

Table 4.2
Air Quality Monitoring Data Summary for Whitehorse

CAC	Averaging Period	Yukon Standards	Level	Observed Concentrations (µg/m ³)					Background Air Quality ¹
				2001	2002	2003	2004	2005	
CO	1-h	15,000	Max.	4872	4408	4408	2552	2088	
			98 th	1276	1044	812	812	812	951
	8-h	5800	Max.	2784	1972	1856	1740	1508	
			98 th	1160	928	696	696	812	858
NO ₂	1-h	400	Max.	5.7	19.1	24.8	84.0	74.5	
			98 th	3.8	5.7	1.9	32.5	32.5	3.8
	24-h	200	Max.	3.8	11.5	9.6	32.5	45.8	
			98 th	3.8	5.7	1.9	21.0	26.7	3.8
	annual	60	n/a	n/a	1.9	n/a	n/a	7.6	
PM _{2.5}	24-h	30	Max.	12	11	14	101	80	
			98 th	9	7	8	46	12	8.0

n/a – not available or not applicable

¹ Background air quality calculated as a 5-year average of the 98th percentile concentrations for CO, and as a 3-year average (2001-2003) of the 98th percentile concentrations for NO₂, and PM_{2.5}

The effect of the forest fires in 2004 and 2005 on air quality in Whitehorse can be seen in the frequency distributions for 1-hour average NO₂ and 24-hour average PM_{2.5} concentrations in 2004-2005 as compared with 2001-2003. Figures 4.1 and 4.2 show that NO₂ concentrations in 2004-2005 were higher than in the preceding 3 years even at the lowest percentiles and were significantly higher even at the 80th percentile. Similarly, the 24-hour average NO₂ concentrations were also anomalously higher in 2004 and 2005 than in the three preceding years. Nevertheless, the maximum NO₂ concentrations recorded in 2004/2005 were still only about 20% of the 1-hour average ambient air quality standard of 400 µg/m³ and 23% of the 24-hour average standard of 200 µg/m³. From the frequency distributions of PM_{2.5} concentrations in 2004 and 2005, it is estimated that the Yukon standard would have been exceeded in Whitehorse on approximately 14-15 days in 2004 and on 3-4 days in 2005 due to smoke from forest fires.

Figure 4.3 shows a similar pattern for PM_{2.5} concentrations to that of NO₂ concentrations over the 2001-2005 period. Concentrations of fine particulate matter were higher than was typical in 2001-2003 above the 90th percentile level in 2004 and above the 98th percentile level in 2005.

Figure 4.1
Frequency Distributions of 1-Hour Average NO₂ Concentrations
Whitehorse 2001-2005

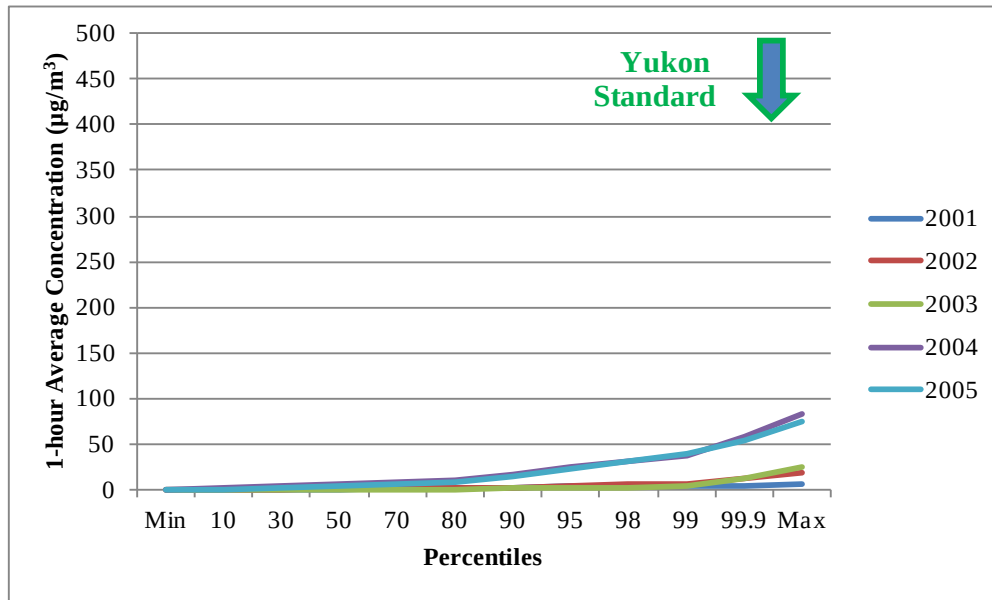


Figure 4.2
Frequency Distributions of 24-Hour Average NO₂ Concentrations
Whitehorse 2001-2005

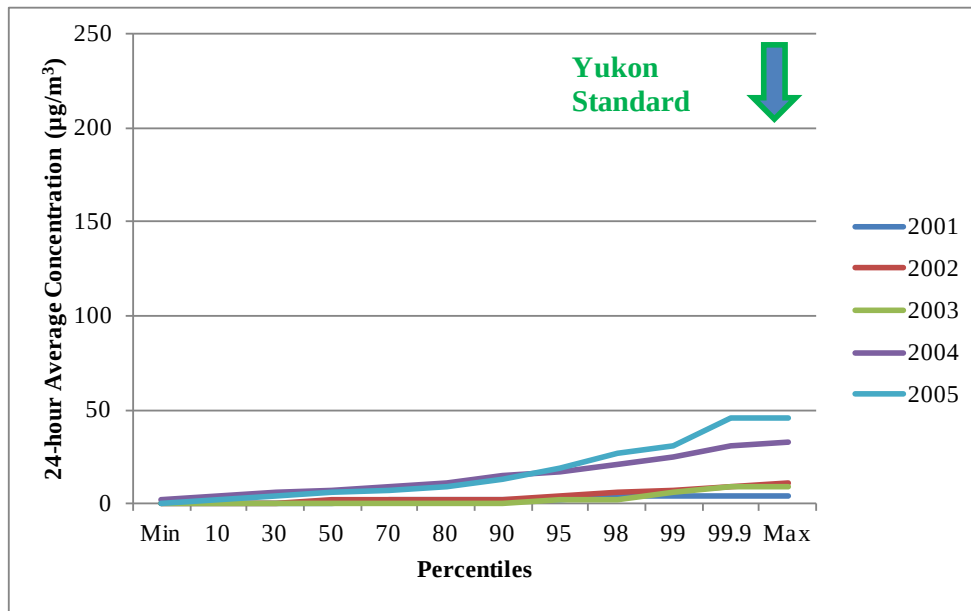
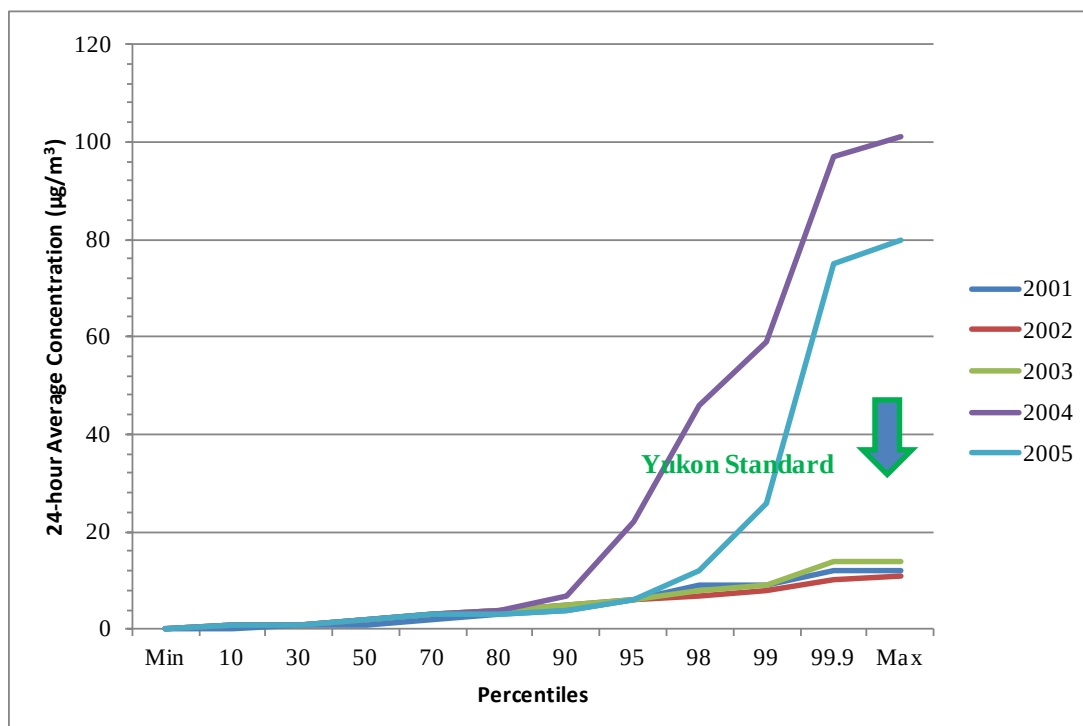


Figure 4.3
Frequency Distributions of 24-Hour Average PM_{2.5} Concentrations
Whitehorse 2001-2005



For regulatory air quality analyses, there is no consistency in the way that regulatory agencies apply air quality monitoring data to define background air quality. Some jurisdictions use the maximum observed concentrations, while others use some lower percentile level such as the 90th percentile (Ontario) or the 98th percentile value (British Columbia). In keeping with the adherence to the B.C. Modelling Guidelines for regulatory applications, the background CO, NO₂ and PM_{2.5} concentrations for Whitehorse were defined as the 98th percentile values from the 2001-2005 period of record.

For the observations of NO₂ and PM_{2.5}, the interpretation of background air quality is complicated by the fact that, as indicated in Figures 4.1, 4.2 and 4.3, two of the five years of record are quite different from the other three due to forest fires. The maximum NO₂ concentrations in 2001-2003 were only 24.8 µg/m³ (1-hour average) and 11.5 µg/m³ (24-hour average), compared with 84 µg/m³ and 45.8 µg/m³ respectively in 2004/2005. Similarly, the 98th percentiles for NO₂ concentrations were just 3.8 µg/m³ for both the 1-hour and 24-hour averaging periods during the 3 non-forest fire years, and 32.5 µg/m³ and 23.9 µg/m³ respectively for 2004/2005. For particulate matter, the maximum 24-hour average PM_{2.5} concentration for

the period 2001-2003 was $14 \mu\text{g}/\text{m}^3$, compared with $101 \mu\text{g}/\text{m}^3$ in 2004. The average 98th percentile concentration for 2001-2003 was just $8 \mu\text{g}/\text{m}^3$, compared with $46 \mu\text{g}/\text{m}^3$ in 2004 and $12 \mu\text{g}/\text{m}^3$ in 2005.

Consequently, it is difficult to determine which values should be used to define the ‘normal’ background levels of either of these pollutants. For the purposes of this assessment, the background CO levels have been calculated over the entire 5-year period 2001-2005. However, the NO₂ and PM_{2.5} concentrations have been defined as the 98th percentile value average over the 3-year period 2001-2003.

5.0 DISCUSSION OF RESULTS

Table 5.1 lists the maximum predicted incremental (excluding background air quality) concentrations at the six discrete receptor sites and the maximum point of impingement for YEC operations under emission Scenarios 1, 2, and 3.

The data indicate that all predicted air quality impacts due to actual operation of the YEC diesel generators in 2010 were low, and that YEC emissions (excluding background air quality) are within the Yukon ambient air quality standards for all contaminants everywhere in Whitehorse, throughout the year, in both Scenario 1 and Scenario 2.

The data in Table 5.1 also indicate that predicted air quality impacts due to YEC emissions would be considerably higher for worst-case operations that might occur after several low water years culminating in an extreme drought (as modelled in Scenario 3). However, even in that worst-case scenario, predicted air quality impacts due to YEC emissions would still be within the Yukon ambient air quality standards for CO, NO₂ and SO₂ everywhere in Whitehorse, throughout the year, and the only exceedence of the Yukon ambient air quality standards (due to YEC operations alone, excluding background air quality) would be with respect to PM_{2.5} at the Max POI, which would occur on only two days of the year (one day each in March and April).

Table 5.1
Summary of Maximum Predicted Incremental Concentrations Due to YEC Emissions
(excluding background air quality)

Emission Scenario	Receptor Location	Maximum Concentrations ($\mu\text{g}/\text{m}^3$)						
		CO		NO ₂		SO ₂		PM _{2.5}
		1-hour	8-hour	1-hour	24-hour	1-hour	24-hour	24-hour
Scenario 1 (Actual 2010)	R1	2.8	1.33	4.7	0.97	0.05	0.011	0.14
	R2	3.6	0.58	6.1	0.32	0.07	0.004	0.05
	R3	1.0	0.15	4.7	0.27	0.02	0.001	0.01
	R4	2.0	0.36	9.5	0.64	0.04	0.002	0.03
	R5	1.2	0.58	7.7	1.81	0.02	0.005	0.07
	R6	10.1	2.48	16.9	2.45	0.19	0.027	0.36
	Max POI	34.9	10.6	58.7	8.7	0.64	0.090	1.30
Scenario 2 (Average-case)	R1	19.32	5.56	31.75	3.81	1.05	0.113	1.69
	R2	8.57	3.45	15.38	2.11	0.51	0.069	1.04
	R3	5.26	0.89	26.02	2.04	0.31	0.023	0.41
	R4	6.65	2.94	32.21	7.18	0.33	0.082	1.17
	R5	5.75	1.95	39.73	5.59	0.35	0.047	0.71
	R6	63.59	28.98	103.85	24.67	3.45	0.795	11.43
	Max POI	74.91	46.24	133.35	49.17	3.83	1.539	23.00
Scenario 3 (Worst-case)	R1	109.2	23.78	63.0	6.4	2.1	0.2	2.3
	R2	46.7	18.00	31.3	4.4	1.0	0.1	1.5
	R3	37.2	4.73	68.7	4.6	0.7	0.0	0.6
	R4	43.1	18.39	83.2	21.4	1.0	0.2	2.7
	R5	35.2	15.05	92.3	16.7	0.8	0.1	1.6
	R6	304.6	159.11	194.1	48.2	6.5	1.6	17.1
	Max POI	306.5	228.7	195.8	94.7	35.3	3.2	33.5
Yukon Standards		15,000	5,800	400	200	450	150	30

Table 5.2 and Figure 5.1 show the cumulative effect of YEC emissions in combination with background concentrations of contaminants for each of the three Scenarios. In particular, Table 5.2 lists the maximum predicted concentrations at the Maximum Point of Impingement near the western edge of the facility property line, including background concentrations from Table 4.2.

Table 5.2 illustrates that Yukon ambient air quality standards would not be exceeded for CO and NO₂ due to the cumulative effect of YEC emissions and background concentrations of those contaminants, in any Scenarios. Note that SO₂ is not monitored in Whitehorse. Therefore, only the incremental concentrations of SO₂ due to YEC operations are listed in Table 5.2. Given the

low predicted impacts from YEC operations and the absence of any other major sources of SO₂ in the community, it can also safely be assumed that the standards would not be exceeded for SO₂ concentrations in any Scenarios.

With respect to PM_{2.5}, Figure 5.1 shows the frequency distribution of predicted 24-hour average PM_{2.5} concentrations (including background air quality) at the Max POI for Scenarios 2 (Average Operating Scenario) and Scenario 3 (Worst-case Operating Scenario).

For Scenario 2, it is anticipated that there would be only one day during the year when the Yukon PM_{2.5} Standard could potentially be exceeded at the Max POI location as a result of the cumulative effect of YEC emissions and an assumed background PM_{2.5} concentration of 8.0 µg/m³.

Figure 5.1 also shows that, even in the event of worst-case operations that might occur after several low water years culminating in an extreme drought (as modelled in Scenario 3), the ambient air quality standard for PM_{2.5} would only be exceeded at the Max POI location on seven days of the year, but not at any other locations in Whitehorse.

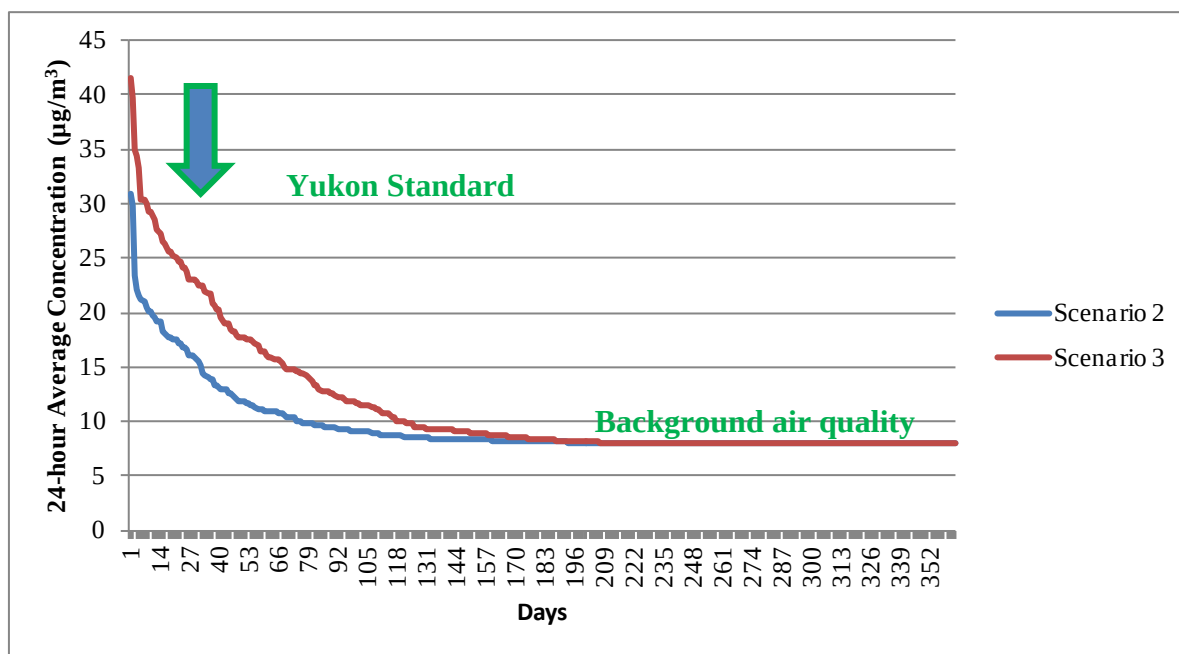
PM_{2.5} concentrations would remain at background levels for 155 days of the year even in severe drought conditions with maximum load operations on the diesel generators.

*Air Quality Assessment Update in Support of Permit Renewal
for Diesel Generator Operations*

Table 5.2
Summary of Maximum Predicted Concentrations at Maximum Point of Impingement
Due to YEC Power Generation
(including background air quality)

Contaminant	Averaging Period	Maximum Predicted Concentration ($\mu\text{g}/\text{m}^3$)			Yukon Standards ($\mu\text{g}/\text{m}^3$)	% of Standard		
		Scenario 1 Actual 2010	Scenario 2 Average	Scenario 3 Max. Load		Scenario 1 Actual 2010	Scenario 2 Average	Scenario 3 Max. Load
CO	1 Hour	985.9	1025.91	1257.5	15,000	6.4%	6.8%	8.4%
	8 Hour	868.6	904.24	1086.7	5,800	15.0%	15.6%	18.7%
NO ₂	1 Hour	62.5	136.85	195.8	400	15.6%	34.2%	49.9%
	24 Hour	12.5	52.97	98.5	200	6.3%	26.5%	49.3%
SO ₂	1 Hour	0.64	3.8	35.3	450	0.1%	0.8%	7.8%
	24 Hour	0.09	1.53	3.2	150	0.06%	1.0%	2.1%
PM _{2.5}	24 Hour	10.3	31.0	41.5	30	34.3%	106.7%	141.7%

Figure 5.1
Frequency Distribution of Predicted 24-hour Average PM_{2.5} Concentrations
Scenarios 2 and 3
(including background air quality)



6.0 CONCLUSIONS

The update of the air quality assessment for the YEC operations in Whitehorse indicates that air contaminant emissions due to actual operations in 2010 were low, and would have been within the limits set by Yukon Environment Ambient Air Quality Standards.

With projected greater potential operations and after successive dry years culminating in an extreme drought year, air quality impacts from YEC operations could be greater, but would still be within the limits set by Yukon standards for CO, NO₂ and SO₂ in all locations, as well as for PM_{2.5} in all locations except for the Maximum Point of Impingement located at the western edge of the facility property line. At this location, the Yukon Standard could be exceeded due to YEC emissions alone (excluding background air quality) only in the extreme drought conditions modelled by Scenario 3, for only two days of the year. Moreover, at this location, the Yukon Standard could be exceeded due to the cumulative effect of YEC emissions and the assumed background concentration of PM_{2.5} for only one day of the year in Scenario 2, and for up to seven days of the year in Scenario 3, due to building downwash of the exhaust plumes from the YEC facility.

However, PM_{2.5} concentrations at all other locations in Whitehorse beyond the facility property line would remain well below the Yukon standards. In fact, the incremental contribution of YEC emissions to ambient air quality levels in most areas of Whitehorse would remain at about 2 µg/m³ or less even for the maximum demand power generation scenario forecast in the event of extraordinarily severe drought conditions when hydro-power generation would need to be substantially supplemented with diesel power generation.

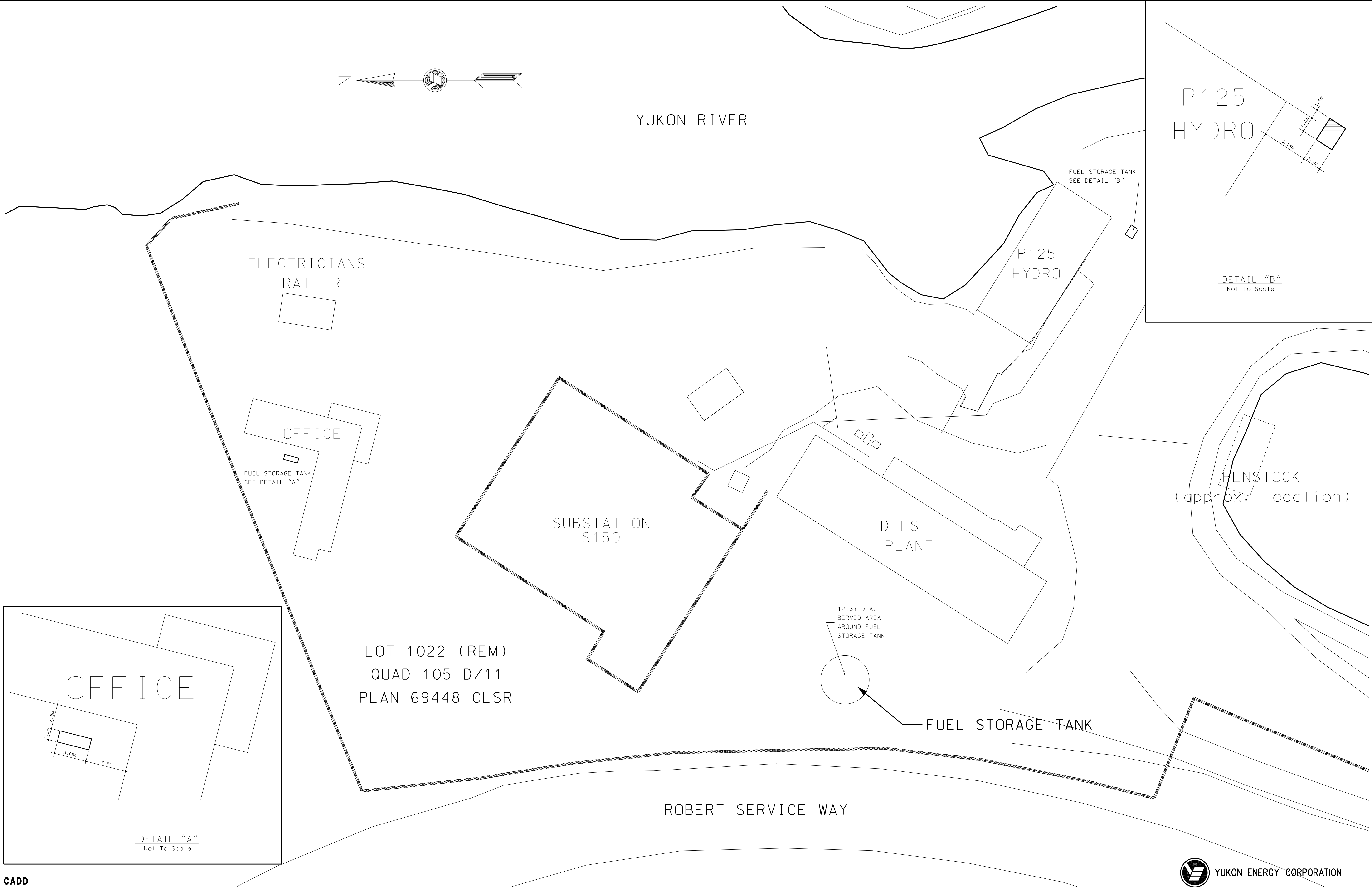
YUKON
ENERGY



***Air Emissions Permit (No. 4201-60-010)
Renewal Application Supporting Document***

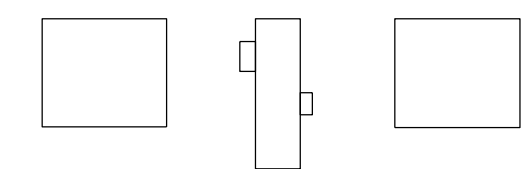
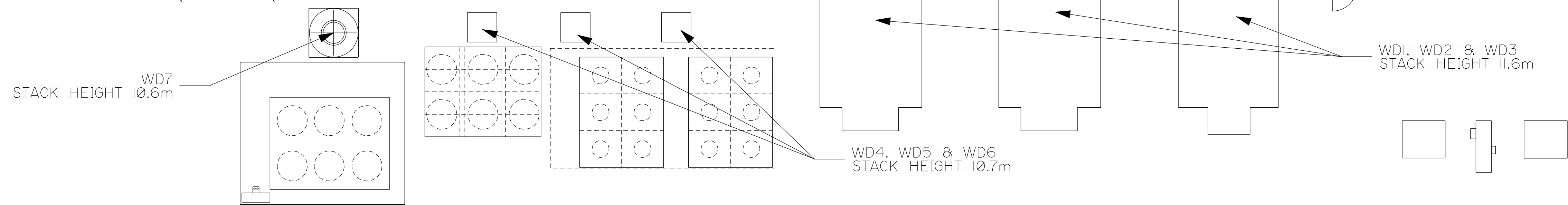
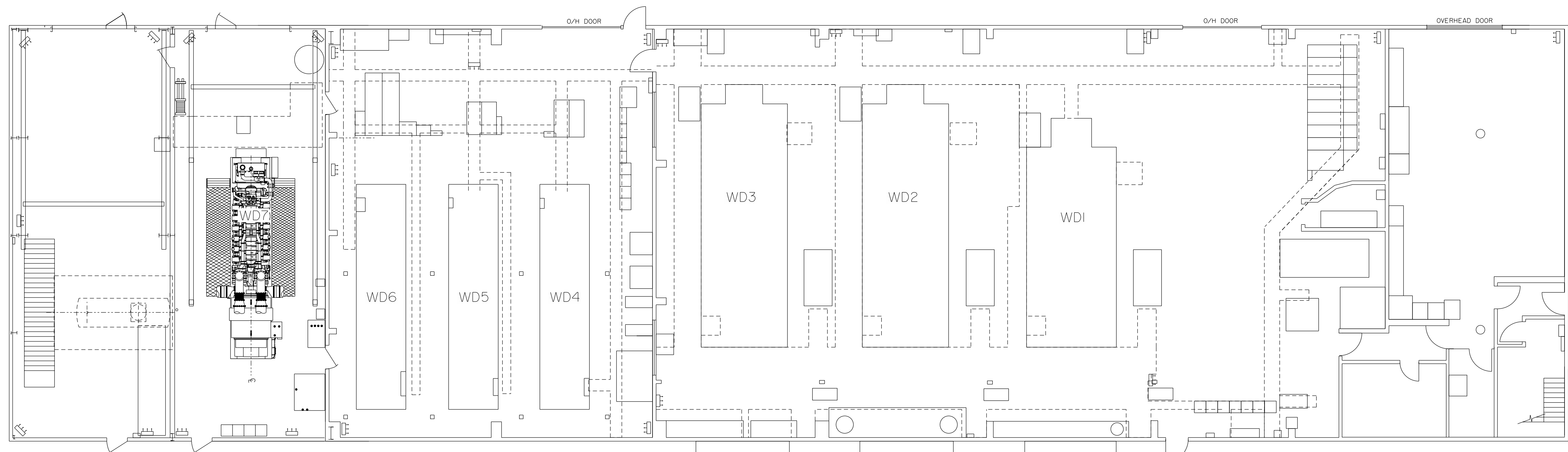
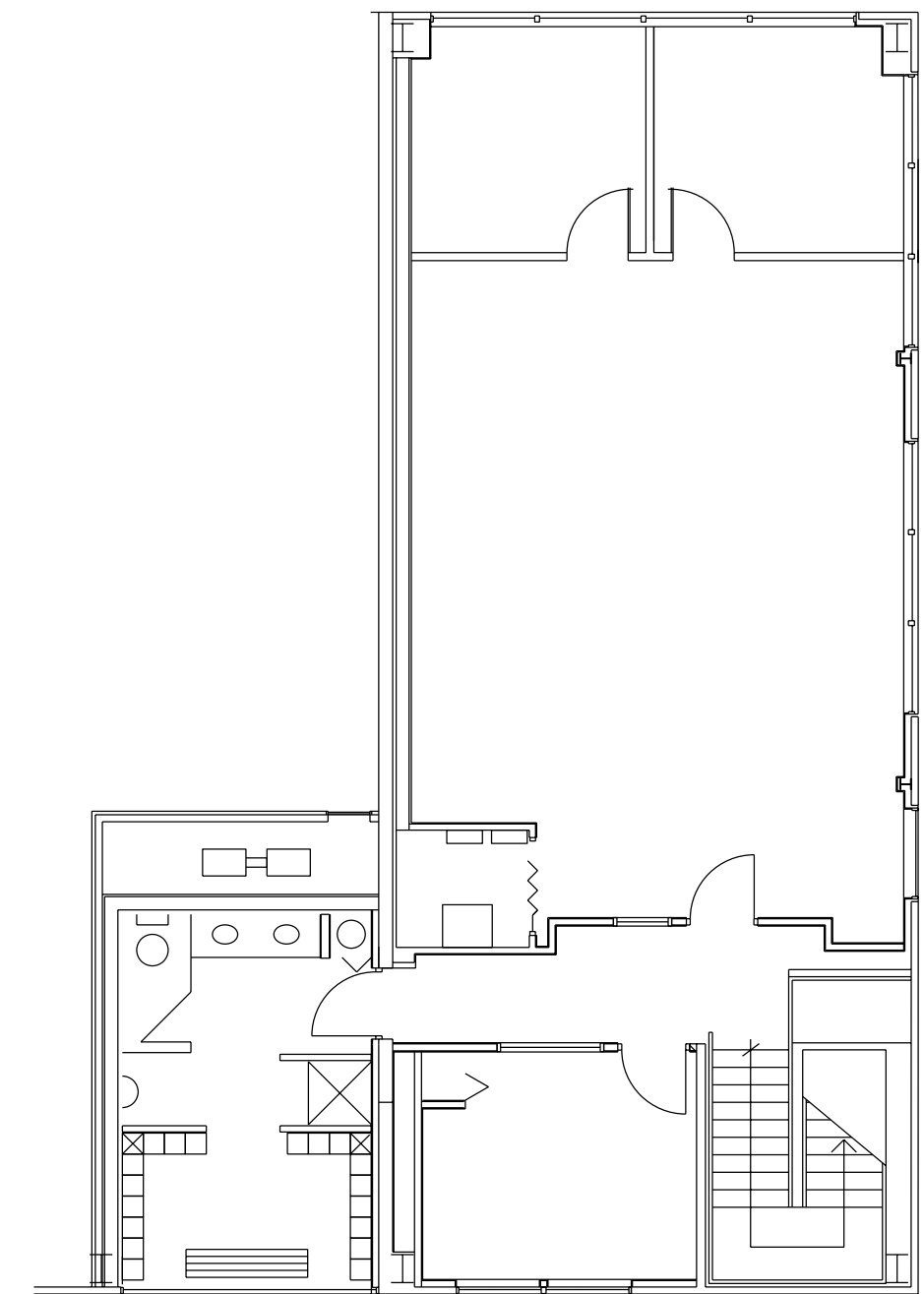
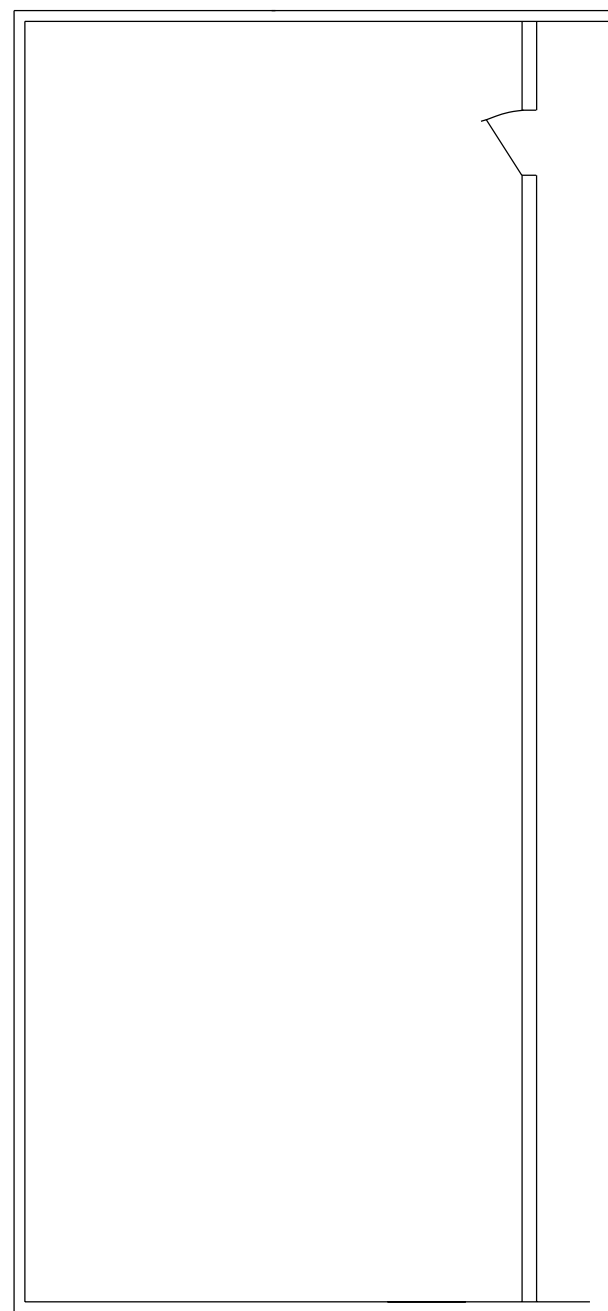
Appendix C

Diesel Plant Drawings



CADD																							PROTECTION				MECHANICAL				2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION SUPPORTING DOCUMENTATION WHITEHORSE HYDRO/DIESEL PLANT SITE PLAN							
																						STANDARD				CIVIL												
																						PROJECT ENG.				DESIGN												
																						ENG. MANAGER				ELECTRICAL												
0	SEPT19/08	2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION		CM																											6-JUN-03	DRAWN TARA		DESIGN BY		SCALE NTS		
NO.	DATE	REVISIONS		BY	CIVIL	DESIGN	ELEC	MECH	PROT	STND	P.ENG	E.MAN	NO.	DATE	REVISIONS		BY	CIVIL	DESIGN	ELEC	MECH	PROT	STND	P.ENG	E.MAN	REF. DWG. NO.		REF. DWG. TITLE		APPROVALS		DATE	APPROVALS		DATE	A1	DWG. NO. WHITEHORSE SITE.DGN	

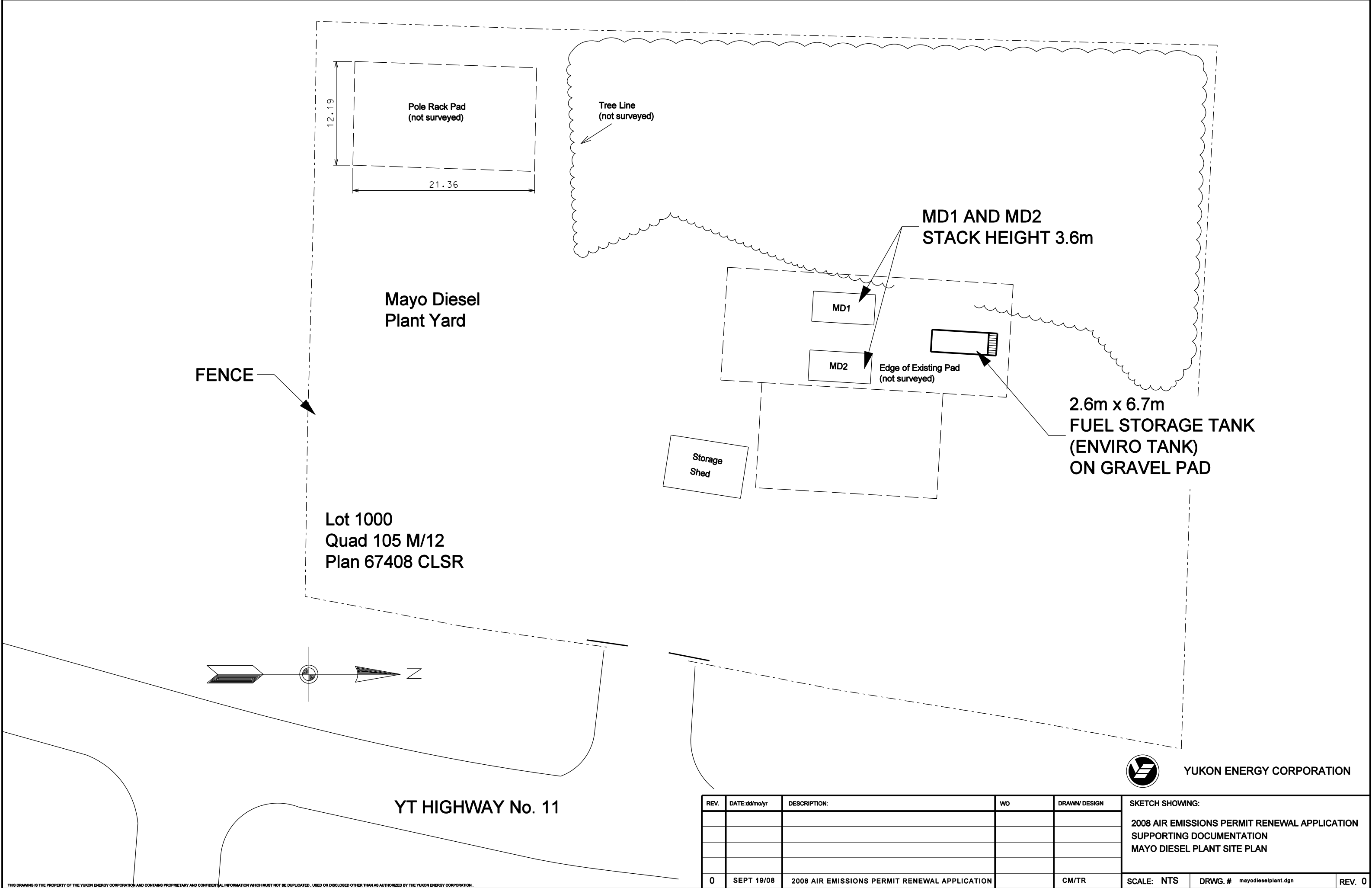
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YUKON ENERGY CORPORATION

REV.	DATE:dd/mo/yr	DESCRIPTION:	WO	DRAWN/ DESIGN	SKETCH SHOWING:	
					2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION SUPPORTING DOCUMENTATION MAYO DIESEL PLANT SITE PLAN	
0	SEPT 19/08	2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION		CM/TR	SCALE: NTS	REV. 0
					DRWG. # mayodieselplant.dgn	

YUKON
ENERGY



*Air Emissions Permit (No. 4201-60-010)
Renewal Application Supporting Document*

Appendix D

Yukon Energy's Existing Air Emissions Permit



Permit No: 60-010

AIR EMISSIONS PERMIT

Issued Pursuant to
the *Environment Act* and the *Air Emissions Regulations*

Permittee: Yukon Energy Corporation

Mailing Address: Box 5920, Whitehorse, YT, Y1A 6S7

Site Locations: Diesel-powered electricity generating stations at:
Dawson
Faro
Mayo
Whitehorse

Authorized Representative: Travis Ritchie
Phone/Fax: (867) 393-5350 / (867) 393-5322
Email: travis.ritchie@yec.yk.ca

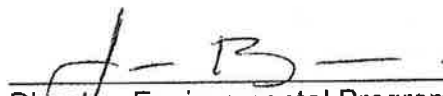
Effective Date: Date of Director's Signature

Expiry Date: December 31, 2011

This permit replaces permit #60-010 issued on June 15, 2009.

Scope of Authorization: In accordance with your application, you are authorized to operate electricity generating equipment with a maximum nameplate capacity equal to or more than 1.0 megawatt ampere, hereinafter referred to as the sources, at the above site locations (the "sites"), as set out in the terms and conditions of this permit.

Dated this 22 day of July, 2011



Director, Environmental Programs Branch
Environment Yukon

DEPARTMENT OF ENVIRONMENT
ENVIRONMENTAL PROGRAMS
Whitehorse, Yukon
Certified true copy of original
Date: July 22, 2011 Initials: SS

1. DEFINITIONS

1. In this permit,

"Act" means the *Environment Act*, R.S.Y. 2002, c. 76;

"approved plan" means a plan that is submitted by the permittee and approved by an environmental protection analyst under this permit and includes any terms and conditions specified by the environmental protection analyst in the approval;

"associated personnel" means all employees, contractors and volunteers involved in the permitted activities;

"Branch" means the Environmental Programs Branch, Environment Yukon;

"environmental protection analyst" means an employee of the Branch so designated by the Minister of Environment under the Act;

"environmental protection officer" means an employee of the Government of Yukon so designated by the Minister of Environment under the Act;

"office" means the office of the permittee located in Yukon;

"Regulations" means the *Air Emissions Regulations*, O.I.C. 1998/207; and

"source" means each fuel-fired electricity generator having a maximum nameplate capacity equal to or more than 1.0 megavolt-ampere at a site.

2. Any term not defined in this permit that is defined in the Act or the Regulations has the same meaning as in the Act or the Regulations.

2. GENERAL

1. No condition of this permit limits the applicability of any other law or bylaw.
2. The permittee shall ensure that all activities authorized by this permit occur on property that the permittee has the right to enter upon and use for that purpose.
3. The permittee shall ensure that all associated personnel:
 - a) have access to a copy of this permit;
 - b) are knowledgeable of the terms and conditions of this permit; and
 - c) receive the appropriate training for the purposes of carrying out the requirements of this permit.
4. The permittee shall provide notice in writing to an environmental protection analyst prior to any significant change of circumstances at the site, including without limitation:
 - a) discontinuation of any regulated activity at the site;
 - b) change of ownership of the site or any of the sources; and
 - c) change to the mailing address or phone number of the permittee.

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ENVIRONMENTAL PROGRAMS
Whitehorse, Yukon
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Date: July 22/11 Initials: SJ...

5. The permittee shall obtain approval from an environmental protection analyst prior to:
 - a) any addition, modification, removal or replacement of any equipment or components related to the release, abatement, control or treatment of air emissions; or
 - b) any change in location of the source(s).
6. Where conflicts exist between this permit, the permit application or any plans, this permit shall prevail.
7. If an inspection reveals that the site or source(s) is in any way not in compliance with this permit, the permittee shall repair the damage or take other actions as required to bring the site or source(s) into compliance.
8. For clarity, all obligations of the permittee under this permit survive the expiry date.

3. PLANS

1. The permittee shall develop and maintain the following plans:
 - a) a fire safety/emergency plan which includes notification procedures and a list of emergency phone numbers relevant to the site; and
 - b) a current site plan showing the location of each source and any stand-alone air pollution control equipment,and shall produce these plans upon request for inspection by an environmental protection officer.
2. The permittee shall ensure that all associated personnel are familiar with the plans listed in paragraph 3.1.
3. When the permittee is required to submit a plan under this permit, the permittee shall:
 - a) ensure the plan meets the requirements for that type of plan as established by the Branch in writing;
 - b) submit the plan in writing to an environmental protection analyst;
 - c) not undertake any of the activities described in the plan until the plan is approved in writing by an environmental protection analyst; and
 - d) implement the plan as of the date it is approved in writing by an environmental protection analyst.
4. If the permittee wants to amend an approved plan, the permittee shall submit the proposed amendment to an environmental protection analyst as if the amendment were a plan under paragraph 3.3 of this permit.
5. If an environmental protection analyst directs in writing and with reasons that an approved plan be amended, the permittee must prepare the required amendment and submit it as if it were a plan referred to in paragraph 3.3 of this permit.

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4. OPERATION AND MAINTENANCE

1. In accordance with the manufacturer's recommendations and best management practices, the permittee shall maintain and operate the sources, any stand-alone air pollution control equipment, and testing and monitoring equipment as necessary to provide optimum control of air contaminant emissions during all operating periods.
2. Except for maintenance or test purposes, the permittee shall run the sources at each site in order of highest possible efficiency under the circumstances.
3. The permittee shall ensure that the fuel used by the source(s) conforms to the most recent Canadian federal *Sulphur in Diesel Fuel Regulations* for off-road applications.

5. RELEASE OF CONTAMINANTS

1. The visible emissions from any source shall not exceed an opacity of 20% as measured by an environmental protection officer.
2. In the event that the opacity of emissions from any source exceeds the criterion established in paragraph 5.1 of this permit, the permittee shall take all reasonable measures to reduce the opacity of the emissions below that criterion within 5 days of the measured exceedance or in such time as may be directed by an environmental protection officer.
3. The permittee shall report all exceedances of the criterion in paragraph 5.1 and any mitigative measures undertaken in accordance with paragraph 5.2 to an environmental protection officer from the Branch within 15 days of the measured exceedance or in such time as may be directed by an environmental protection officer.
4. The permittee shall ensure that particulates collected using emission control equipment are contained so that there is no release of contaminants to the atmosphere or into an open body of water.

6. MODELLING, TESTING AND REPORTING

1. The permittee shall carry out any dispersion modelling required by this permit in accordance with the document entitled "Guidelines for Air Quality Dispersion Modelling in British Columbia", as updated from time to time.
2. The permittee shall ensure that any stack testing required by this permit is carried out by experienced environmental professionals in accordance with generally-accepted industry practice.
3. The permittee shall conduct stack testing on all sources at the Whitehorse site by August 31st, 2011.

DEPARTMENT OF ENVIRONMENT
ENVIRONMENTAL PROGRAMS

Whitehorse, Yukon

certified true copy of original

Date: July 22/11 Initials: SS

4. The permittee shall submit a report to an environmental protection analyst by September 30th, 2011 which:
 - a. shows the emission rates for NO₂, SO₂, PM_{2.5}, and CO for each source at the Whitehorse site as measured by the stack tests performed in accordance with paragraph 6.3; and
 - b. describes an updated air dispersion model for every site covered by this permit in which all applicable assumptions in the previous models are replaced with relevant emissions data from the Whitehorse stack tests and which identifies:
 - i) the ambient air quality at the site boundaries when the sources at each site are operating under steady-state conditions and as normally required to meet the demand for electricity from that site (i.e. a normal operating scenario);
 - ii) the ambient air quality at the site boundaries when all of the sources at each site are operating under steady-state conditions and at 100% capacity (i.e. a worst-case scenario);
 - iii) emission rates of NO₂, SO₂, PM_{2.5}, and CO from each source based on measured emissions data from the Whitehorse sources;
 - iv) estimated emission rates from the sources at which the Yukon Ambient Air Quality Standards would be exceeded at the site boundaries for NO₂, SO₂, PM_{2.5}, and CO; and
 - v) any assumptions or data used in the development of the models.
5. If an updated dispersion model developed in accordance with paragraph 6.4 shows that any of the Yukon Ambient Air Quality Standards for NO₂, SO₂, PM_{2.5}, or CO would be exceeded at the site boundary under a normal operating scenario based on the average run time of all sources at the site over the previous calendar year, the permittee shall submit a plan to reduce emissions from the sources to an environmental protection analyst for approval by November 30th of the year the updated model was developed.
6. If the permittee is required to submit a plan under paragraph 6.5, the permittee shall also perform a stack test on all sources at each site by June 30th of the year following the year the initial stack test was completed to confirm that all of the Yukon Ambient Air Quality Standards for NO₂, SO₂, PM_{2.5}, and CO are then being met.
7. If additional stack tests under paragraph 6.6 indicate that any of the Yukon Ambient Air Quality Standards for NO₂, SO₂, PM_{2.5} or CO emissions are not being met, the Branch may require the permittee to undertake additional stack testing, remodelling and/or other pollution prevention activities as per the direction of an environmental protection officer.

7. INSPECTIONS

1. The permittee shall conduct visual inspections and maintenance on all source components as per the manufacturer's instructions.

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8. UNAUTHORIZED EMISSIONS

1. The permittee shall contact either an environmental protection officer or the 24-hour Yukon Spill Report Centre (867-667-7244) as soon as possible under the circumstances in the event of an unauthorized release or emission, such as fugitive emissions or emissions resulting from burning fuel other than that allowed for under this permit.

9. RECORDS

1. The permittee shall keep all records required under this permit in a format acceptable to an environmental protection officer for a minimum of three years and make them available for inspection by an environmental protection officer upon request.
2. The permittee shall keep the following records at the office:
 - a) a copy of each report and plan developed under this permit, and any amendments to and approvals (if applicable) of each report and plan;
 - b) summaries of all inspections carried out under this permit (including the name of the person conducting the inspection, the date of each inspection, any observations recorded during the inspection, actions taken as a result of those observations, and the date each action was taken);
 - c) notes concerning any spills, leaks or unauthorized emissions occurring at the site, including substance involved, estimated quantity, date of observation of the spill or leak, spill reports made and clean-up procedures implemented;
 - d) any and all deficiencies remedied in accordance with paragraph 2.7, and how and when they were remedied; and
 - e) notes concerning any instance where the most efficient source was not used in accordance with paragraph 4.2 and the reason for use of the less efficient source.

DEPARTMENT OF ENVIRONMENT
ENVIRONMENTAL PROGRAMS
Whitehorse, Yukon
Certified true copy of original
Date: July 22/11 Initials: ST.....



**Yukon Energy
Corporation**
P.O. Box 5920
Whitehorse
Yukon Y1A 6S7
Ph: (867) 393-5300
Fax: (867) 393-5322

October 25, 2011

Kathy Thibaudeau, Manager
Southeast Assessment District/Watson Lake Designated Office
Yukon Environmental & Socio-economic Assessment Board
PO Box 294
Watson Lake, YT Y0A 1C0

(Via YESAB Online Registry)

Dear Ms. Thibaudeau,

**RE: PROJECT PROPOSAL FOR RENEWAL OF AIR EMISSIONS PERMIT NO.
4201-60-010 – FARO DIESEL PLANT**

Yukon Energy is pleased to submit for your consideration the project proposal for the renewal of the Corporation's existing Air Emissions Permit.

This submission has been provided electronically via the YESAB Online Registry, only. The application includes the associated Form 1, which has been completed and filed to the YESAB online registry as well. The supporting document attached to this letter, and referenced in Form 1, forms part of the proposal and is intended for use in the assessment and permitting processes.

Please note that in preparing this project proposal Yukon Energy has taken special care to ensure that the same type of information that was included in the 2008 permit renewal project proposal, as well as the responses to the Designated Office's request for additional proposal information during the adequacy review stage, have been addressed in this filing. Moreover, there have been no changes to the proposed activities or facilities associated with the required permit since the last assessment. We trust that with this knowledge meeting the test for proposal adequacy should be substantively simplified for the Designated Office to confirm for this renewal assessment.

Please do not hesitate to contact me at 867.393.5350 or by email: travis.ritchie@yec.yk.ca should there be any questions, comments, or concerns regarding the proposal.

Thank you for your time and consideration in this matter.

Yours Sincerely,

A handwritten signature in blue ink, appearing to read "Travis Ritchie", with a stylized flourish at the end.

Travis Ritchie, P.Biol., CCEP
Manager – Environment, Assessment & Licencing

Attachment

***AIR EMISSIONS PERMIT (NO. 4201-60-010)
RENEWAL APPLICATION
SUPPORTING DOCUMENT***

October 25, 2011



TABLE OF CONTENTS

TABLE OF CONTENTS	I
1.0 INTRODUCTION.....	1
1.1 PROJECT OVERVIEW & DOCUMENT STRUCTURE	1
1.2 PROPONENT INFORMATION	4
1.3 PROJECT/ACTIVITY PURPOSE AND NEED	6
1.4 REQUIRED AUTHORIZATIONS AND REGULATORY APPROVALS.....	6
2.0 ASSESSMENT APPROACH & SCOPE.....	7
2.1 AIR QUALITY STUDIES	7
2.2 IDENTIFICATION OF VALUED COMPONENTS	11
2.3 ANALYSIS & SIGNIFICANCE OF POTENTIAL EFFECTS	12
3.0 FACILITY DESCRIPTIONS	16
3.1 OPERATIONAL RANGES & REQUIREMENTS	16
3.2 GENERATION INVENTORY.....	18
3.3 WHITEHORSE.....	20
3.3.1 Facility Overview	20
3.4 DAWSON CITY.....	22
3.4.1 Facility Overview	22
3.5 MAYO.....	24
3.5.1 Facility Overview	24
3.6 FARO.....	26
3.6.1 Facility Overview	26
3.7 TYPICAL EMISSIONS CHARACTER.....	28
3.8 OPERATIONAL RESOURCE USE & WASTE GENERATION	28
3.9 REGULATORY CONTEXT	29
3.9.1 Regulation under the Public Utilities Act	29
3.9.2 Legal & Regulatory Constraints under Environment Act and Air Emissions Regulations	31

4.0 ENVIRONMENTAL & SOCIO-ECONOMIC SETTING	36
4.1 GENERAL.....	36
4.2 WHITEHORSE.....	37
4.2.1 Emissions Inventory	37
4.2.2 Ambient Air Quality.....	38
4.3 FARO.....	39
4.3.1 Emissions Inventory	39
4.4 MAYO.....	40
4.4.1 Emissions Inventory	40
4.5 DAWSON CITY.....	40
4.5.1 Emissions Inventory	40
5.0 EFFECTS ASSESSMENT	41
5.1 GENERAL.....	41
5.2 GENERATION PROFILES.....	42
5.3 REPRESENTATIVE RECEPTOR SITES.....	43
5.4 POTENTIAL HEALTH EFFECTS & APPLICABLE ENVIRONMENTAL STANDARDS	45
5.5 EFFECTS SUMMARY	46
5.5.1 Beneficial Effect of Yukon Energy's Diesel Facilities	46
5.5.2 Potential Effects Resulting from Combustion Gas Emissions (CO, SO ₂ , and NO ₂)	46
5.5.3 Potential Effects Resulting from Particulate Matter Emissions (PM _{2.5})	47
5.6 SIGNIFICANCE CONCLUSIONS	49
6.0 ACKNOWLEDGEMENT AND CERTIFICATION.....	50

LIST OF FIGURES

Figure 1 Whitehorse Generating Facility Area Overview	21
Figure 2 Dawson Generating Facility Area Overview.....	23
Figure 3 Mayo Generating Facility Area Overview.....	25
Figure 4 Faro Generating Facility Area Overview	27
Figure 5 Inner Modelling Domain and Discrete Receptor Locations	44

LIST OF TABLES

Table 1 Summary of Annual Diesel Generation 2008-2010	17
Table 2 Summary of Forecasted Diesel Energy Requirements 2012-2014.....	18
Table 3 Yukon Energy Diesel Generation Inventory	19
Table 4 Summary of Select Component Contributions to Air Emissions in Whitehorse .	38

LIST OF APPENDICES

Appendix A	Application for Air Emissions Permit
Appendix B	Report of Air Quality Assessment Update for Yukon Energy Diesel Generator Operations - Prepared by SENES Consultants Ltd.
Appendix C	Diesel Plant Drawings
Appendix D	Air Emissions Permit 4201-60-010 (as amended)

LIST OF ACRONYMS AND ABBREVIATIONS

CAC	Common Air Contaminants of Concern
GHG	Green House Gasses
GWh	Gigawatt hour
Max POI	Maximum Point of Impingement
MD	Mayo-Dawson Power Generation and Transmission System
MW	Megawatt
MWh	Megawatt hour
WAF	Whitehorse-Aishihik-Faro Power Generation and Transmission System
YESAA	<i>Yukon Environmental & Socio-economic Assessment Act</i>
YESAB	Yukon Environmental & Socio-economic Assessment Board
YUB	Yukon Utilities Board

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW & DOCUMENT STRUCTURE

The Yukon Energy Corporation (Yukon Energy) is applying under Parts 6 and 9 of the *Environment Act* and Part V of the *Air Emissions Regulations* for a three-year renewal of Air Emissions Permit No. 4201-60-010 authorizing Yukon Energy to operate its existing diesel-fired electricity generating facilities in Dawson City, Faro, Mayo, and Whitehorse.

Yukon Energy seeks a renewal of the Permit for a three-year term commencing on or before the expiration of the term of the existing Permit (which expires on December 31, 2011), and expiring on December 31, 2014.

The renewal is subject to an environmental and socio-economic effects assessment at the Designated Office level by the Yukon Environmental and Socio-economic Assessment Board (YESAB) under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA).

Pursuant to that assessment, Yukon Energy requests a recommendation from the Designated Office to allow the Permit renewal to proceed, on the basis that the Project (i.e., the continuing operation of the Yukon Energy's diesel generating facilities during the 2012-2014 period in accordance with the terms and conditions of the Permit and the applicable provisions of the *Environment Act* and *Air Emissions Regulations*) **will not have a significant adverse environmental or socio-economic effect** within the meaning of section 56(1)(a) of YESAA.

This document provides supporting information for the Permit renewal process and the associated environmental and socio-economic assessment, and includes detailed information referenced in the YESAA Designated Office Evaluation Form 1, which has also been completed and is filed on the YESAB Online Registry.

As this document and its attachments form part of an application to renew an existing permit, and given that the last assessment occurred only three years ago,

Yukon Energy requests that reviewers of this project examine the previous assessment documentation maintained on the YESAB Online Registry (Projects 2008-0228 through 2008-0231), for further information and clarifications previously requested regarding the proposed activities, as well as the comprehensive responses provided by Yukon Energy during that assessment. The information maintained in the YESAB Online Registry for the previous assessments may be especially instructive, to the extent Yukon Energy has already provided responses to many questions asked in the context of the previous assessments, and for which the responses were accepted by each applicable Designated Office. There have been no changes to the proposed activities or facilities associated with the required permit since the last assessment in 2008.

Section 1 of this document contains general application information including:

- The intent and structure of this document and related information;
- The proponent, Yukon Energy;
- The purpose of, and need for, the Project; and,
- An identification of the required assessment and regulatory approvals.

Section 2 of this document contains information regarding the assessment approach and scope, including:

- A brief description of the air quality impact assessment conducted;
- The identification of valued components for focussed effects assessment; and,
- The context and criteria Yukon Energy has used for determining the significance of any identified potential effects to the valued components.

Section 3 of this document contains information describing the character and location of our diesel generators, including:

- Operational requirements and ranges;
- A generation inventory;

- Site specific facility descriptions;
- A description of the typical emission character of the generators;
- Operational resource usage and waste generation; and,
- Brief comments on the applicable regulatory context under the *Public Utilities Act* and applicable legal and regulatory constraints on the operation of the facilities under the existing Permit and applicable environmental legislation.

Section 4 of this document contains information regarding the environmental setting in each community of operation, including:

- Reference to previous studies and the community emissions inventories; and,
- Ambient air quality assessment for Whitehorse.

Section 5 of this document presents the effects assessment and includes:

- A description of the modelled diesel generation profiles;
- An identification of sensitive receptor sites in the vicinity of Yukon Energy's diesel operations;
- A discussion regarding the indicators and measures used to determine the significance of potential effects to receptors;
- A summary of the potential effects of diesel generation air emissions; and,
- Assessment conclusions respecting the significance of the potential effects.

Four appendices are included as follows:

- Appendix A contains Yukon Energy's application to renew the Air Emissions Permit;
- Appendix B contains a report describing the results and findings of an updated air quality assessment of Yukon Energy's diesel generation operations conducted by SENES Consultants Ltd.;
- Appendix C contains drawings for each of Yukon Energy's diesel plants in Yukon;

- Appendix D contains a copy of Yukon Energy's current Air Emissions Permit No.4201-60-010 (as amended on July 22, 2011).

1.2 PROPONENT INFORMATION

Yukon Energy is the Project proponent. Established in 1987, Yukon Energy is a public electric utility that operates as a business, at arm's length from the Yukon Government, and is wholly owned by the Yukon Development Corporation (a Crown corporation).

Yukon Energy's headquarters are located near the Whitehorse Rapids hydro plant in Whitehorse, with community offices in Mayo, Faro, and Dawson City. It employs approximately 85 highly skilled and motivated Yukoners who are committed to offering the highest quality service possible. Yukon Energy works hard to meet the challenge of providing electricity and related energy services to Yukoners in the most economical, yet environmentally and socially responsible way.

Yukon Energy is the main generator and transmitter of electrical energy in the Yukon, and works with its parent company, Yukon Development Corporation, to provide Yukoners with a sufficient supply of safe, reliable electricity and related energy services. Yukon Energy owns and operates the 138 kV Whitehorse-Aishihik-Faro (WAF) and 69 kV Mayo-Dawson (MD) transmission grids, which are now connected as a single grid, as well as over 90% of the electric generation resources on these grids; it is also the public utility with primary responsibility for planning and development of new generation and transmission facilities in Yukon.

There are almost 15,000 electricity consumers in the territory. Yukon Energy directly serves about 1,800 of these customers, most of who live in and around Dawson City, Mayo and Faro. Indirectly, we provide power to approximately 15,000 other Yukon customers in Whitehorse, Carcross, Carmacks, Haines Junction, Ross River, Teslin, and Pelly Crossing, through the sale of energy to the Yukon Electrical Company Limited. Yukon Electrical buys wholesale power from Yukon Energy and sells it to retail customers in the territory via its own distribution network.

By the end of 2011 Yukon Energy will have the capacity to generate approximately 133 megawatts (MW) of power:

- at present, 75 MW of that capacity are provided by Yukon Energy's hydro generation facilities in Whitehorse, Mayo and Aishihik Lake (40 MW at Whitehorse, 30 MW at Aishihik, and 5 MW at Mayo); however, this will be increased to approximately 92 MW of total hydro generating capacity by the end of 2011, due to upgrading of the power plants at Mayo and Aishihik (which will add approximately 10 MW and 7 MW, respectively to those facilities);
- approximately 40 MW of capacity are provided by Yukon Energy's diesel-fired generators, including seven generators in Whitehorse, two in Mayo, five in Dawson City, four in Faro, and several relatively small portable generators; and
- 0.8 MW of capacity are provided by two wind turbines located on Haeckel Hill near Whitehorse.

In contrast to the diesel generation facilities operated by the Yukon Electrical Company Ltd. in communities such as Watson Lake and Old Crow, for example, which are isolated from the transmission grid and must therefore operate continuously (24 hours per day, 365 days per year), Yukon Energy only 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. This is because most of the needs of customers on the system are satisfied by Yukon Energy's three hydro generating stations. For the vast majority of the time, the diesel generators do not operate. However, Yukon Energy's diesel generation facilities are essential to its ability to provide a reliable supply of electricity to customers whenever demand outstrips hydro supply (e.g. as a result of planned maintenance, emergency repair, or peaking demand during cold temperatures).¹

Yukon Energy is regulated principally under the Yukon *Business Corporations Act*, *Public Utilities Act*, and *Waters Act*, and the federal *Fisheries Act*. In particular, under

¹ For example, Yukon Energy's reliance on the diesel generation facilities was essential when a major power outage occurred on the WAF grid in January 2006 due to a failure on the connection to the Aishihik hydro generating facility. If Yukon Energy had not had the ability to operate its diesel units in those circumstances, customers would have been left without power in the middle of the winter.

the *Public Utilities Act*, Yukon Energy has an obligation to supply electricity service to its customers, and its rates and operations are subject to regulation by the Yukon Utilities Board. Yukon Energy's diesel generation facilities are also subject to regulation under the *Yukon Environment Act* and *Air Emissions Regulations*, as well as YESAA.

1.3 PROJECT/ACTIVITY PURPOSE AND NEED

Yukon Energy's diesel electric generating plants are installed and operated so as to ensure the overall WAF and MD systems, and so all customers on these systems can receive reliable power consistent with Yukon Energy's corporate and regulatory obligations.

Given the current generation mix (hydro, wind, and diesel) and system design, Yukon Energy's ability to operate the installed diesel plants, particularly during conditions where demand for electricity cannot be adequately met by hydro (e.g., planned maintenance, emergency repair, demand during cold winter temperatures), is essential to avoid scenarios where there would be a requirement to impose blackout conditions to various customers. This is particularly relevant during times where the lack of such ability would at best be very inconvenient, and at worst dangerous to infrastructure and human health and safety, such as would be the case during cold winter temperatures.

1.4 REQUIRED AUTHORIZATIONS AND REGULATORY APPROVALS

Yukon Energy requires renewal of its existing Air Emissions Permit no. 4201-60-010 on or before December 31, 2011, in order to maintain the ability to operate its diesel generating facilities, and ensure the continuity of a reliable supply of power to Yukoners. The Permit is renewable by the Minister responsible for the Department of the Environment, for a period of up to three years, pursuant to section 12 of the *Air Emissions Regulations* under the *Environment Act*.

To renew the Permit, the Yukon Government must issue a decision document based on the environmental and socio-economic assessment of the renewal application under YESAA. An environmental and socio-economic assessment is required under Schedule 1, Part 4, Item 2(b) of the *Assessable Activities, Exceptions and Executive Committee*

Projects Regulations under YESAA, because the Permit is for the “operation ... of ... a fossil fuel-fired electrical generating station”.

As noted in the Project Overview above, Yukon Energy is requesting a recommendation by the Designated Office to allow the Permit renewal to proceed, on the basis that the Project (i.e., the continuing operation of the Yukon Energy’s diesel generating facilities during the 2012-2014 period in accordance with the terms and conditions of the Permit and the applicable provisions of the *Environment Act* and *Air Emissions Regulations*) will not have a significant adverse environmental or socio-economic effect within the meaning of section 56(1)(a) of YESAA.

2.0 ASSESSMENT APPROACH & SCOPE

2.1 AIR QUALITY STUDIES

In 2008, SENES Consultants Ltd. was initially engaged to conduct an air quality assessment for Yukon Energy’s diesel operations around Yukon in order to understand the potential effects of its operations and of other sources of emissions. The results of this assessment were submitted to YESAB for review in 2008 to facilitate the previous renewal of Yukon Energy’s air emissions permit.

The components of the 2008 study included the following:

1. Emission inventories for the communities of Whitehorse, Dawson City, Faro and Mayo. The inventories for each community are summarized in the context of Yukon Energy’s operations in Section 4.0 – Environmental & Socio-economic Setting. The inventories include the following components:
 - a) Common Air Contaminants (CAC)
 - i) nitrogen oxides (NO_x)
 - ii) carbon monoxide (CO)
 - iii) volatile organic compounds (VOC)
 - iv) sulphur oxides (SO_x)
 - v) inhalable particulate matter (PM₁₀)

- vi) respirable particulate matter (PM_{2.5})
- vii) ammonia (NH₄)
- b) Greenhouse Gases (GHG)
 - i) carbon dioxide (CO₂)
 - ii) methane (CH₄)
 - iii) nitrous oxide (N₂O)
- 2. A summary of air quality monitoring data for Whitehorse during the period 2000-2005 based on the monitoring station in downtown Whitehorse operated by Environment Canada as part of the National Air Pollution Surveillance (NAPS) network.
- 3. Air dispersion modelling of emissions from the Yukon Energy diesel plant in Whitehorse were conducted based on normal and hypothetical operational scenarios.
- 4. A screening level human health risk assessment of the emissions from several generation profiles for the Whitehorse facility.

The 2008 air quality impact assessment report was submitted as part of the previous permit renewal process and is available to reviewers on the YESAB Online Registry under projects 2008-0228 through 2008-0231 (File 002-1).

To Yukon Energy's knowledge, the air emissions inventories prepared by SENES for the four communities, and SENES's further detailed modelling and analysis of air emissions in Whitehorse, together represented one of the most comprehensive and thorough studies of the potential effects of air emissions that has ever been carried out in the Yukon.

Yukon Energy undertook this study in recognition of its corporate and regulatory obligations, and its specific commitment to provide energy services to Yukoners in the most economical, yet environmentally and socially responsible way.

For the purposes of its air dispersion modelling, SENES considered Whitehorse to provide an ideal modelling situation since both surface and upper air data were available to use as inputs to the atmospheric model. The Whitehorse modelling was conducted to get a good sense of what, if any, effect Yukon Energy's diesel engine emissions may have on air quality within the Whitehorse community. Since Whitehorse has 'good' meteorological data available, it was appropriate to conduct the modelling in this airshed instead of any other. For this reason, the modelling simulation for Whitehorse was considered to be superior to simulations that could have been conducted in the other three airsheds where Yukon Energy units are operated.

In the previous assessment conducted by the Designated Offices in 2008, the following two mitigation measures were included as conditions of the recommendation for an air emissions permit renewal to be granted to Yukon Energy:

- Yukon Energy was required to report its emissions to the National Pollutant Release Inventory (NPRI) if its operational emissions meet the thresholds for required reporting under that national reporting program. Calculation of annual emissions and reporting (as required) to the NPRI program is an annual exercise undertaken by Yukon Energy. The results of that reporting are available publicly on Environment Canada's NPRI website (available at <http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=B85A1846-1>).
- The Designated Offices' recommendations also incorporated requirements for Yukon Energy to conduct stack testing of its diesel engines (upon certain conditions being met) to address uncertainty with regard to the actual emission rates of Yukon Energy's diesel engines, and to confirm the character of Yukon Energy's actual emissions to ensure the assumptions relied on by SENES in its previous air quality assessment were appropriate. This recommendation was incorporated (with some variation) into the renewed permit issued by Yukon Government in 2009; and, in 2011, stack testing was in fact completed for each of the Whitehorse diesel engines to reliably measure the actual emission character of Yukon Energy's diesel generation facilities.

The results of the stack testing completed in 2011 indicate that the emission rates assumed by SENES for the purposes of the 2008 air quality impact assessment were overestimated, i.e., the actual measured emissions for Yukon Energy's diesel generators are actually lower than the published emission factors used in the model during the 2008 assessment. This information removes the uncertainty that previously existed in 2008 with regard to the character of Yukon Energy's diesel generator emissions.

In support of Yukon Energy's current application to renew the air emissions permit for the 2012-2014 period, SENES has prepared an update to the previous 2008 study.

SENES's updated air quality assessment report (attached as Appendix B):

- is based on the actual measured emission rates for each of the stationary diesel generators in Yukon Energy's Whitehorse facility (in place of the assumed emission rates that were used in the 2008 assessment);
- also takes into account projected increased power demand in the Yukon through to 2014 (which projections are incorporated into updated operating scenarios for the 2012-2014 period);
- uses updated meteorological data; and
- reflects the Yukon Ambient Air Quality Standards adopted by the Yukon Government in 2010, which were not yet in existence at the time of the 2008 assessment.

As with SENES's original 2008 study, SENES's updated air dispersion modelling was completed for emissions from the Yukon Energy facility in Whitehorse. As previously accepted by the Watson Lake, Mayo and Dawson City Designated Offices in 2008, the implications of the modelling analysis for Whitehorse can again be used to determine what the likely impacts may be in the other three communities (Faro, Mayo and Dawson City), since the engine configuration (engine size, exhaust stack height, etc.) in the other three communities is similar to that in Whitehorse. Although further modelling could theoretically be conducted in the three other Yukon communities, the results would have to be considered as having a higher degree of uncertainty, since surface and upper air data are not available at these locations. There is also no air quality monitoring data to provide estimates of background concentrations, although it is likely that background

levels in these communities would be lower than in Whitehorse due to lower population levels and lower overall emissions as determined in the 2008 assessment by SENES.

2.2 IDENTIFICATION OF VALUED COMPONENTS

For the purpose of identifying and assessing potential environmental and socio-economic effects, value may be attributed to a component of the environment and/or the socio-economic system for economic, social, environmental, aesthetic or ethical reasons.

Valued environmental and socio-economic components (or VESECs) are parts of the local environment and socio-economic fabric that are valued because of their ecological and/or socio-economic importance. VESECs can represent a class of species, a type of ecosystem, or an important component of a social and/or economic system, and are used in the assessment of potential effects arising from a project and associated activities.

Based on its understanding of the environmental and socio-economic setting of its generating facilities, and upon an examination of known and typical interests related to air emissions, Yukon Energy has identified Human Health and Safety to be the key valued component for the purpose of the environmental and socio-economic assessment of this Project.

Other components of the environment, such as water, soils, and general maintenance of environmental quality, are more appropriately related to such things as the potential for petroleum hydrocarbon releases, and have not been examined beyond the scoping stage of this assessment, as such matters are adequately addressed by operational and non-discretionary regulatory controls currently in place such as Yukon Energy's Special Waste Permit, Storage Tank Permit, etc, and not by the Air Emissions Permit renewal which Yukon Energy is applying for at this time.

2.3 ANALYSIS & SIGNIFICANCE OF POTENTIAL EFFECTS

The Designated Office must evaluate the potential effects, if any, on human health and safety resulting from the renewal of Yukon Energy's Air Emissions Permit for another three-year term, and must make a recommendation to the Environment Minister based on that evaluation, in accordance with section 56(1) of YESAA.

In particular, under section 56(1)(a), if the Designated Office is satisfied that Yukon Energy's continuing operation of its diesel generators in 2012-2014, in compliance with the terms and conditions of its Air Emissions Permit and all other relevant legislative and regulatory requirements (e.g. under the *Environment Act* and *Air Emissions Regulations*), will not have "significant adverse environmental or socio-economic effects in or outside the Yukon", the Office must recommend that the renewal of the Permit be allowed to proceed.²

In its September 8, 2009 Designated Office Evaluation Report on Project Number 2009-0107 (YECL Air Emissions Permit Renewal – Watson Lake, YT), the Watson Lake Designated Office determined it was appropriate to exercise its authority under section 56(1)(a) with reference to both "the application of existing legislation as well as the mitigation measures proposed by the proponent" (at page 1).

This was in the context of an application by Yukon Electrical Company Ltd. ("YECL") to renew the air emissions permit for the diesel generator station it operates on a full-time basis, year round as the sole source of electrical supply for the communities of Watson Lake, Upper Liard, and Lower Post, BC (in contrast to Yukon Energy's diesel generating facilities, which are operated only as back-up during hydro system outages, and, occasionally, to supplement energy demand during colder periods of the year).

Accordingly, in Project Number 2009-0107, where the Watson Lake Designated Office found that the application of existing legislation as well as mitigation measures proposed by the proponent would be "adequate to eliminate, reduce or control the significant

² Alternatively, the Designated Office also has authority to recommend that the Permit be renewed subject to specified terms and conditions, if it determines that the continuing operation of the diesel generators "will have significant adverse environmental or socio-economic effects...that can be mitigated by those terms and conditions" within the meaning of section 56(1)(b).

adverse effects of the project” resulting from the continuous, year round operation of YECL’s diesel generator station in Watson Lake, the Designated Office concluded that the project “will not have significant adverse environmental or socio-economic effects in or outside Yukon”, and recommended under section 56(1)(a) that the project be allowed to proceed.

The same approach to section 56(1)(a) was adopted with respect to YECL’s other air emission permit renewal applications, by:

- the Dawson City Designated Office in its September 9, 2009 Evaluation Report on Project Number 2009-0104 (YECL Air Emissions Permit Renewal – Old Crow) (in the context of another YECL diesel generating station operated on a full-time basis year round, as the sole source of electrical supply for the community of Old Crow);
- the Teslin Designated Office in its September 4, 2009 Evaluation Report on Project Number 2009-0105 (Teslin Electrical Generating Station Air Emissions Permit Renewal);
- the Watson Lake Designated Office in its September 4, 2009 Evaluation Report on Project Number 2009-0106 (YECL Air Emissions Permit Renewal – Ross River, YT);
- the Haines Junction Designated Office in its September 8, 2009 Evaluation Report on Project Number 2009-0108 (Air Emissions Permit Renewal – Haines Junction, YT); and
- the Mayo Designated Office in its September 4, 2009 Evaluation Report on Project Number 2009-0109 (Air Emissions Permit Renewal – Carmacks).

To ensure consistency in the interpretation and application of section 56(1) of YESAA, the same approach must be applied by the Designated Office in assessing and issuing a recommendation with respect to Yukon Energy’s proposed renewal of its Air Emissions Permit: i.e., the potential effects (if any) of the project must be assessed on the basis of Yukon Energy continuing to operate its facilities (on an emergency back-up/secondary supply basis only) during 2012-2014 in compliance with the terms and conditions of the Permit and all other legislative and regulatory requirements, in addition to the principal mitigation measures proposed by Yukon Energy, which include the following:

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

In assessing whether any effect resulting from such continuing operation of Yukon Energy's facilities may be considered "significant" within the meaning of section 56(1) of YESAA, the Designated Office should further apply the framework of analysis adopted by the YESAB Executive Committee in Part 4.3 of its November 2, 2007 Screening Report & Recommendation on Project Assessment 2006-0286 (Yukon Energy Corporation Carmacks-Stewart/Minto Spur Transmission Project) (at page 15):

The determination of whether or not a particular effect is significant is undertaken in the context of the effect, and the circumstances encountered. In developing mitigative measures to address effects, the level of adversity (duration, magnitude, extent, reversibility) and acceptability (i.e., as linked to social expectations) are key criteria that facilitate the determination of which effects should be mitigated. Societal expectations are often a reflection of the adversity of an effect as compared to the level of effort required to address the effect.

Two broad categories of effects exist along the spectrum of significance: insignificant, and significant ...

Category A [Insignificant] consists of those potential effects for which mitigation is not necessary. This category would include beneficial effects as well as adverse effects that are within established norms (e.g. natural variation of baseline conditions), and levels of acceptable change/societal expectations (e.g. effects from walking through the forest).

Category B [Significant] consists of all those effects that do not fall under category A. In this category, there exists a broad spectrum of adverse effects that are considered significant, which may range from minor adverse effects outside of local environmental norms/societal expectations to major consequential effects. Mitigative measures have been recommended for all adverse effects in this category, as required by YESAA.

As explained in Part 12.0 of YESAB's "Guide to Socio-economic Effects Assessment", the significance of a Project's potential effects on a particular VESEC (such as human health and safety) should also be assessed under section 56(1) of YESAA with

reference to any relevant effect attributes, which could include the direction of change (i.e., positive, neutral, negative, or both positive and negative), the magnitude of a potential effect, its geographic extent, duration, frequency, reversibility, and likelihood of occurrence, and the applicable socio-economic context.

Having regard to the foregoing:

- the determination of the “significance” of the potential effects of the continuing operation of Yukon Energy’s diesel facilities on human health and safety requires the identification and assessment of both the potential beneficial and adverse effects;
- in that exercise, potential adverse effects should be assessed with reference to those effect attributes which are relevant to the level of adversity and acceptability of the effect;
- attributes relevant to the character of an effect may include the reasonably contemplated frequency, likelihood of occurrence, duration, magnitude, extent, and reversibility of the effect over the three-year term of the renewed Permit (as referenced in one or both of the Carmacks-Stewart Screening Report and/or in YESAB’s Guide to Socio-economic Effects Assessment); and
- the level of acceptability of an effect should also be assessed with reference to the environmental standards now established under the Yukon Ambient Air Quality Standards, which have been developed in consideration of those common effect attributes and reasonable societal expectations.

3.0 FACILITY DESCRIPTIONS

3.1 OPERATIONAL RANGES & REQUIREMENTS

As previously discussed, Yukon Energy's diesel electric generating plants are installed and operated so as to ensure the overall integrated WAF and MD systems, and so all customers on these systems can receive reliable power consistent with Yukon Energy's corporate and regulatory obligations. Hydro generation stations on the Yukon grid are typically supplemented as necessary by diesel for peaking or maintenance purposes.

The current need for diesel generation is related to several factors including:

- The need to meet demand for electricity during those times when hydro-electric facilities are taken offline for routine maintenance;
- The need to meet demand for electricity during those times when hydro-electric facilities are offline as a result of an emergency condition;
- The need to meet demand for electricity during those times when hydro-electric facilities are otherwise unable to meet current demand for energy;
- The need to 'exercise' a particular diesel unit as a part of routine maintenance;

The following table summarizes the annual diesel generation required over the last few years.

Table 1 Summary of Annual Diesel Generation 2008-2010

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

Note: Results with positive run time hours, but zero generation represent units running at speed with no load for maintenance or testing purposes,

Electricity demand is growing in Yukon and, through 2014, Yukon Energy is forecasting increased need to support its hydro assets with diesel electricity in order to meet the needs of Yukoners.

Having regard to this increased demand, the attached table presents three generation profiles for Yukon Energy's diesel facilities in Whitehorse, Mayo, Faro, and Dawson City, which were analyzed by SENES for the purpose of completing its updated air quality assessment report:

- **Scenario 1:** actual 2010 generation levels by facility.
- **Scenario 2:** forecast "average case" levels of diesel generation through to 2014. This scenario reflects Yukon Energy's projections of the most likely highest levels of diesel generation over the 2012-2014 period, given current hydrological conditions and electricity demand predictions.
- **Scenario 3:** hypothetical "worst case" scenario. This scenario reflects Yukon Energy's projections of the maximum demand that might theoretically need to be met from diesel generation, in the unlikely event that Yukon Energy's ability to supply demand through hydro generation were to be very seriously constrained as a result of a series of successive drought years culminating in the most extreme drought conditions occurring in 2014. This scenario represents the extreme case of

extraordinarily severe and successive annual drought conditions, which is very unlikely to occur over the term 2012-2014.

Table 2 Summary of Forecasted Diesel Energy Requirements 2012-2014

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

Note: For the purposes of comparison, Scenario 1 represents the actual energy produced by diesel generators in 2010. Scenario 2, is the predicted *average* energy requirement to be made up by diesel. Scenario 3 is the maximum case energy requirement to be made up by diesel, which would follow several very dry years, culminating in an extreme drought year in 2014 .

3.2 GENERATION INVENTORY

Yukon Energy maintains diesel generators in Whitehorse, Mayo, Dawson City, and Faro. The largest diesel units are located in Whitehorse, followed by Faro, with Mayo and Dawson City having the smallest generators, which are on average three times smaller than the Whitehorse units, as can be seen in Table 3. The Corporation also has two mobile diesel units. Small, black-start units are also deployed to provide onsite power in the event of power failures. The following table summarizes the Corporation's generation inventory from all sources excluding the small black start units.

Table 3 Yukon Energy Diesel Generation Inventory

Location	Unit No.	Manufacturer	Name Plate Capacity (kW)
Faro	FD1	Mirrlees	5,150
	FD3	Caterpillar	1,000
	FD5	Caterpillar	1,400
	FD7	Caterpillar	3,000
Dawson	DD1	Caterpillar	800
	DD2	Caterpillar	1,000
	DD3	Caterpillar	1,000
	DD4	Caterpillar	700
	DD5	Caterpillar	1,500
Mayo	MD1	Caterpillar	1,000
	MD2	Caterpillar	1,000
Whitehorse	WD1	Mirrlees	3,920
	WD2	Mirrlees	5,150
	WD3	Mirrlees	5,150
	WD4	EMD	2,500
	WD5	EMD	2,500
	WD6	EMD	2,700
	WD7	Caterpillar	3,300
Mobile Diesels	YM1	Caterpillar	1,400
	YM2	John Deere	150

3.3 WHITEHORSE

3.3.1 Facility Overview

The Whitehorse diesel plant is located at the site of the Corporation's Whitehorse Rapids Power Development and adjacent the Whitehorse Rapids Dam. The legal description of the property is as follows:

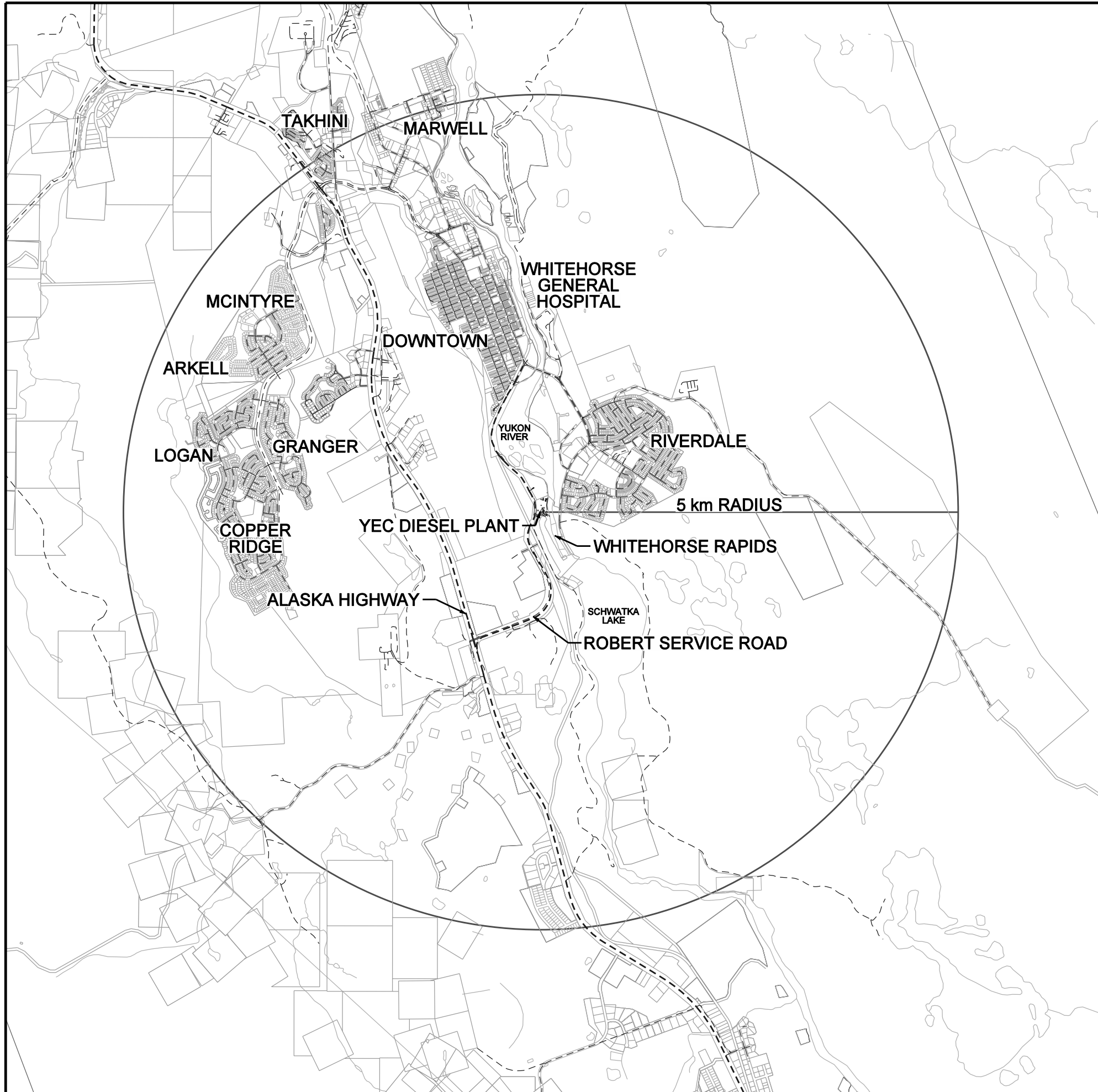
Lot 1022, Quad 105 D/11, Plan 73440 LTO, DCT No. 93Y377 - registered to Yukon Energy Corporation.

Approximate coordinates of the diesel plant:

- UTM Zone 8
- Northing: 6729200.0
- Easting: 497522.99

The diesel plant maintains seven units as described in Table 3.

The following figure provides an overview of the location of the diesel generators relative to the community of Whitehorse.



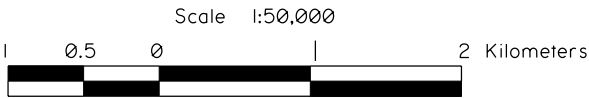
LEGEND

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Yukon Community Cadastral Information and First Nations Settlement Lands compiled by Legal Surveys, Natural Resources Canada.

UTM Zone 8 NAD83



Rev. No.	Date	Description	Approv'd
1	SEPT 4, 2008	INITIAL REVIEW	TR
2	SEPT 19, 2008	FINAL	TR



YUKON ENERGY CORPORATION

2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION
SUPPORTING DOCUMENTATION

FIGURE 1:
OVERVIEW OF YEC WHITEHORSE DIESEL PLANT AREA

Drawn:	C.McGILLIVRAY	Date:	SEPTEMBER 2008
Scale:	1:50000	Map Sheet No.	105DII
Revision Number:	2	Dwg Name:	FIGURE 1

3.4 DAWSON CITY

3.4.1 Facility Overview

The Dawson City diesel plant is located near the entrance to downtown Dawson City. The legal description of the property is as follows:

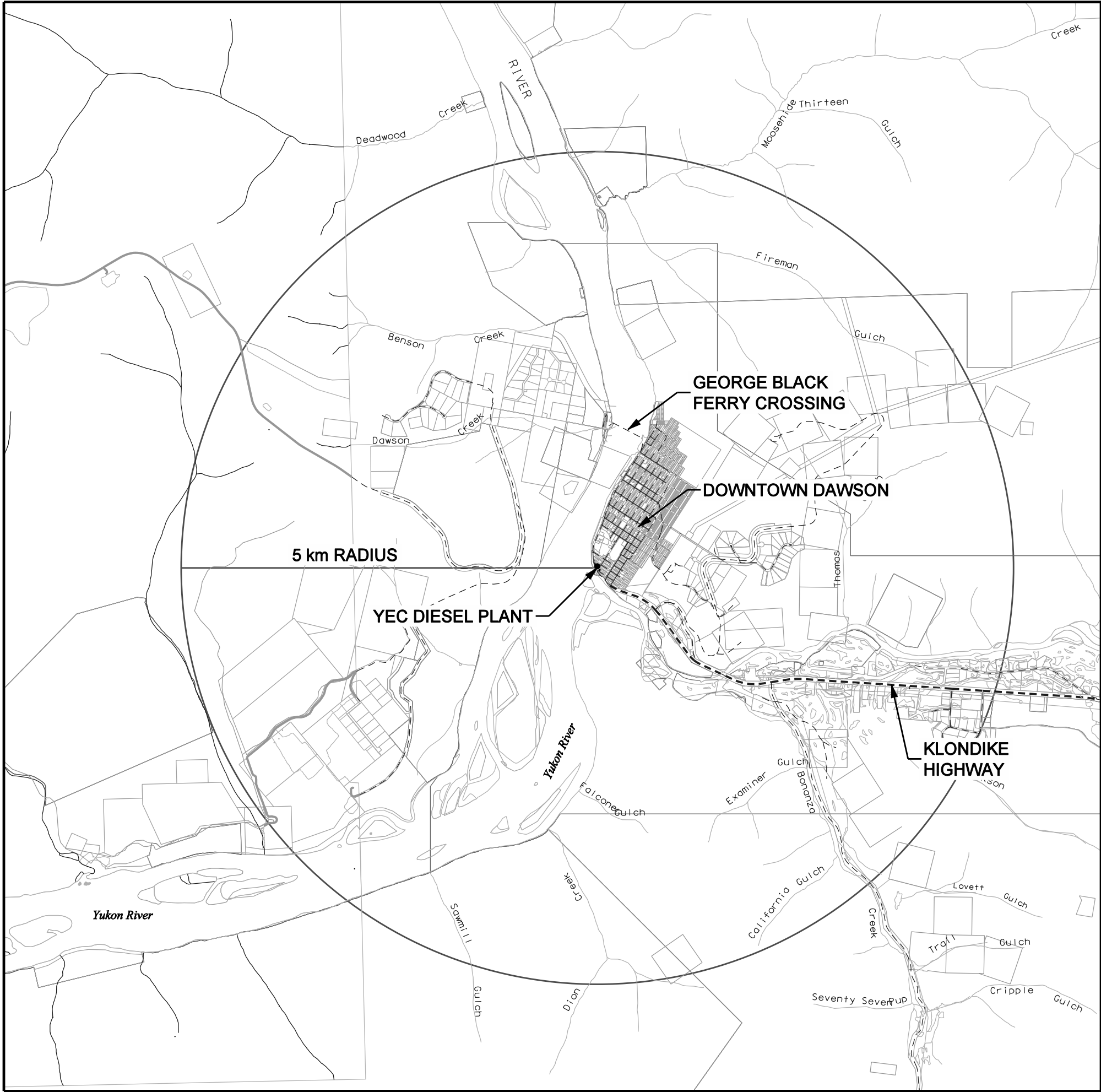
Lots 1 and 2, Block 11, Quad 116B/03, Plan 8395 LTO DCT No. 93Y380 - registered to Yukon Energy Corporation.

Approximate coordinates of the diesel plant:

- UTM Zone 7
- Northing: 7104026.7685
- Easting: 576156.199

The diesel plant maintains five units as described in Table 3.

The following figure provides an overview of the location of the diesel generators relative to the community of Dawson City.



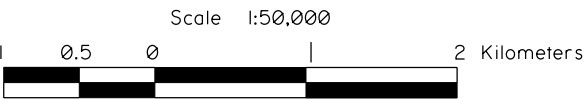
LEGEND

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1	SEPT 4, 2008	INITIAL REVIEW	TR
2	SEPT 19, 2008	FINAL	TR



2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION
SUPPORTING DOCUMENTATION

FIGURE 2:
OVERVIEW OF YEC DAWSON DIESEL PLANT AREA

Drawn: C.McGILLIVRAY	Date: SEPTEMBER 2008
Scale: 1:50000	Map Sheet No. 116B3
Revision Number: 2	Dwg Name: FIGURE 2

3.5 MAYO

3.5.1 Facility Overview

The Mayo diesel plant is located adjacent the main community access road approximately 850 m north of the Stewart River. The legal description of the property is as follows:

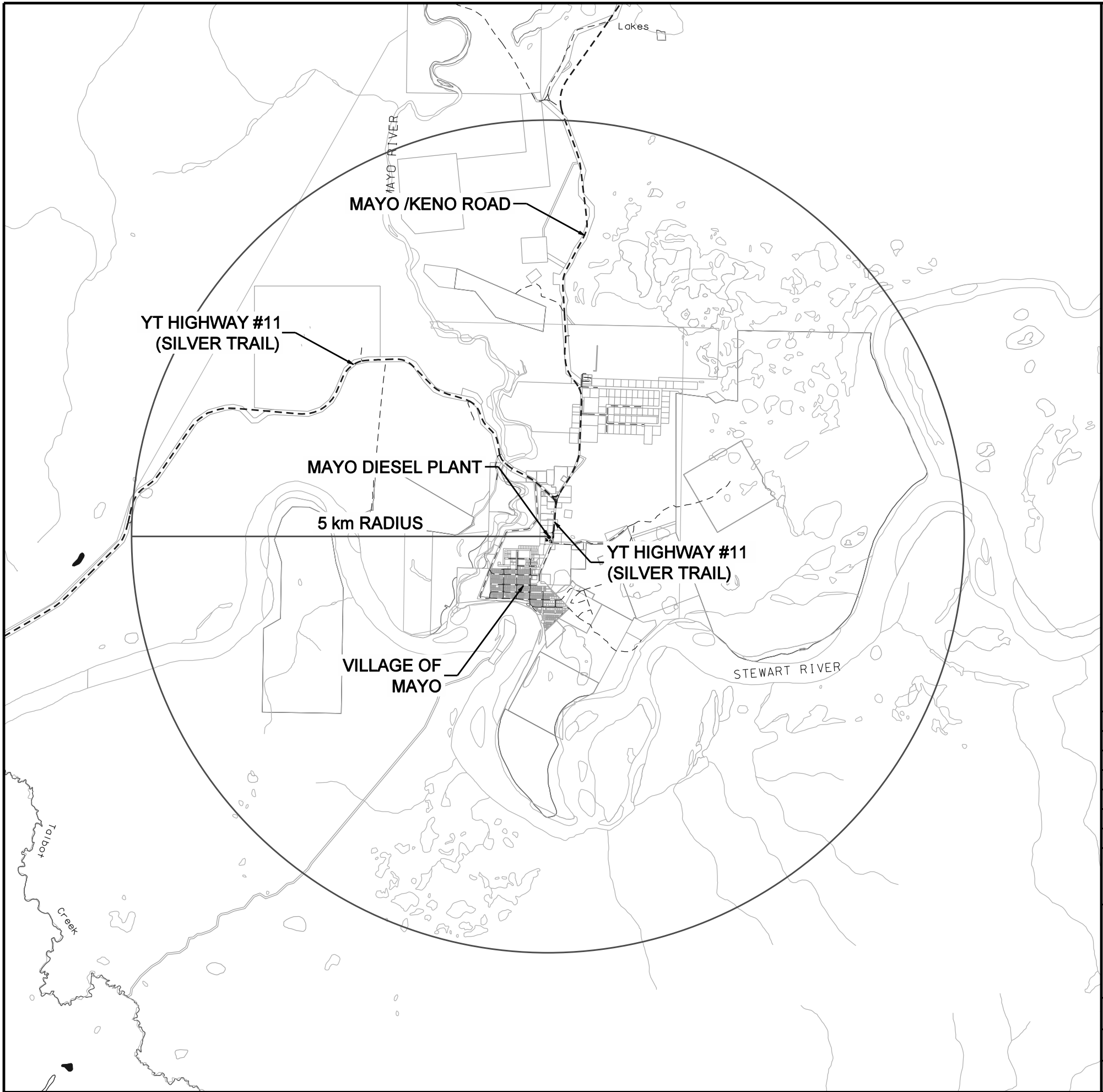
Lot 1000, Quad 105 M/12, Group 1004, Plan 61437 LTO DCT No. 93Y378 - registered to Yukon Energy Corporation.

Approximate coordinates of the diesel plant:

- UTM, Zone 8
- Northing: 7052505.0275
- Easting: 455892.8273

The diesel plant maintains two units as described in Table 3.

The following figure provides an overview of the location of the diesel generators relative to the community of Mayo.



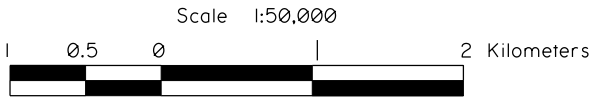
LEGEND

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Rev. No.	Date	Description	Approv'd
1	SEPT 4, 2008	INITIAL REVIEW	TR
2	SEPT 19, 2008	FINAL	TR



2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION
SUPPORTING DOCUMENTATION

FIGURE 3:
OVERVIEW OF YEC MAYO DIESEL PLANT AREA

Drawn: C.McGILLIVRAY	Date: SEPTEMBER 2008
Scale: 1:50000	Map Sheet No. 105M12
Revision Number: 2	Dwg Name: FIGURE 3

3.6 FARO

3.6.1 Facility Overview

The Faro diesel plant is located near the entrance to Faro off the mine access road. The legal description of the property is as follows:

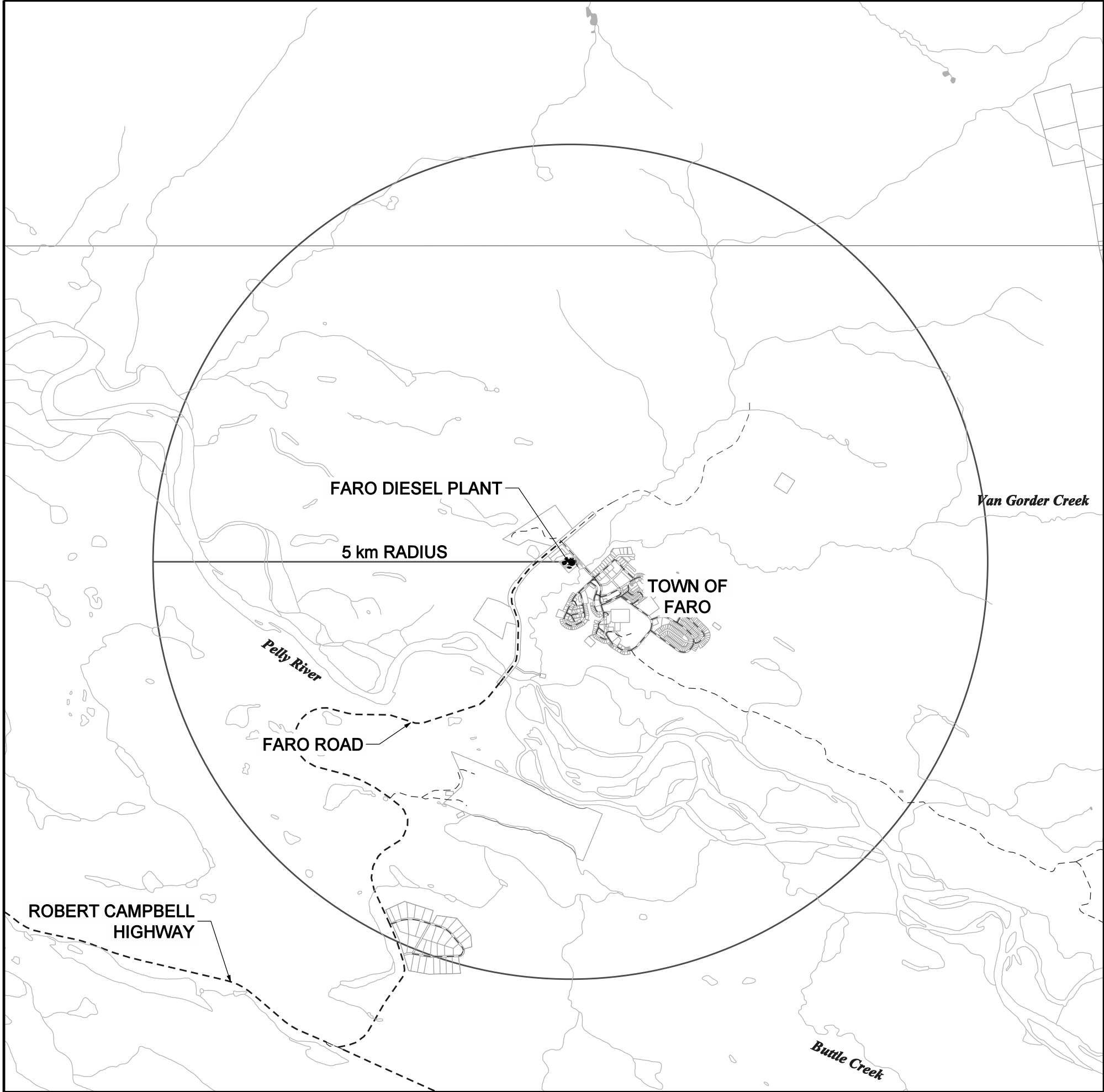
Lot 114, Quad 105 K/03, Plan 49716 LTO DCT No. 93Y377 - registered to Yukon Energy Corporation.

Approximate coordinates of the diesel plant:

- UTM Zone 8
- Northing: 6901266.5646
- Easting: 585174.5418

The diesel plant maintains four units as described in Table 3.

The following figure provides an overview of the location of the diesel generators relative to the community of Faro.



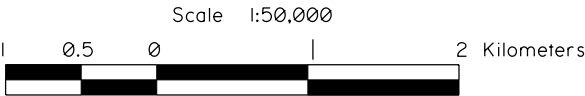
LEGEND

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UTM Zone 8 NAD83



Rev. No.	Date	Description	Approv'd
1	SEPT 4, 2008	INITIAL REVIEW	TR
2	SEPT 19, 2008	FINAL	TR



YUKON ENERGY CORPORATION

2008 AIR EMISSIONS PERMIT RENEWAL APPLICATION
SUPPORTING DOCUMENTATION

FIGURE 4:
OVERVIEW OF YEC FARO DIESEL PLANT AREA

Drawn: C.McGILLIVRAY	Date: SEPTEMBER 2008
Scale: 1:50000	Map Sheet No. 105K03
Revision Number: 2	Dwg Name: FIGURE 4

3.7 TYPICAL EMISSIONS CHARACTER

As described in Section 2.1, above, the air quality assessment conducted by SENES in 2008, for the purpose of Yukon Energy's previous application for renewal of the air emissions permit for its diesel generation facilities, used assumed emission rates for Yukon Energy's diesel engines, based on published, activity-based emission rates for comparable diesel engines to those Yukon Energy maintains in Whitehorse.

Further to the mitigation measures recommended by the Designated Offices in the previous assessment, actual measurements (stack emission tests) were conducted to verify the emission rates for Yukon Energy's diesel facilities, using the largest units in Yukon Energy's diesel generator fleet, all based in Whitehorse. As a result, SENES has been able to refine the modelling in its updated air quality assessment, by using the actual measured emission rates for Yukon Energy's diesel facilities, instead of assumed emission rates based on published data for comparable engines.

The SENES report, contained in Appendix B, summarizes the results of the stack testing and resulting emissions characteristics.

3.8 OPERATIONAL RESOURCE USE & WASTE GENERATION

Each diesel plant maintains a permitted bulk fuel supply of ultra low sulphur diesel (50 parts per million), which is the only fuel type used. Fuel storage facilities meet National Fire Code standards and each is permitted by the Yukon Fire Marshall's Office pursuant to the *Environment Act* and *Fuel Storage Regulations*. Spill containment and response equipment is maintained in appropriate locations and quantities at each site. Routine checks of the facilities are conducted to ensure appropriate containment and operation of the storage systems. Yukon Energy personnel are also trained in spill response. Yukon Energy maintains a policy to externally report any release of hazardous material to land in excess of 500ml (used), five litres (fresh) and, according to regulation, any release to a watercourse, no matter the volume.

In addition to air emissions, other wastes are generated at these facilities. For example waste oil, waste solvents, waste coolants, and used absorbents are all commonly

generated. Pursuant to the requirements of Part 7 of the Environment Act and the Special Waste Regulations, storage and handling of these materials follows Corporation's Special Waste Permit and industry best practice. All wastes are disposed of annually, or more often, through permitted commercial recycling, reuse, and/or disposal contractors, such as the Yukon Government Special Waste Collection and Disposal Program, permitted waste oil collectors, and approved waste disposal facilities in each community.

3.9 REGULATORY CONTEXT

3.9.1 Regulation under the Public Utilities Act

Yukon Energy's diesel plants are operated as a critical component of the Corporation's facilities required to satisfy its obligation to supply electricity service to its customers under the *Public Utilities Act*. As such, the plants are regulated by the Yukon Utilities Board (YUB) both in terms of the requirement for installed capacity, and the ability of Yukon Energy to recover any costs spent on these facilities through electrical rates.

To satisfy Yukon Energy's obligations, the diesel plants must be designed and installed so as to ensure that the power systems are able to supply utility-grade reliable power to customers. This requires the diesel plants to meet the capacity planning criteria³ reviewed by the YUB in its review of Yukon Energy's 20-year Resource Plan 2006-2025, and the consequent recommendations from the YUB to the Minister of Justice dated January 15, 2007.

³ The criteria adopted by Yukon Energy and set out in the 20 year Resource Plan 2006-2025 are as follows:

1. **WAF and MD System-wide capacity planning criteria:** Each system (WAF and MD) will be planned not to exceed a Loss of Load Expectation (or LOLE) of two hours per year.
2. **Emergency (or "N-1") WAF and MD system capacity planning criteria:** Each grid system (WAF and MD) will be planned to be able to carry the forecast peak winter loads (excluding major industrial loads) under the largest single contingency (known as "N-1"). The N-1 criterion determines system capacity assuming the loss of the system's single largest generating or transmission-related generation source. In the case of WAF, this is presently the Aishihik transmission line, without which the WAF grid loses ability to access approximately 30 MW of generation.
3. **WAF and MD "community" criteria:** For communities on the WAF or MD grids, any location with a load large enough to justify a diesel unit of about 1 MW or more will be considered as a preferred location for new diesel units if that community does not already have back-up from another source (e.g., having an existing diesel unit). The new diesel units would provide grid support, and in times of line failures would provide local generation for the communities where they are located.

Absent the ability to meet utility standard planning criteria in terms of the quantity of installed diesel on the system, and at the right locations on the system, as well as the ability to operate the diesels as required to the full capability of their rated output, Yukon Energy could experience one or more of the following conditions:

- In **very cold weather conditions**, Yukon Energy would be unable to meet the peak loads of the integrated transmission grid. This would give rise to interruptions of service on substantial components of the power grid, likely during peak load hours (e.g., daytime hours). Further, once such outages occur it becomes very difficult to resume service due to a condition known as 'cold load pick-up' where the generation available must be well in excess of the normal average load on a feeder in order to be able to restore service (due, for example, to the fact that after even a brief outage in such weather, basically every furnace fan or heat tape installed on the system will automatically be drawing load when the system is restored).
- In **unplanned system outages**, particularly in winter conditions, Yukon Energy would similarly be unable to supply load. Outages due to this factor could readily be of extended duration, such as the experience of January 29, 2006, where due to a major failure of the power cables at the Aishihik hydro plant, up to 6 WAF diesels operated for 2 days to maintain power to the system. For a further 8 days the WAF system operated in a constrained mode without diesels operating, but needed to be ready to operate at any time. The system was not fully restored to normal status until February 21, more than three weeks after the incident. Diesel generation was similarly used to supply substantial components of the load following the fire at the Whitehorse Rapids hydro plant in October 1997, and to various grid locations during forest fires (when transmission lines are at times required to be de-energized) in recent years.
- During **drought conditions**, even at the current load levels, the diesel units could be required for energy-related reasons to maintain service to load and ensure the hydro plants can maintain their water levels within licenced ranges. For example, diesel generation for this purpose was required in the late winter of 1999 due to the severe drought conditions experienced at Aishihik in 1998. While this can lead to sustained diesel generation, the output is typically at a low level. For example, during the early

part of 1999, the average output of all combined diesel generation on WAF was 3 MW, or less than 10% of the installed diesel capability on WAF.

- In **planned system outages**, such as transmission line maintenance, communities such as Faro and Dawson which are located away from the hydro plants require diesel generation to maintain continuity of service.

If Yukon Energy's ability to use and operate the diesel generators were to be constrained during the 2012-2014 period in any way that could prevent the Corporation from being able to rely on the facilities to provide a reliable supply of back-up power to customers in accordance with utility standard planning criteria, such constraints could result in one or more of the foregoing situations arising, in which Yukon Energy would be unable to supply customers with power in accordance with its obligations under the *Public Utilities Act*. This would present an obvious and acute risk of harm to human health and safety and public and private infrastructure, particularly during cold winter temperatures.

3.9.2 Legal & Regulatory Constraints under Environment Act and Air Emissions Regulations

Aside from the regulation of Yukon Energy's diesel facilities by the YUB under the *Public Utilities Act*, Yukon Energy's use and reliance on its diesel facilities during the 2012-2014 period will be constrained by the terms and conditions of its Air Emissions Permit, as well as the requirements of relevant legislation that applies to the project, including the *Environment Act* and the *Air Emissions Regulations*.

As noted in Part 2.3 above, for the purpose of assessing what, if any, potential effects the renewal of the Permit could have on human health and safety, the Designated Office must assume (as was done, for example, in the Watson Lake Designated Office Evaluation Report on Project Number 2009-0107, at pages 1 and 16) that Yukon Energy will continue to operate its diesel generation facilities in compliance with all relevant legislative and regulatory requirements, and that the decisions bodies and regulators will continue to enforce such requirements, in order to help ensure that no significant adverse effects occur as a result of the operation of the facilities.

In particular, assuming Yukon Energy's Permit is renewed for the 2012-2014 period on terms and conditions similar to those contained in the existing Permit #60-010 (as amended on July 22, 2011) (see Appendix D), Yukon Energy's operation of the facilities will continue to be subject to the following requirements under the Permit:

- All associated personnel (employees, contractors or volunteers) are required to be knowledgeable of the terms and conditions of the Permit, and to receive appropriate training for the purposes of carrying out the requirements of the Permit (paragraph 2.3);
- Yukon Energy is required to provide written notice to an environmental protection analyst before any significant change of circumstances at the site, including, without limitation, discontinuation of any regulated activity at the site, or any change of ownership of the site or any of the sources (paragraph 2.4);
- Yukon Energy is required to obtain approval from an environmental protection analyst before adding, modifying, removing or replacing any equipment or components relating to the release, abatement, control or treatment of air emissions, and before any change in location of the source(s) (paragraph 2.5);
- If an inspection reveals that the site or source(s) is in any way not in compliance with the Permit, Yukon Energy is required to repair the damage or take other actions required to bring the site or source(s) into compliance (paragraph 2.6);
- Yukon Energy is required to develop and maintain a fire safety/emergency plan and a current site plan in accordance with the Permit and any requirements established by the Environmental Programs Branch of Environment Yukon; such plans (and any amendments) must be approved by an environmental protection analyst, and Yukon Energy is also required to implement approved plans, and to ensure all associated personnel are familiar with them (paragraphs 3.1 to 3.5);
- Yukon Energy is required to maintain and operate the sources, as well as any stand-alone air pollution control equipment and testing and monitoring equipment, in accordance with manufacturer's recommendations and best management practices, as necessary to provide optimum control of air contaminant emission during all operating periods (paragraph 4.1);

- Yukon Energy is also required to run the sources at each site in order of highest possible efficiency in the circumstances, except for maintenance or test purposes (paragraph 4.2);
- Yukon Energy is required to ensure that the fuel used by the source(s) conforms to the most recent Canadian federal *Sulphur in Diesel Fuel Regulations* for off-road applications (paragraph 4.3);
- Yukon Energy is prohibited from allowing visible emissions from any source to exceed an opacity of 20% as measured by an environmental protection officer (paragraph 5.1), and must comply with further requirements to notify an environmental protection officer of any measured exceedance within 15 days or such time as may be directed by an environmental protection officer (paragraph 5.3), and to take reasonable measures to reduce opacity of emissions within 5 days of any measured exceedance, or in such time as may be directed by an environmental protection officer (paragraph 5.2);
- Yukon Energy must ensure that particulates collected using emission control equipment are contained so that there is no release of contaminants into the atmosphere or any open body of water (paragraph 5.4);
- Yukon Energy is required to conduct visual inspections and maintenance on all source components as per manufacturer's instructions (paragraph 7.1);
- Yukon Energy is required to contact either an environmental protection officer or the Yukon Spill Report Centre as soon as possible under the circumstances in the event of an unauthorized release or emission, such as fugitive emissions or emissions resulting from burning fuel other than that allowed under the Permit (paragraph 8.1);
- Yukon Energy is required to maintain records for at least three years in a format acceptable to an environmental protection officer, and to make them available on request for inspection by an environmental protection officer, including every plan developed under the Permit, summaries of all inspections carried out under the Permit, notes concerning any spills, leaks or unauthorized emissions, any deficiencies identified in an inspection and how and when they were remedied, and notes concerning any instance where the most efficient source was not used, and the reason for use of the less efficient source (paragraphs 9.1 and 9.2).

Yukon Energy's operation of the facilities will also continue to be subject to all applicable requirements and prohibitions under the *Environment Act* and *Air Emissions Regulations*, including:

- the general prohibition under section 6 of the *Regulations* against Yukon Energy releasing or allowing the release of any contaminant to such extent or degree as may: (a) 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;
- Yukon Energy's obligation under section 12(3) of the *Regulations* to provide written notice to the Minister, as soon as is reasonably feasible, of any significant change of circumstances involving the permitted activity;
- the authority of an environmental protection officer under section 12(4) of the *Regulations* to conduct periodic inspections of Yukon Energy's facilities to ensure compliance with the terms and conditions of the Permit;
- the authority of an environmental protection officer to issue a "hold order" under section 153 of the *Act*, or an "environmental protection order" under section 159 of the *Act*, in any of the circumstances described in those sections;
- the authority of the Minister to issue an "environmental protection order" under section 160 of the *Act*; and
- the overriding authority of the Minister to suspend or cancel the Permit under section 91 of the *Act*, if Yukon Energy contravenes a term or condition or the Permit or a provision of the *Act* or *Regulations*, or if, in the Minister's opinion, Yukon Energy's operation of its diesel facilities "has caused or is likely to cause irreparable or costly damage to the natural environment", or if, on the advice of a health officer, it is the Minister's opinion that Yukon Energy's operation or its diesel facilities "has caused or is likely to cause a threat to public health or safety".

It should be emphasized that if, during the term of the renewed Permit, a situation arises in which the continuing operation of Yukon Energy's could ever cause actual or imminent harm to public health or safety because of any change in circumstances or operating

conditions that is not contemplated at this time, the *Environment Act* and *Regulations* will give overriding authority to an environmental protection officer and/or the Minister, in the circumstances specified, to require Yukon Energy to cease operating one or more of the diesel units, or take other action that may be deemed necessary to prevent, remedy or otherwise mitigate that harm.

Other relevant legislative requirements include:

- section 27 of the *Occupational Health Regulations*, which stipulates workers' exposure limits for airborne contaminants, usually based on an 8-hour permissible exposure limit;
- sections 46 to 50 of the *Canadian Environmental Protection Act, 1999*, which speaks to the reporting requirements of the National Pollutant Release Inventory (NPRI);
- *Yukon Special Waste Regulations*;
- *Yukon Contaminated Site Regulations*;
- *Yukon Storage Tank Regulations*.

4.0 ENVIRONMENTAL & SOCIO-ECONOMIC SETTING

4.1 GENERAL

For the purposes of the assessment and its focus on air quality and human health, the human environment is considered to be very similar across each of the four communities in which Yukon Energy maintains diesel generators. It is assumed that there are no material differences among the four communities with respect to common human components such as a population of male, female, child, adult, and elderly persons with a common community health profile, the presence of common community infrastructure such as homes, schools, hospitals or nursing stations, communal recreation areas, etc. It is also assumed that there are no material differences in other socio-economic characteristics.

As noted previously, the key valued component identified for detailed assessment relative to this application is human health and safety. Human health and safety, with regard to the potential effects of diesel generation, is a function of overall ambient air quality (as opposed to emissions from any particular point source). Therefore the focus of this section is on describing the existing environment by describing the likely sources of air emissions in each of the communities.

Prior to 2008, there were no pre-existing air emission inventories available for use in the assessment which SENES conducted for the purpose of Yukon Energy's previous permit renewal application. Accordingly, individual inventories were developed in 2008 for each community in which Yukon Energy maintains diesel generators. These inventories assisted in developing an understanding of other community air emission sources and their relative contributions to the environment, and continue to be of such assistance in the context of Yukon Energy's current renewal application.

These inventories provide a backdrop for understanding the role and relationship of individual emission sources within the communities. The actual inventories are presented in the SENES report in Appendix B of the 2008 project proposals and represent an activity based emission inventory for the year 2006, which was chosen as a

sample year due to the availability of data. The overall emissions from the activity within the communities would not significantly differ for 2005 or 2007.

The annual emission tables within the 2008 SENES report summarize approximately 120 unique sources for each community for a series of Common Air Contaminants (CAC) and Greenhouse Gas (GHG) Emissions. Not every community has every emission source, particularly the smaller communities, and adjustments in the inventories were made accordingly.

Of particular note, and as explained further below, it should be emphasized that the relative contribution by Yukon Energy's facilities to total PM_{2.5} emissions from all sources in each of the four communities is extremely low: < 1% in each community, and only 0.02% in Whitehorse specifically.

4.2 WHITEHORSE

4.2.1 Emissions Inventory

The City of Whitehorse contains the majority of the population within the Yukon and represents the foundation for development of the emission inventories. The airshed boundary identified for the emission inventory uses the boundaries identified in the Official Community Plan, which was available from the City's web site. The following are points of interest for the 2008 inventory:

- Within the city boundary there is very little agricultural activity both for agricultural land use practices and equipment usage.
- Four point sources have been identified: the Whitehorse General Hospital, the sand and gravel supply in the southern parts of town, the local asphalt batch plant, and the concrete batch plants, in addition to the Yukon Energy generators.
- The highway traffic accounts for vehicles travelling along a 36 km stretch of the Alaska Highway.
- A population of 23,751 was estimated for the inventory year.

- A total of 27,525 flights were recorded between the two airports.
- A total of 24,600 cords of wood were estimated to have been burned during the year.

The following table summarizes the 2006 component contributions to the Whitehorse airshed for some emissions of interest.

Table 4 Summary of Select Component Contributions to Air Emissions in Whitehorse⁴

Source	Particulate Matter (PM _{2.5})	Oxides of Nitrogen (NO _x)	Carbon Dioxide (CO ₂)
Yukon Energy Diesel Generators	0.02%	1%	0.1%
Home Heating	84%	26%	57%
Local Vehicle Traffic	0.9%	46%	25%
All Others Sources Combined	15%	27%	18%

4.2.2 Ambient Air Quality

Environment Canada operates an air quality monitoring station in Whitehorse, located at 1091 - 1st Avenue, as part of the National Air Pollution Surveillance (NAPS) network. The most recent 5-year data record includes monitoring for CO, NO, NO₂ and PM_{2.5} for the period 2001-2005. This data was used and analyzed during the air quality assessment and is presented in SENES's report in Appendix B. (This was the same data used in SENES's original 2008 study; however, there was no more recent data available for the purposes of the updated air quality assessment.)

The data from the station indicate that, in non-forest fire years (2001-2003), the maximum levels of CO, NO₂ and PM_{2.5} in Whitehorse are well below the ambient air quality standards adopted by Yukon Environment in 2010. In fact, in September 2011,

⁴ All figures in Table 3 are approximate.

the World Health Organization rated Whitehorse as the cleanest city in Canada on the basis of an annual average $PM_{2.5}$ level of only $3 \mu\text{g}/\text{m}^3$.

Data from the station for NO_2 and $PM_{2.5}$ in 2004 and 2005 are anomalously high due to forest fires in the area in those years, and as such are not representative of typical levels of these contaminants in Whitehorse. Accordingly, for the purposes of the assessment, SENES has assumed background concentrations of NO_2 and $PM_{2.5}$ defined as the 98th percentile value average over the 3-year period 2001-2003 ($3.8 \mu\text{g}/\text{m}^3$ for NO_2 , and $8 \mu\text{g}/\text{m}^3$ for $PM_{2.5}$).

4.3 FARO

4.3.1 Emissions Inventory

The Town of Faro contains a small fraction of the population within the Yukon and its inventory utilizes scaled activity from the Whitehorse inventory in situations where local data were not available. The following are points of interest for the 2008 inventory:

- Within the inventory bounds there is very little agricultural activity both for land use activity and agricultural equipment usage.
- There were no significant point sources identified for Faro other than the Yukon Energy power plant.
- The highway traffic accounts for vehicles travelling along a 15 km stretch of the Campbell Highway.
- A population of 388 was estimated for the inventory year.
- A total of 786 flights were recorded at the local airport.
- A total of 367 cords of wood were estimated to have been burned during the year.
- Yukon Energy diesel operations contributed approximately 0.4%, 16%, and 2% of the total community emissions of $PM_{2.5}$, NO_x , and CO_2 , respectively.

4.4 MAYO

4.4.1 Emissions Inventory

The Town of Mayo contains a small fraction of the population within the Yukon and its inventory also utilizes scaled activity from the Whitehorse inventory in situations where local data were not available. The following are points of interest for the 2008 inventory:

- Within the inventory bounds there is very little agricultural activity both for land use activity and agricultural equipment usage.
- There were no significant point sources identified for Mayo, other than the Yukon Energy power plant.
- The highway traffic accounts for vehicles along a 25 km stretch of Highway 11.
- A population of 409 was estimated for the inventory year.
- A total of 4,377 flights were recorded at the local airport.
- A total of 470 cords of wood were estimated to have been burned during the year.
- Yukon Energy diesel operations contributed approximately 0.1%, 4%, and 0.3% of the total community emissions of PM_{2.5}, NO_x, and CO₂, respectively.

4.5 DAWSON CITY

4.5.1 Emissions Inventory

Dawson City contains a small fraction of the population within the Yukon and its inventory also utilizes scaled activity from the Whitehorse inventory in situations where local data were not available. The following are points of interest for the 2008 inventory:

- Within the inventory bounds, there is very little agricultural activity both for land use activity and agricultural equipment usage.
- A single point source representing sand and gravel supply is included, in addition to the Yukon Energy power plant.

- The highway traffic accounts for vehicles travelling along a 20 km stretch of the Klondike Highway.
- A population of 1,813 was estimated for the inventory year.
- A total of 5,567 flights were recorded at the local airport, located approximately 15 km east of town and are included for comparison to the other communities.
- A total of 2,201 cords of wood were estimated to have been burned during the year.
- Yukon Energy diesel operations contributed approximately 0.3%, 15%, and 2% of the total community emissions of $PM_{2.5}$, NO_x , and CO_2 , respectively.

5.0 EFFECTS ASSESSMENT

5.1 GENERAL

The updated air quality effects assessment carried out by SENES, and outlined in its report in Appendix B, includes a thorough and comprehensive dispersion modelling analysis to assess the potential effects within the Whitehorse airshed of four air contaminants produced from the diesel generators: carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and respirable particulate matter ($PM_{2.5}$).

The potential effect of Yukon Energy emissions of those contaminants was modelled, analyzed, and assessed based on simulations of three different levels of operation of the Whitehorse diesel facilities, as outlined below.

The updated effects assessment focuses principally on modelling of emissions in the Whitehorse airshed, and comparing them to the ambient air quality standards adopted by the Yukon Government in 2010. As with the original 2008 assessment, the Whitehorse facility was selected because of the availability of suitable meteorological data that was required to conduct the modelling, as well as suitable ambient air quality monitoring data that provides a measure of background concentrations against which to assess the potential impact of Yukon Energy operations. Equivalent data was not available for Mayo, Faro, or Dawson City; in the absence of such data, it is assumed that the results and findings for Whitehorse provide reasonably representative, conservative estimates of the outcomes that could be expected for the smaller diesel plants in the

other three communities, given the likely levels of use of the units in these communities during the three-year term of the renewed Permit.

It should also be noted that by their very nature, the effects of diesel generation emissions on human health result from the cumulative interaction of emissions from Yukon Energy and all other sources of contaminants in the airshed, including community sources such as local vehicular traffic, home heating (using either fuel oil or wood stoves), and other (non-Yukon Energy) industrial activity. Those other sources, which are not within the Corporation's control, collectively produce the vast majority of contaminants in all four communities (as outlined in Section 4.0 above, and in the air quality inventories prepared by SENES in their 2008 report). Any potential effects on human health would be as a result of overall ambient air quality.

As such, the effects assessment focuses both on:

- the incremental contribution of Yukon Energy emissions to air quality in Whitehorse (excluding background air quality); and
- the cumulative effect of Yukon Energy emissions combined with reasonably contemplated background concentrations of contaminants from other sources, based on actual ambient air quality data observed during a typical three-year period (2001-2003) that is assumed to be reasonably representative of the background levels of contaminants that would normally be expected to occur.

5.2 GENERATION PROFILES

For the purpose of analyzing the potential effects on human health of emissions from the Whitehorse diesel facilities, SENES developed and conducted air dispersion modelling of the three operating scenarios, as follows:

- **Scenario 1:** actual 2010 generation levels by facility.
- **Scenario 2:** forecast "average case" levels of diesel generation through to 2014. This scenario reflects Yukon Energy's projections of the most likely highest levels of diesel generation over the 2012-2014 period, given current hydrological conditions and electricity demand predictions.

- **Scenario 3:** hypothetical “worst case” scenario. This scenario reflects Yukon Energy’s projections of the maximum demand that might theoretically need to be met from diesel generation, in the unlikely event that Yukon Energy’s ability to supply demand through hydro generation were to be very seriously constrained as a result of a series of successive drought years culminating in the most extreme drought conditions occurring in 2014. This scenario represents the extreme case of extraordinarily severe drought conditions, which is very unlikely to occur over the term 2012-2014.

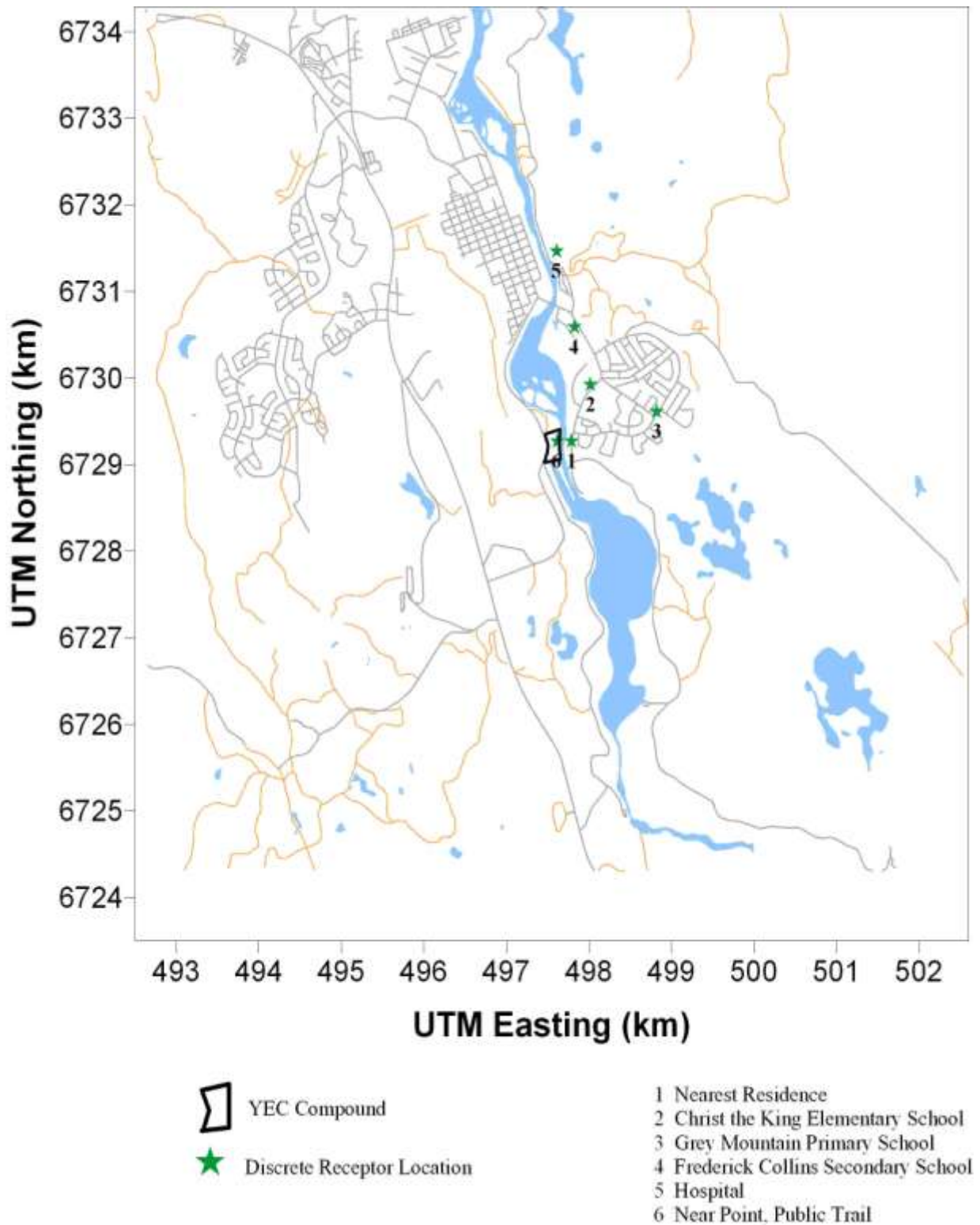
5.3 REPRESENTATIVE RECEPTOR SITES

Estimates of ambient air quality concentrations were produced on a regular grid every 20 metres within 200 metres of the diesel plant, every 50 metres between 200 metres and 500 metres from the plant and then every 200 metres for the remainder of the study area. In addition, six discrete receptor locations were used. Discrete receptors are commonly used in air quality assessments to look at the full distribution of predicted ambient concentrations at locations considered particularly sensitive to air contaminants, such as homes, schools and hospitals.

The six sensitive receptors chosen were as follows and are presented in Figure 5, below (approximate distance from the plant shown in brackets):

1. nearest residence to the power plant, located on the east side of the Yukon River (240 m);
2. Christ the King Elementary School (840 m);
3. Grey Mountain Primary School (1.3 km);
4. Frederick H. Collins Secondary School (1.4 km);
5. the Whitehorse General Hospital (2.2 km); and,
6. the Whitehorse plant property eastern fence line near the Yukon River (75 m).

Figure 5 Inner Modelling Domain and Discrete Receptor Locations



5.4 POTENTIAL HEALTH EFFECTS & APPLICABLE ENVIRONMENTAL STANDARDS

The screening-level human health risk assessment conducted by SENES and outlined in its report considers predicted concentrations of CO, SO₂, NO₂ and PM_{2.5} in the actual and hypothetical operating scenarios modelled under each of Scenarios 1, 2 and 3, at each of the six selected receptor sites and at the “maximum point of impingement” (Max POI)⁵, and the resulting risk (if any) to human health.

The predicted total ambient concentration of each contaminant depends on the combination of the predicted concentration arising from Yukon Energy’s operation of its diesel facilities plus the expected background concentration of the contaminant arising from other sources, including other community emission sources, such as local vehicular traffic, home heating (using either fuel oil or wood stoves), and other (non-Yukon Energy) industrial activity. Background concentrations of contaminants such as NO₂ and PM_{2.5} may also vary significantly as a result of natural variations in baseline conditions not within Yukon Energy’s control (i.e., forest fires), causing an increased presence of those contaminants in the airshed, when those events might occur.

The Yukon Ambient Air Quality Standards, adopted by the Yukon Government in 2010, now represent an established and recognized environmental norm that provides an appropriate and sound basis against which to assess the potential “significance” of any potential adverse health effects arising from CO, SO₂, NO₂ and PM_{2.5} emissions from Yukon Energy’s facilities, for the purpose of section 56(1) of YESAA, in conjunction with any other effect attributes that are relevant to the “significance” analysis, such as extent, duration, frequency, and in particular, the likelihood of any effect occurring.

With respect to PM_{2.5}, such other effect attributes include the very low extent to which Yukon Energy’s diesel facilities actually contribute to total concentrations of PM_{2.5} relative to other community sources of PM_{2.5} emissions, or natural variations in baseline conditions resulting from forest fires, which are not within the Corporation’s control and against which it cannot reasonably be expected to mitigate.

⁵ The Max POI includes any point in the modelling domain outside the property line of the facility where the highest concentration of the contaminant is predicted to occur.

5.5 EFFECTS SUMMARY

5.5.1 *Beneficial Effect of Yukon Energy's Diesel Facilities*

Yukon Energy's diesel generation facilities have an obvious beneficial effect on human health and safety, given Yukon Energy's reliance on those facilities for back-up power generation capacity. The diesel facilities are essential to the Corporation's ability to provide a reliable supply of electricity to customers on those occasions when Yukon Energy is unable to satisfy total customer demand through hydro generation alone; i.e. in emergency situations, as well as during periods of planned maintenance, or when demand otherwise outstrips hydro supply as a result of peaking demand during cold winter temperatures.

If Yukon Energy were not able to use and rely on its diesel generation facilities to provide a reliable supply of back-up power to customers in these circumstances, this would put both infrastructure and human health and safety at very serious risk, particularly during the cold winter months.

5.5.2 *Potential Effects Resulting from Combustion Gas Emissions (CO, SO₂, and NO₂)*

SENES's analysis demonstrates that, based on application of the Yukon ambient air quality standards, there are no potential adverse health effects from CO, SO₂, or NO₂ emissions from Yukon Energy's diesel facilities.

In particular, SENES's modeling demonstrates that the cumulative effect of CO, SO₂ and NO₂ emissions from Yukon Energy's diesel facilities, in combination with background concentrations of those contaminants, would not result in the ambient air quality standards for CO, SO₂ or NO₂ being exceeded anywhere in Whitehorse, at any time, in any Scenario, including even under the extreme (and very unlikely) "worst case" operating conditions represented by Scenario 3.

5.5.3 Potential Effects Resulting from Particulate Matter Emissions ($PM_{2.5}$)

It also follows from SENES's modeling and analyses that, based on application of the Yukon ambient air quality standards, $PM_{2.5}$ emissions from Yukon Energy's diesel facilities similarly are not expected to have any significant adverse effects within the meaning of section 56(1) of YESAA.

In particular, SENES's modeling shows that Yukon Energy's incremental contribution to air quality in Whitehorse (excluding background air quality) would remain well within the Yukon $PM_{2.5}$ standard, at all times, at all locations in Whitehorse, whether based on Yukon Energy's actual diesel operations in 2010 (Scenario 1), or projections of the most likely levels of diesel generation reasonably anticipated over the 2012-2014 period (Scenario 2).

Even under the extreme (and very unlikely) "worst case" operating conditions represented by Scenario 3, Yukon Energy's incremental contribution to air quality in Whitehorse would remain within the Yukon $PM_{2.5}$ standard everywhere in Whitehorse, except, on two days of the year only, at the Max POI on the western edge of the Yukon Energy facility property line (where members of the public are not likely to be present except for very brief periods of exposure), as a result of building downwash effects on the plumes from the facility. Other than that, Yukon Energy's incremental contribution to ambient air quality levels at all locations in Whitehorse would remain within the limits of the Yukon $PM_{2.5}$ standard, at all times, even in the unlikely "worst case" scenario.

In fact, the incremental contribution of Yukon Energy emissions to ambient $PM_{2.5}$ levels in most areas of Whitehorse would remain at or below about $2 \mu\text{g}/\text{m}^3$ (less than 7% of the Yukon $PM_{2.5}$ standard) even under the modelled "worst case" operating conditions.

As regards the cumulative effect of Yukon Energy emissions in combination with an assumed background $PM_{2.5}$ concentration of $8.0 \mu\text{g}/\text{m}^3$:

- this still would not result in the Yukon $PM_{2.5}$ standard being exceeded anywhere in Whitehorse, at any time, based on actual diesel operations in 2010 (Scenario 1);

- under the most likely levels of diesel generation anticipated over the 2012-2014 period (Scenario 2), the cumulative effect of Yukon Energy emissions in combination with expected background PM_{2.5} concentration from all other sources would only result in the Yukon PM_{2.5} standard being exceeded on one day of the year, at the Max POI on Yukon Energy property only (and not at any other locations in Whitehorse); and
- even under the extreme (and very unlikely) “worst case” operating conditions modeled in Scenario 3, the cumulative effect of Yukon Energy emissions in combination with expected background PM_{2.5} concentration from all other sources would only result in the Yukon PM_{2.5} standard being exceeded on up to seven days of the year, and, again, at the Max POI on Yukon Energy property only (and not at any other locations in Whitehorse).

Indeed, it is contemplated that PM_{2.5} concentrations would remain at background levels (8.0 µg/m³) for 155 days of the year, even in severe drought conditions with maximum load operations on the diesel generators as modelled in Scenario 3.

In the circumstances, these hypothetical impacts cannot reasonably be considered “significant” potential adverse effects for the purposes of section 56(1) of YESAA, particularly having regard to:

- the mitigation measures proposed by Yukon Energy (as referenced in Section 2.3 above), together with the other legal and regulatory constraints on Yukon Energy’s operation of its facilities (as outlined in Section 3.9.2 above), which, taken together, must be considered adequate to eliminate, reduce or control any such, potential adverse effects of the project;⁶

⁶ Any other conclusion would be inconsistent with the approach adopted by the Watson Lake Designated Office in its September 8, 2009 Evaluation Report on Project Number 2009-0107 (YECL Air Emissions Permit Renewal – Watson Lake, YT), in reviewing the Yukon Electrical Company Ltd.’s application to renew the air emissions permit for the diesel generator station it operates continuously, on a full-time basis (24-hours per day, 365 days per year) as the primary power source in Watson Lake (see Section 2.3 above).

- the very unlikely nature of the “worst case” conditions modeled in Scenario 3, which assumes a series of successive drought years culminating in the most extreme drought conditions occurring in 2014; and
- the predominant attributes of the potential effect, namely effect extent, effect duration, effect frequency, and most importantly, the likelihood of the potential effect occurring.

5.6 SIGNIFICANCE CONCLUSIONS

Having regard to the foregoing review of the potential effects of Yukon Energy’s diesel generation facilities on human health and safety, it must be concluded that no significant adverse effects to human health and safety within the meaning of section 56(1) of YESAA are reasonably anticipated to result from Yukon Energy’s continuing operation of the diesel units under a renewed Permit, during the 2012-2014 period.

Accordingly, Yukon Energy requests that the Designated Office issue a recommendation to the Yukon Government under section 56(1)(a) of YESAA to allow the renewal of Yukon Energy’s Air Emissions Permit to proceed, on the basis that Yukon Energy’s continuing operation of the diesel units during the 2012-2014 term of the renewed Permit, in compliance with the terms of the renewed Permit and the requirements of the *Environment Act* and *Air Emissions Regulations*, will not have significant adverse environmental or socio-economic effects in or outside the Yukon.

6.0 ACKNOWLEDGEMENT AND CERTIFICATION

The information submitted in this Project Proposal is required for the purpose of conducting an evaluation under the *Yukon Environmental and Socio-economic Assessment Act*.

I acknowledge that, pursuant to sections 119 and 120 of the *Act*, a copy of this Project Proposal will be placed on a public register and be available to any member of the public to review. I understand that misrepresenting or omitting information required for the evaluation may cause delays in the evaluation or render the recommendations invalid.

I certify that the information provided is true and correct to the best of my knowledge and belief.



Travis Ritchie, P.Biol. CCEP
Manager – Environment, Assessment & Licencing

October 25, 2011

Date



Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro

Project Assessment 2011-0246

Proponent: Yukon Energy Corporation

Assessment Completion Date: December 30, 2011

Watson Lake Designated Office

PO BOX 294

Watson Lake, YT Y0A 1C0

Tel: (867) 536-4040

Fax: (867) 536-4049

www.yesab.ca

EXECUTIVE SUMMARY

The proponent, Yukon Energy Corporation (YEC), is applying for the renewal of their Air Emissions Permit to continue operating its existing diesel-fired electricity generating station in the community of Faro. The generator serves as a secondary energy supply to supplement the transmission grid and as an emergency back-up power source. The station is located near the entrance to Faro off the mine access road. The proposed operation and management of the Faro Generating Station will occur over a three year period beginning in January 2012. Views and information on the project were submitted by 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 not have significant adverse effects on all the above-mentioned valued components. The assessor believes that mitigations proposed by the proponent and compliance with the applicable existing non-discretionary legislation are adequate to eliminate, reduce, or control the significant adverse effects of the project.

OUTCOME

The Watson Lake Designated Office, pursuant to section 56(1)(a) of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA), recommends to the decision bodies that the project be allowed to proceed, as it has determined that the project will not have significant adverse environmental or socio-economic effects in or outside Yukon.

Issued by the Watson Lake Designated Office on December 30, 2011.

For more information please contact:

Sarah Chan

Assessment Officer

Tel: (867) 536-4040

Email: Watsonlake.do@yesab.ca

Table of Contents

Part A.	Introduction	3
1.0	PROJECT DESCRIPTION	3
1.1	Proponent Information	3
1.2	Geographical Context.....	3
1.3	History of Project	5
1.4	Project Details	7
1.5	Project Scope	10
2.0	ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING	10
2.1	Biological Environment.....	10
2.2	Physical Environment.....	11
2.3	Socio-economic Environment.....	11
3.0	REQUIREMENT FOR AN ASSESSMENT	12
4.0	SCOPE OF THE ASSESSMENT	13
Part B.	Effects Assessment and reasons for recommendation.....	16
5.0	AIR QUALITY.....	16
5.1	Overview.....	16
5.2	Project Effects	16
5.3	Commitments and Mitigations From the Proponent.....	22
5.4	Non-discretionary legislation	23
5.5	Significance Determination.....	23
5.6	Recommended Mitigations.....	24
5.7	Residual Effects.....	24
5.8	Cumulative Effects	24
6.0	ENVIRONMENTAL QUALITY.....	25
6.1	Overview.....	25
6.2	Project Effects	25
6.3	Commitments and Mitigations From the Proponent.....	26
6.4	Non-discretionary legislation	26
6.5	Significance Determination.....	26
6.6	Proposed Mitigations.....	26
6.7	Residual effects	27

6.8	Cumulative Effects	27
Appendix A	LIST OF KEY MITIGATIONS THE PROPONENT HAS COMMITTED TO UNDERTAKE	28
Appendix B	LIST OF RELEVANT NON-DISCRETIONARY LEGISLATION APPLICABLE TO THE PROJECT.....	29
Appendix C	LIST OF SUBMISSIONS MADE BY INTERESTED PERSONS AND OTHERS DURING THE ASSESSMENT	30
Appendix D	REFERENCES.....	31

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 the public electric utility Yukon Energy Corporation (YEC), a Crown corporation that operates as a business arms-length from Yukon Government that was established in 1987. YEC is the main electricity generator and transmitter in the Yukon and operates a variety of hydroelectric, wind, and diesel power generation facilities as well as the now connected Whitehorse-Aishihik-Faro (WAF) and Mayo-Dawson (MD) transmission grids.

The contact person for this project is Travis Ritchie, Manager of Environment, Assessment & Licensing

Address: P.O. Box 5920
Whitehorse, Yukon
Y1A 6S7

Phone: (867)-393-5350

Email: travis.ritchie@yec.yk.ca

1.2 GEOGRAPHICAL CONTEXT

The Faro diesel plant is located near the entrance to Faro off the mine access road (Figure 1). Information about geographical coordinates, involved First Nation Traditional Territories, overlapping watersheds and nearby waterbodies are found in Table 1.

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

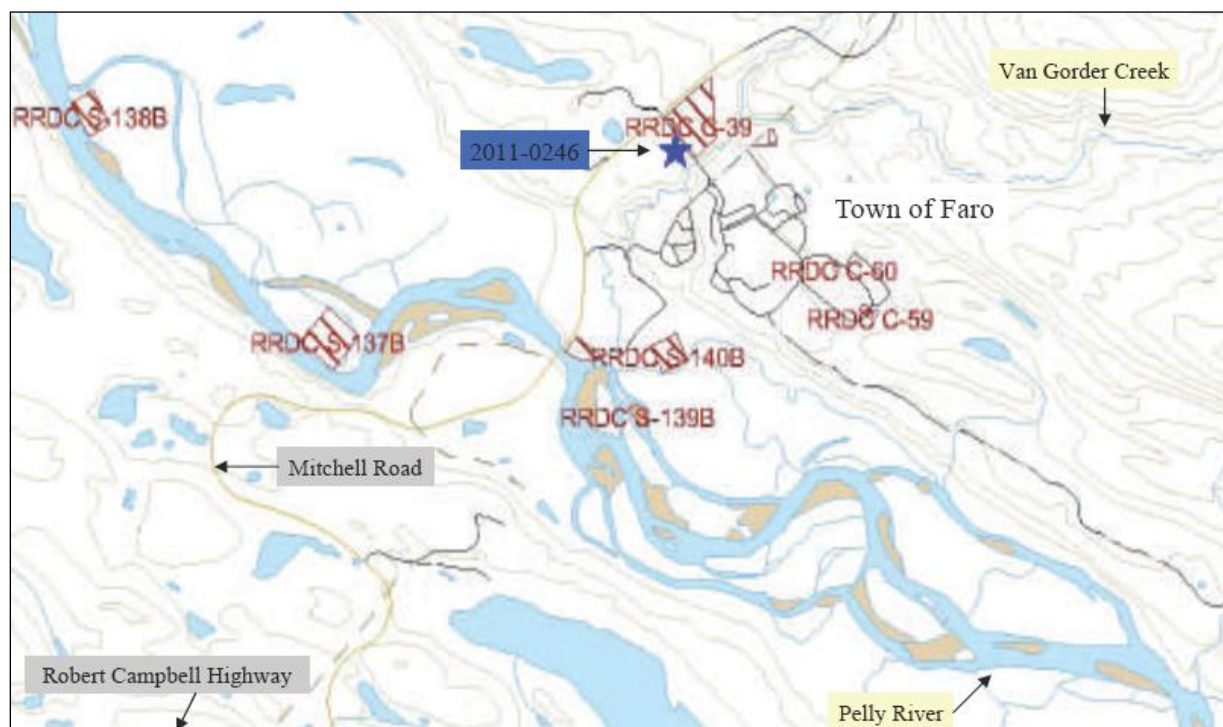


Figure 1: Project Location

Table 1: Project Location

Project Coordinates:	UTM Zone 8 6901266 N, 585174 E (Map sheet: 105K/03)
First Nation Traditional Territories Involved:	Ross River Dena Council and Liard First Nation
Drainage Region:	Major Drainage Area: Yukon River Sub Drainage: Pelly Sub-Sub Drainage: Lower Pelly
Nearby Water Courses or Waterbodies:	Pelly River (approximately 2 km southwest of the project)

1.3 HISTORY OF PROJECT

Yukon's Energy System

Yukon Energy Corporation (YEC) directly serves customers, mostly in the areas around Whitehorse, Dawson City, Mayo and Faro, but also sells wholesale power to Yukon Electrical Company Limited (YECL), who in turn sells it retail to customers in the territory through its own distribution network.

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 hydroelectric 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 Faro¹

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.

The existing air emissions permit (Permit # 4201-60-010) expires Dec. 31, 2011. YEC is seeking to renew this permit under the same terms and conditions, for a three-year period beginning in January 2012.

Energy Supply and Demand in the 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

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

¹ YOR document 2011-0246-004-1

² Yukon Energy 2010

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

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 Columbia³.

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.

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.

Assessment History

The assessment related to the renewal of YEC's Air Emissions Permit (Permit #4201-60-010) for the Faro Generating Station was carried out by the YESAB Watson Lake Designated Office in 2008 (Project # 2008-0230). As a result of that assessment, the Air Emissions Permit was renewed for a 3-year term that expires on December 31, 2011. YEC is seeking to renew the existing permit under the same terms and conditions for a period beginning in January 2012. As a note, the permit also includes the Dawson, Mayo, and Whitehorse generating stations.

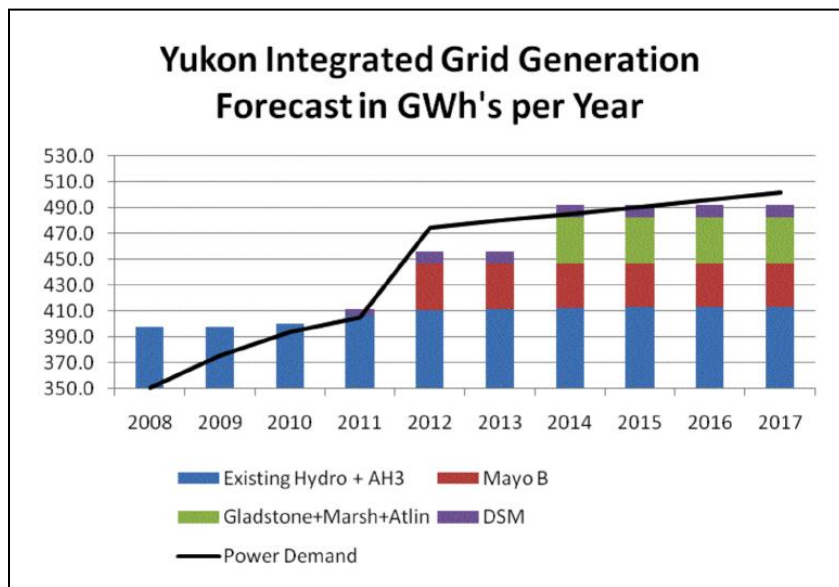


Figure 2: Yukon Integrated Grid Generation and Power Demand Forecast 2008-2017. AH3 and Mayo B should be online by the end of 2011. DSM = demand-side management⁴

³ Yukon Energy Corporation 2011

⁴ Yukon Energy Corporation, 2010

1.4 PROJECT DETAILS

The following information is taken from the project proposal and additional information provided by the proponent:

YEC's diesel electric generating plants are installed and operated to ensure the overall WAF and MD systems, and so all customers on these systems can receive reliable power. Given the mix of energy generation (hydro, wind, and diesel), in addition to periods of high demand that cannot be met solely by hydro, YEC's ability to operate its diesel plants is essential to avoid scenarios where there would be a requirement to impose blackout conditions.

The Faro diesel generating facility has three 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; and
- there is a need to 'exercise' a particular diesel unit as part of regular maintenance⁵.

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 and 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. Two of Faro's generators (FD3 and FD5) are due for replacement in 2020, while the third (FD7) is due around 2030⁶.

Diesel Generation

Between 2008 and 2010, the total run time and energy produced by YEC's diesel facilities has increased dramatically. Total 2010 diesel running time at the Faro facility was 189% of 2008 levels and total power generated from diesel (0.39 GWh) was 488% of 2008 levels (0.08 GWh). Table 2 provides a summary of annual diesel generation at YEC's facilities for the 2008-2010 period.

⁵ YOR document 2011-0246-004-1

⁶ YOR document 2011-0246-007-1

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

Table 2: Summary of Annual Diesel Generation 2008-2010. Results with positive run time hours, but zero generation represent units running at speed with no load for maintenance or testing purposes. (Source: adapted from YOR Document 2011-0246-004-1, p. 17)

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

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 GWh⁷. 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 multiple 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 have otherwise occurred⁸.

YEC has stated "*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 However, 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

⁷ Yukon Energy Website. 2011. http://www.yukonenergy.ca/customer/tips_tools/consumption/ (Accessed November 30, 2011).

⁸ YOR document 2011-0246-005-1

⁹ YOR document 2011-0246-004-1

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

Permit renewal. Over time, if the renewable energy projects YEC is currently investigating come online the need for diesel should be reduced.

Table 3 shows the summary of forecasted diesel energy requirements between 2012 and 2014. Scenario 1 represents actual 2010 generation. Scenario 2 is the predicted average diesel requirement and Scenario 3 represents a worst-case drought situation. As can be seen, total Yukon-wide diesel use is projected to increase substantially from the previous permit period.

Table 3: Summary of Forecasted Diesel Energy Requirements 2012-2014

(Source: YOR Document #2011-0246-005-1)

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

The assessor considers Scenario 3 to be the most appropriate scenario on which to base the current assessment as 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 time¹⁰. 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

¹⁰ YOR document 2011-0246-027-1

low since there are numerous factors that limit running the generator continuously at full bore (e.g. downtime for maintenance; optimizing operations).

In terms of emission reduction measures, ultra-low sulphur diesel is exclusively used in order to reduce emissions of particulate matter and SO₂ relative to other available fuels. According to the proponent, preventative maintenance is carried out regularly according to the manufacturer's specifications in order to ensure that units are running at peak efficiency.

The proponent is seeking a renewal of their Air Emissions Permit for the Faro diesel plant and for their diesel plants located in three other Yukon communities which are subject to separate assessment by their local YESAB Designated Offices: Whitehorse (Project # 2011-0241), Mayo (Project # 2011-0242), and Dawson (Project # 2011-0244).

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 Yukon Energy Corporation's (YEC) Air Emissions Permit in order to maintain the ability to operate its diesel generating facilities. The principal activity is the continued operation of 4 diesel generators located at the Faro diesel plant near the entrance to Faro off the mine access road.

The operational life of the diesel 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 BIOLOGICAL ENVIRONMENT

Vegetation

The project is located within the Yukon Plateau-North Ecoregion of the Boreal Cordillera ecozone¹¹. The vegetation ranges from boreal to alpine, with northern boreal forest reaching elevations up to 1,500 m. The dominant forest type of the boreal zone is characterized by open canopy black spruce with a moist or drier lichen understory. White spruce forests, occasionally with aspen or lodgepole pine, occur in warmer and better-drained sites. Various willows, sedges, and aquatic plants are present in or around wetland areas.

Wildlife

The Yukon Plateau-North Ecoregion provides habitat for a variety of wildlife and bird species typical of the boreal forest¹². The ecoregion supports populations of grizzly and black bears, caribou, moose, wolverine, marten, wolf, Stone and Fannin sheep, lynx, red fox, beavers, and other small mammals. There is a large

¹¹ Yukon Ecoregions Working Group, 2004

¹² Yukon Ecoregions Working Group, 2004

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

abundance of grizzlies in the Faro area. The Tintina Trench serves as an important migratory corridor for large numbers of sandhill cranes that breed in Alaska. The region's wetlands are also used as breeding grounds for raptors, songbirds, forest birds, and waterfowl.

Fish

Some of the fish species inhabiting the Pelly River are Chinook, Coho, and Chum salmon, lake trout, Arctic grayling, northern pike, burbot, and whitefish.

2.2 PHYSICAL ENVIRONMENT

Setting

Faro is located in the Pelly River Valley in the Anvil Mountains, which is 356 km northeast of Whitehorse on the Tintina Trench fault line on the edge of the Yukon Plateau-North Ecoregion. It is located at an elevation of approximately 690 m above sea level. The soil surrounding the facility is composed of sand and gravel layers with some silt.

Permafrost

The project is located within the Yukon Plateau-North Ecoregion. This ecoregion occurs in the discontinuous permafrost zone¹³. The depth and extent of permafrost at the site is not known; however, permafrost has been noted to be thinner and less extensive in the Faro area compared to other areas of the ecoregion, with a depth of approximately 10 m recorded several years ago¹⁴.

Water Drainage and Nearby Waterbodies

The project location is about 2 km from the Pelly River. Van Gorder Creek is approximately 0.8 km to the southeast.

2.3 SOCIO-ECONOMIC ENVIRONMENT

Nearby Communities

The Town of Faro is located just off the Robert Campbell Highway, 356 km northeast of Whitehorse and 423 km from Watson Lake. In 2006, the population of Faro was 341¹⁵. Essential services in Faro include a municipal landfill; an RCMP detachment; the Faro Nursing Station; a hotel; schools; an airport; volunteer fire, ambulance and search-and-rescue services; and other businesses, including a bank.

First Nations

The project is located within the traditional territories of the Ross River Dena Council and the Liard First Nation.

¹³ Yukon Ecoregions Working Group, 2004

¹⁴ Yukon Ecoregions Working Group, 2004

¹⁵ Statistics Canada, 2007

Administrative Boundaries and Other Land Use Activities

Other administrative boundaries that overlap with the project include group trapline concession #405 and outfitting concession #9. Hikers and other recreational users may occasionally frequent the wooded areas surrounding the project. Land uses near the community include mining, recreation, hunting, trapping, and other traditional land uses.

Nearby Development

Aside from the residential/commercial infrastructure and municipal infrastructure within Faro, nearby development includes the Robert Campbell Highway and the Faro Mine site (approximately 20 km away). The solid waste disposal facility (assessed by YESAB project #2011-0234) is less than 1 km away.

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:

Construction, operation, modification, decommissioning, or abandonment or, or other activity in relation to, b) a fossil fuel-fired electrical generation 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 Watson Lake Designated Office during the assessment. A list of the decision body(s) and authorizations required for the project can be found in Table 4 below.

Table 4: Decision Body and Authorizations Required

Decision Body	Authorization(s) Required	Act or Regulation
Yukon Government – Environment	Air Emissions Permit	<i>Environment Act, <u>Air Emissions Regulations</u></i>

4.0 SCOPE OF THE ASSESSMENT

This assessment considers the project scope, as described above, and how it relates to valued environmental and socio-economic components of the area as well as matters to be considered in 42(1) of YESAA. Views and information submitted during the assessment generally identified concerns of the potential effects to air quality and environmental quality.

Consideration of YESAB Evaluation 2008-0230

The current proposal consists of the renewal of Air Emissions Permit #4201-60-010 that was issued in 2009 for this project. The proponent has indicated in a letter that this proposal is essentially identical to project 2008-0230: “...there have been no changes to the proposed activities or facilities associated with the required permit since the last assessment.”¹⁶ The assessor has consequently determined that the documentation submitted for project 2008-0230, including the evaluation report previously issued by YESAB,¹⁷ is still valid and relevant to the present evaluation and will be taken into consideration.

Consideration of Air Quality

Comments were submitted by YG, Environment,¹⁸ who identified air quality as the key environmental value with concerns that the project may affect human health due to the air emissions produced by the generators and their associated pollutants. These comments noted that exceedances of ambient air quality criteria may occur if equipment is not properly maintained or if fuels of lesser quality are burned. Effects on air quality and human health are discussed further in section 5.0, Air Quality.

Yukon Air Quality Standards

In 2010, Environment Yukon adopted the *Yukon Ambient Air Quality Standards* for sulphur dioxide (SO₂), ground level ozone (O₃), total suspended particulate matter (TSP), carbon monoxide (CO), fine particulate matter (PM_{2.5}) and nitrogen dioxide (NO₂). These are in line with Canada-wide minimum standards, although some jurisdictions including British Columbia have enacted requirements that are more stringent. The standards are the maximum concentrations of pollutants acceptable in ambient air throughout the Yukon Territory (Table 5). They are to be used to determine the acceptability of emissions from proposed and existing developments¹⁹.

¹⁶ YOR document 2011-0246-004-1

¹⁷ YOR document 2008-0230-036-1

¹⁸ YOR document 2011-0246-021-1

¹⁹ Yukon Environment, 2010

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

Table 5: Yukon Air Quality Standards

Note: All ambient air quality measurements will be referenced to standard conditions of 25 degrees Celsius and 101.3 kiloPascals. $\mu\text{g}/\text{m}^3$ = micrograms per cubic metre, ppm = parts per million, ppbv = parts per billion by volume.²⁰

Parameter	Standard ($\mu\text{g}/\text{m}^3$)	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 ($\text{PM}_{2.5}$)			
24-hour average	30		
Nitrogen Dioxide (NO_2)			
1-hour average			213
24-hour average			106
Annual arithmetic mean			32

Consideration of the Air Quality Modelling

An air quality model, prepared by SENES in October 2011, was submitted as part of the proposal. The model provided for all of YEC's generating stations was prepared for the Whitehorse generating station, using local air quality conditions and emission levels. YG, Environment provided further comment and analysis on the air quality modelling report. It was noted that the adoption of stack emissions standards by Environment Yukon would have been helpful in determining whether emissions from YEC's generators are at levels that are protective of human health and the environment. The use of this model for the assessment of the air quality in and around Faro is considered in section 5.0, Air Quality.

Consideration of Human Health and Safety

As noted above, the pollutants associated with air emissions produced by the operation of diesel generators may affect human health. This will be further discussed in section 5.0, Air Quality.

Consideration of Environmental Quality

Project activities include the generation of special wastes, and therefore there is the risk that contaminants from these wastes are released into the surrounding environment. This will be discussed in section 6.0, Environmental Quality.

The comment submission provided by YG, Community Services, discussed permit requirements for the storage of fuel and general fire protection measures²¹. As these comments concern regulations and non-

²⁰ Yukon Environment, 2010

²¹ YOR document 2011-0246-021-1

discretionary measures that the proponent must adhere to, they have been considered as information only for the purpose of this assessment and will not be discussed further.

Valued Environmental and Socio-economic Components

The scope of the assessment is determined by considering the activities described in the scope of the project and, based on consideration of the matters set out in section 42(1) of YESAA, identifying the valued environmental and socio-economic components that may be affected by those project activities. Comments submitted during the assessment also assisted the Designated Office in identifying valued components and understanding the potential affects the project activities may have on them. The following valued components are considered in this assessment:

- 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 on the key findings of the assessment.

5.0 AIR QUALITY

5.1 OVERVIEW

The proposed project involves the operation of four diesel generators, with a total generating capacity of 10.5 megawatts, to supplement electricity needs to the WAF/MD transmission grids to meet peak demands, during emergency conditions and for routine maintenance.

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

- decreased ambient air quality due to emissions of air pollutants from the operations of the diesel generators; and
- adverse health effects from exposure to pollutants.

The assessor has determined that the proposed project will not result in significant adverse effects to air quality. The following sections will provide a description of project effects and the rationale used to determine significance of effects of the Faro Generating Station on air quality.

5.2 PROJECT EFFECTS

The following discussion will further consider the effects of the diesel generating station as they relate to ambient air quality and its ensuing effect on human health and safety through effects to air quality.

Consideration of the Air Quality Modelling Assessment

The proponent commissioned SENES Consultants Limited (SENES) to produce a report: *Air Quality Assessment Update in Support of Permit Renewal for Diesel Generator Operations*²². SENES also produced an initial air quality modelling report in support of the permit renewal conducted in 2008²³. The report provided was an air quality modelling assessment based on measured emission factors from a stack sampling program completed in July 2011 at the Whitehorse facility.

The report includes an air emissions inventory as well as modelling of the dispersion of CO, NO₂, SO₂, and fine particulate matter (PM_{2.5}) under three operating scenarios for YEC's diesel facilities.

²² YOR document 2011-0246-005-1

²³ YOR document 2008-0230-002-1

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 could be met by the first few units in the stacking order, 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 extraordinarily 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.

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 Power Benefit Model (PBM) are fed into CALPUFF. CALPUFF then provides a model of how emissions would be dispersed given all of the inputs²⁴.

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 NO₂. Total oxides of nitrogen (NO_x) are comprised of nitric acid (NO) and nitrogen dioxide (NO₂). Typically, the concentration of NO₂ from combustion sources is 5-10% of the NO_x concentration. Transformation of NO to NO₂ continues in the atmosphere due to the rapid reaction with atmospheric

²⁴ YOR document 2011-0246-005-1

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

ozone²⁵. The *Yukon Ambient Air Quality Standards* (Table 5) sets limits on NO₂ 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 NO₂ in the mixture of NO_x released into the air. Here, SENES utilized a method called the “Janssen Method” which was developed from airborne sampling above thermal power generation (boiler) plumes in the Netherlands²⁶. The “Janssen Method” is not one of the recommended means for determining NO₂ emissions in the BC or Alberta air quality modelling guidelines. Using this method assumes that NO₂ levels in the stack begin at 5% of NO_x, whereas the various methods that are recommended in the BC guidelines start with NO₂ levels in the stack at 10%. Thus, using the “Janssen Method” has the potential to under-represent NO₂ emissions by 2 to 4 times²⁷.

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 NO₂ 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 NO₂ in Whitehorse²⁸. 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.”*²⁹.

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 affect water availability for hydroelectric 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 is not truly “background air quality as it still includes contributions from anthropogenic sources, including YEC’s generators.”*³⁰ However, diesel use in Whitehorse during 2001-2005 was significantly lower than present

²⁵ Province of British Columbia, 2008. p. 99

²⁶ YOR document 2011-0246-005-1

²⁷ YOR document 2011-0246-027-1

²⁸ YOR document 2011-0246-004-1

²⁹ YOR document 2011-0246-021-1

³⁰ YOR document 2011-0246-021-1

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

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 NO₂ and PM_{2.5} for the reasons discussed above. As a result, background PM_{2.5} and NO₂ 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.

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. Yukon Government utilized data up to 2008 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 came to the following conclusions when looking at YEC emissions alone for Whitehorse (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 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 “Janssen Method”, NO₂ emissions may have approached or exceeded the Yukon Air Quality Standards for NO₂ along the project boundary³¹.

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 generators³².

³¹ YOR document 2011-0246-027-1

³² YOR document 2011-0246-005-1

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

APPLICATION OF THIS MODELLING TO THE FARO GENERATING STATION

The SENES document notes that the modelling analysis for Whitehorse can be used to determine the likely impacts of the YEC Generating Stations in Faro, Mayo, and Dawson³³. The reasoning provided for this application is that the engine configuration (engine size, exhaust stack height, etc.) in these communities is similar to that in Whitehorse. Also, the proponent states that “...*Whitehorse has the greatest number of units higher in the stacking order (i.e., more energy can be, and is predicted to be, generated in Whitehorse than in the smaller plants in the other communities).*”

The SENES document also states that as there is lower generation in Faro, Mayo, and Dawson and therefore, the contribution to ambient air quality from the YEC diesel plants would be lower than that of Whitehorse. Further, as populations are smaller in these communities, overall emissions from other sources would therefore, also be lower. Based on these assumptions, the report concludes that the likelihood of the *Yukon Ambient Air Quality Standards* (Table 5) being exceeded in the three communities due to YEC operations is lower than in Whitehorse.

Effects on Ambient 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 products³⁴. The composition of the mixture is dependent on fuel composition, the design of the engine, operating conditions, lubricating oil, additives, and the emission control system³⁵.

Diesel exhaust is known to include approximately 40 toxic substances³⁶. 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 (PM₁₀), respirable 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 (O₃), and volatile organic compounds (VOC's).

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 infrastructure³⁷. Adverse health effects can occur from exposure to pollutants released from diesel combustion such as particulate matter, ozone or nitrogen dioxide, include. These adverse effects include effects on pulmonary function, increased allergic airway inflammation reactions, modest transient changes in the respiratory tract, impaired pulmonary function, increased risk of symptoms requiring emergency room or hospital treatment, and increased risk of death from cardiovascular diseases, respiratory diseases, or lung cancer³⁸. The

³³ YOR document 2011-0246-005-1

³⁴ Ullman 1989

³⁵ Obert 1973

³⁶ CAL EPA 2007

³⁷ WHO 2010

³⁸ WHO 2010

Watson Lake Designated Office Evaluation Report

Air Emissions Permit Renewal - Faro – 2011-0246

magnitude of health effects as a result of contaminant exposure depends on the duration and level of exposure to pollutants. High-level and/or prolonged exposure to pollutants pose a greater health risk than one-time or low-level exposures.

As mentioned, in 2010, Environment Yukon adopted the *Yukon Ambient Air Quality Standards* for sulphur dioxide (SO₂), ground level ozone (O₃), total suspended particulate matter (TSP), carbon monoxide (CO), fine particulate matter (PM_{2.5}), and nitrogen dioxide (NO₂) (Table 5). These are in line with Canada-wide minimum standards, although some jurisdictions, including British Columbia, have enacted more stringent requirements for some contaminants. The standards are the maximum concentrations of pollutants acceptable in ambient air throughout the Yukon Territory. They are to be used to determine the acceptability of emissions from proposed and existing developments³⁹. There is currently no mechanism in place to rectify the air quality situation once the standards have been exceeded. The intent is that measures should be taken to avoid exceeding the standards in the first place.

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.”⁴⁰ As such, any circumstances where overall ambient air quality standards are exceeded would be considered a significantly adverse effect on air quality.

Human Health and Safety

YG, Environment indicated that the project has the potential to effect human health due to degraded air quality. As noted previously, 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 2031⁷. While these are national figures, they provide important context to the importance of good air quality on human health.

Threshold levels represent concentration values at which exposure to a substance is likely to adversely affect human health. The results of the modelling that SENES conducted at the Whitehorse Generating Staion indicate that in Scenerio 1 and 2 (scenerios described in this section in *Consideration of the Air Quality Modelling Assessment*) the YEC emissions (excluding background air quality) were within the *Yukon Ambient Air Quality Standards* for all contaminants throughout the year. In Scenerio 3, (worst-case operations), the results show that the YEC emissions would be within the Yukon standards for CO, NO₂, and SO₂ throughout the year. Exceedences of the Yukon standard for PM_{2.5} at the Max POI would only

³⁹ Available online at http://www.env.gov.yk.ca/monitoringenvironment/documents/ambient_air_quality_standards_2010.pdf

⁴⁰ BC Air Quality – Objectives and Standards. Accessed Dec 12 2011. <http://www.bcairquality.ca/regulatory/air-objectives-standards.html>

occur two days of the year, once in March and once in April. As discussed earlier in this section (*Application of this Modelling to the Faro Generating Station*), the release of pollutants from the Faro Generating Station is expected to be considerably less than that released in Whitehorse. Thus it follows that pollutant levels released at the Faro Generating Station will be below the thresholds specified in the applicable guidelines.

Consideration of Emissions related to Total Energy Produced

The Faro Generating Station operates as a back-up system and is only active during unplanned power outages, planned maintenance, or during peak loading times. For the past three full years (2008-2010), the run time has been, respectively, 86, 374, and 163 unit hours; this equates to 0.08, 0.25 and 0.39 GWhrs of energy produced (respectively). This indicates that energy produced at Faro has increased by almost a factor of 5 in the last three years. However, when compared to the energy produced at the Whitehorse station, Faro is still producing significantly less energy. For example, in 2010 Faro produced only 13% of what the Whitehorse station produced (Whitehorse produced 2.92 GWhr) (Table 2).

The results of the SENES report (discussed earlier in this section) indicate that ambient air quality criteria are not exceeded in Whitehorse with current levels of energy production. As Faro has a significantly smaller population than Whitehorse, it is reasonable that levels of background pollutants are similarly smaller. Therefore, it is highly unlikely that ambient air quality levels would surpass thresholds, especially as diesel energy production in Faro is currently substantially less than that in Whitehorse. Also, YEC has noted that Faro has only four generating units (Whitehorse has seven) and therefore, *“it is not physically possible for the Faro facility to produce the same amount of power that leads to the maximum air quality impacts at Whitehorse.”*⁴¹

The nearest sensitive receptors to the Faro facility, which include residences and a school, are approximately 330 m from the facility. This distance is 90 m further than the nearest sensitive receptor (R1 – nearest residence) used in the Air Quality Assessment for Whitehorse. More importantly, the nearest sensitive receptor in Faro is 255 m further than the Whitehorse facility property line. This property line is the location at which the CALPUFF model predicted the highest concentrations of contaminants generated from YEC emissions. Therefore, based on the greater distance between the Faro generators and the nearest sensitive receptors, it is unlikely that the generating units would cause significant adverse effects to air quality.

5.3 COMMITMENTS AND MITIGATIONS FROM THE PROPONENT

The following are key commitments and mitigations the proponent has indicated in the project proposal⁴² that have been considered when determining the significance of project effects on health and safety.

- Generators are operated and maintained regularly as per manufacturer’s specifications to provide a reliable and efficient source of electricity.

⁴¹ YOR document 2011-0246-007-1

⁴² YOR document 2011-0246-004-1

- Ultra low sulphur fuel will be used (0.0015% sulphur content by weight).

5.4 NON-DISCRETIONARY LEGISLATION

The assessor has considered the requirements of:

- Occupational Health Regulations which stipulate exposure limits for air contaminants, usually based on an 8 hr permissible exposure limit;
- *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; and
- *Canadian Environmental Protection Act*, 1999 which speaks to the reporting requirements of the National Pollutant Release Inventory (NPRI).

5.5 SIGNIFICANCE DETERMINATION

The assessor has considered the information in section 5.2, including the local setting, characteristics of the Faro Diesel Generating Station, the modeled Whitehorse facility, and the commitments from the proponent (section 5.3) and the nondiscretionary legislation (section 5.4). The assessor has also considered the additional terms and conditions that YG, Environment intends to include in the Air Emissions Permit renewal. These terms and conditions are found within the comment submissions by YG, Environment on the YECL projects⁴³. It is the assessors understanding that these terms and conditions will be incorporated into all of the renewed air emission permits related to diesel generators.

In the case of the Faro Generating Station, duration of exposure to pollutants is short term in nature, occurring in erratic and unpredictable spurts. As the generators at the Faro Generating Station are operated as a back-up system, the total hours of operation of the generators vary and cannot be predicted. However, it is assumed that the facility will continue to operate infrequently on an as-needed

⁴³ YOR documents 2011-0249-024-1, 2011-0250-022-1, 2011-0251-022-1, 2011-0252-025-1, 2011-0253-22-1, and 2011-254-029-1

basis and therefore, duration of exposure to contaminants released by the generating station will be low, reducing the likelihood that the project will adversely affect the health of Faro residents.

The assessor is satisfied that implementation of the commitments from the proponent, and application of the non-discretionary legislation and YG, Environment's additional terms and conditions will satisfactorily eliminate, reduce, or control the significant adverse effects of the project on the valued component.

5.6 RECOMMENDED MITIGATIONS

No additional mitigation is required.

5.7 RESIDUAL EFFECTS

The proposed project may have residual effects on air quality. Residual effects are considered to include the release of air pollutants into the atmospheric environment.

However, the residual effects due to project activities are considered minimal for the following reasons:

- operating hours at the station are low; and
- the release of sulphur and air pollutants is considered to be reduced with the implementation of the proponent's commitments and mitigations.

The diesel generating station may result in residual effects to health and safety related to the release of pollutants from the combustion of diesel fuel. The assessor is satisfied that with compliance with legislation as well as the key mitigations that the proponent has committed to (see Appendix A), the project will not result in significant adverse residual effects to health and safety through effects to air quality.

5.8 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 all 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 health and safety has been considered within the community of Faro for the duration of the renewed Air Emission Permit (3 years).

The proposed project occurs within the community of Faro which has a population of approximately 388 people. There were no significant point sources identified for Faro other than the YEC plant. YEC diesel

operations contribute approximately 0.4%, 16% and 2% of the total community emissions of PM_{2.5}, NO_x, and CO₂, respectively⁴⁴.

The solid waste facility is approximately 1 km to the north, and the diesel station is located away from the town centre. Existing activities include vehicular traffic along the Robert Campbell Highway and the Faro Road, use of aircraft, home heating, and commercial activities.

Residual Effects Interaction and Significance Determination

Surrounding activities as noted above may have residual effects on air quality related to release of hydrocarbon contaminants into the environment. No information on ambient air quality of the Faro area is available, and therefore background concentrations of pollutants are unknown.

The assessor has determined that the project will not result in residual effects. 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.

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 rationale used to determine the effects and significance of the Faro Diesel Generating Station on this valued component.

6.2 PROJECT EFFECTS

Waste Management

Operation of the Faro Diesel Generating Station will result in the generation of special waste such as waste solvents, waste oil, waste coolants, and used absorbents. 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

⁴⁴ YOR Document #2011-0246-004-1

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.

6.3 COMMITMENTS AND MITIGATIONS FROM THE PROPONENT

The following are key commitments and mitigations the proponent has indicated in the project proposal that have been considered when determining the significance of project effects on environmental quality.

- Pursuant to the requirements of Part 7 of the *Environment Act* and the Special Waste Regulations, storage and handling of these materials follows Corporation's Special Waste Permit and industry best practice. All wastes are disposed of annually, or more often, through permitted commercial recycling, reuse, and/or disposal contractors, such as the Yukon Government Special Waste Collection and Disposal Program, permitted waste oil collectors, and approved waste disposal facilities in each community.⁴⁵

6.4 NON-DISCRETIONARY LEGISLATION

The assessor has considered the requirements of:

- *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, specifically for off-road applications.

6.5 SIGNIFICANCE DETERMINATION

The assessor has considered the information in section 6.2, the commitment from the proponent (section 6.3), and the non-discretionary legislation (section 6.4). The assessor is satisfied that the application of the commitment from the proponent and the non-discretionary legislation will satisfactorily eliminate, reduce, or control significant adverse effects to environmental quality due to waste.

6.6 PROPOSED MITIGATIONS

No further mitigation is required.

⁴⁵ YOR Document #2011-0246-004-1

6.7 RESIDUAL EFFECTS

The proposed project may have residual effects on environmental quality. Residual effects are considered limited to the release of contaminants into the environment.

The residual effects due to project activities are considered minimal. The release of special wastes or contaminants is considered to be reduced with the implementation of the proponent's commitment and mitigation and compliance with non-discretionary legislation. The assessor is satisfied that the project will not result in significant adverse residual effects to environmental quality.

6.8 CUMULATIVE EFFECTS

The potential for cumulative effects on environmental quality has been considered within the community of Faro and for the duration of the renewed Air Emission Permit (3 years).

The proposed project occurs within the community of Faro which has a population of approximately 388 people. The solid waste facility is approximately 1 km to the north, and the diesel station is located away from the town centre. Existing activities include vehicular traffic along the Robert Campbell Highway and the Faro Road, the airport, home heating, and commercial activities.

Residual Effects Interaction and Significance Determination

Surrounding activities, including the handling and storage of petroleum products for vehicles and home furnaces, and waste management, may have residual effects on environmental quality related to the release of hydrocarbon contaminants into the environment. Under existing legislation, any fuel or contaminant spill must be remediated to a level that meets the applicable territorial and federal standards and guidelines for contaminated areas.

The assessor has determined that the project will not result in residual effects. 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.

7.0 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, as the project will not have significant adverse environmental or socio-economic effects in or outside Yukon.

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 project proposal (YOR document 2011-0249-002-1). 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.

- Generators being operated and maintained regularly as per manufacturer's specifications to provide a reliable and efficient source of electricity.
- Visual opacity limits and monitoring.
- Use of ultra-low sulphur fuel only.
- Pursuant to the requirements of Part 7 of the Environment Act and the Special Waste Regulations, storage and handling of these materials follows Corporation's Special Waste Permit and industry best practice. All wastes are disposed of annually, or more often, through permitted commercial recycling, reuse, and/or disposal contractors, such as the Yukon Government Special Waste Collection and Disposal Program, permitted waste oil collectors, and approved waste disposal facilities in each community.

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)
<u>Occupational Health Regulations</u>	
<u>Air Emissions Regulations</u>	Section 3, 4 & 6
<i>Canadian Environmental Protection Act</i>	
<i>Environment Act</i>	
<u>Special Waste Regulations</u>	
<i>Public Utilities Act</i>	Section 106
<u>Sulphur in Diesel Fuel Regulations</u>	

**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
YG, Environment	Comment	2011-0246-021-1	Dec. 2, 2011
YG, Community Services	Comment	2011-0246-021-1	Dec. 2, 2011

Appendix D REFERENCES

- Cal EPA (California Environmental Protection Agency). (2007) *The Health Effects of Diesel Exhaust: A fact sheet from California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) and the American Lung Association*. Retrieved from http://oehha.ca.gov/public_info/facts/pdf/diesel4-02.pdf, on December 10, 2011.
- FISS (2011). Fisheries Information and Summary System (FISS) Database Search Engine. Retrieved from <http://habitat.rhq.pac.dfo-mpo.gc.ca/fiss/dcf01.cfm>, on October 26, 2011.
- Obert EF. (1973) *Internal Combustion Engines and Air Pollution*, 3rd ed. New York: Harper and Row.
- Smith, C.A.S., J.C. Meikle, and C.F. Roots (2004). *Ecoregions of the Yukon Territory, Biophysical Properties of Yukon Landscapes*. Summerland, British Columbia.
- Statistics Canada. (2007). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. Retrieved from <http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/search-recherche/lst/page.cfm?Lang=E&GeoCode=60>, on November 30, 2011.
- Ullman TL. (1989) *Investigation of the Effects of Fuel Composition on Heavy Duty Diesel Engine Emissions*. SAE Technical Paper No. 892072. Society of Automotive Engineers.
- WHO (World Health Organization). (2010) Exposure to Air Pollution: A major Public Health Concern. Retrieved from http://www.who.int/ipcs/features/air_pollution.pdf, on December 5, 2011.
- Yukon Bureau of Statistics. (2011) Population Report June 2011. Retrieved from http://www.eco.gov.yk.ca/stats/pdf/populationjun_2011.pdf, on November 30, 2011.
- Yukon Environmental and Socio-economic Assessment Board (2009). [Interactive maps of biophysical and socio-economic geographic data, May 29, 2009]. Geo-Locator Report for Project Location, Geo-Locator. Retrieved from <http://maps.gov.yk.ca/imf.jsp?site=yesab>, on November 22, 2011.
- Yukon Environment. (2010) Yukon Ambient Air Quality Standards. Retrieved from http://www.env.gov.yk.ca/monitoringenvironment/documents/ambient_air_quality_standards_2010.pdf, on December 7, 2011.

Jan 09, 2012

YOR Ref. No.: 2011-0246-032-1

Decision Document

YESAB Project Number: 2011-0246

Project Title: Air Emissions Permit Renewal - Faro

To correct previous Decision Document which had incorrect proponent name

Yukon Environmental & Socioeconomic Assessment Act **Decision Document**

This document meets the requirements of a Decision Document as set out in the *Yukon Environmental & Socioeconomic Assessment Act*.

Decision Document Issued By

YG Decision Body:	Department of Environment
Other Decision Body:	N/A
First Nation Decision Body(ies):	N/A

Project

Project Name : YEC Air Emissions Permit Renewal 2011 – Faro	YESAA File Number: 2011-0246
Proponent Name:	Yukon Energy Corporation
Project Scope: Yukon Energy Corporation (YEC), is applying for the renewal of their Air Emissions Permit to continue operating its existing diesel-fired electricity generating station in the community of Faro. The generator serves as a secondary energy supply to supplement the transmission grid and as an emergency back-up power source.	

Other Decision Bodies

Other Decision Body Consultation:	N/A
Consolidated Decision Document:	☐ N/A ☒ No ☐ Yes

Decision

Pursuant to YESAA s. 75, 76 and 80, the decision body has considered the YESAA assessment of this project and:	
x	a) Accept the following recommendation (inserted below): The Watson Lake Designated Office, pursuant to section 56(1)(a) of the <i>Yukon Environmental and Socio-economic Assessment Act</i> (YESAA), recommends to the decision bodies that the project be allowed to proceed, as it has determined that the project will not have significant adverse environmental or socio-economic effects in or outside Yukon.
	b) Rejects the following recommendation (inserted below) for the following reason(s):
	c) Vary the recommendations (inserted below) as follows for the reason(s) specified:

Dates

Project Recommendation Issued: December 30, 2011	Decision Document Issued: January 3, 2012
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Recommendation Received From

YESAA Decision Document – Yukon Government

Designated Office	X	Location: Watson Lake
Executive Committee		
Panel		a) Panel of the YESAB
		b) CEAA Panel
		c) Joint Panel (YESAB and other assessment body)

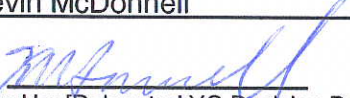
Authority

By signing below, the Decision Bodies have exercised their authority as per YESAA s. 75 or s. 76 to issue a decision document on this project.

Yukon Government

Name: Kevin McDonnell

Position: Director, Environmental Programs Branch

Signature: 

Date: January 9, 2012

Original signed by [Delegated YG Decision Body]

Copies Forwarded to (as required by YESAA s. 81)):

☐ Other Decision Bodies

☒ Project Proponent

Yukon Energy Corporation

☒ Development Assessment Branch

Executive Council Office

☒ YESAB Designated Office

Watson Lake

☐ YESAB Executive Committee

[when applicable] _____

☐ Minister Environment (Canada)

[when applicable] _____