



February 27, 2006

VIA E-MAIL

Doug.dowell@edmonton.ca

The City of Edmonton
Materials Management
Room 800, Chancery Hall
3 Sir Winston Churchill Square
Edmonton, Alberta T5J 2C3

Attention: Mr. Doug Dowell
Project Manager

Re: Worker Exposure Assessment Report – Diesel Components & Silica
Westwood Transit Garage
PHH ARC Project: 6053CY

Enclosed is 1 electronic copy of the report for the above mentioned project. Hard copies of the report will follow by mail. If you have any questions, please contact me at 425-6600 ext. 285

Sincerely,

PHH ARC Environmental Ltd.

Per:

Chris Taylor, EET
Project Manager

Worker Exposure Assessment The City of Edmonton Westwood Transit Garage

Prepared for:
The City of Edmonton
Materials Management
Room 800, Chancery Hall
3 Sir Winston Churchill Square
Edmonton, Alberta T5J 2C3

Attention: Mr. Doug Dowell, Project Manager

Prepared by:
PHH ARC Environmental Ltd.
Suite 200 – 9707 110 Street
Edmonton, Alberta T5K 2L9

Toll Free: 1-877-322-4744

March 1, 2006

PHH ARC Project: 6053CY

Executive Summary

PHH ARC Environmental Ltd. (PHH ARC) was retained by The City of Edmonton to conduct an assessment of worker exposure to diesel exhaust components and silica in the Westwood Transit Garage, located in Edmonton, Alberta. The assessment was performed between February 12th & 14th, 2006 by Chris Taylor, Project Manager.

This assessment was conducted due to concerns brought forth by workers and management, but primarily for due diligence purposes. The survey roughly follows a similar sampling protocol conducted in 2002 and 2004.

PHH ARC concludes and recommends:

1. Levels of coal tar pitch volatiles were all below their applicable criteria, although levels consistently exceeded 50% of the criteria and the area sample taken during the morning peak period approached the excursion limit criteria.
2. Levels of diesel particulate were all below the guideline criteria, although the area samples exceeded 50% of the guideline criteria.
3. Levels of silica were all well below the applicable criteria.
4. Levels of carbon monoxide were all well below the applicable criteria.
5. Levels of nitrogen dioxide were all below the applicable criteria, although levels at one location exceeded 50% of the 15 minute criteria during the morning rush period and one location exceeded 50% of the 15 minute criteria during the afternoon rush period.
6. Based on these results PHH ARC recommends ensuring that workers out in the main barn area wear appropriate respiratory protection during the morning rush hour period and that the city investigate options in improving ventilation (either capture or dilution) during the morning and afternoon rush periods.
7. PHH ARC also recommends informing all appropriate workers of the results of this survey as per Alberta regulatory requirements.

Table of Contents

1.0	INTRODUCTION	1
1.1	Study Rationale.....	1
1.2	Scope of Work	1
2.0	METHODOLOGY AND FINDINGS	1
2.1	Interviews.....	1
2.2	Worker Activities	1
2.3	Analytical Results	2
2.3.1	Coal Tar Pitch Volatiles	2
2.3.2	Diesel Particulate	3
2.3.3	Silica.....	4
2.3.4	Carbon Monoxide and Nitrogen Dioxide.....	4
2.3.5	Exposure to Multiple Compounds	5
3.0	CONCLUSIONS & RECOMMENDATIONS	5
4.0	LIMITATIONS	7

Appendices

Appendix I	Methodology
Appendix II	Analytical Results
Appendix III	Legislation & Standards
Appendix IV	Photographs (PHOTOS NOT AVAILABLE)
Appendix V	Drawings

1.0 INTRODUCTION

PHH ARC Environmental Ltd. (PHH ARC) was retained by The City of Edmonton to conduct an assessment of worker exposure to diesel exhaust components and silica in the Westwood Transit Garage, located in Edmonton, Alberta. The assessment was performed between February 12th & 14th, 2006 by Chris Taylor, Project Manager.

The Westwood Garage is located at 11840 - 106A Street, Edmonton and is the central hub for Edmonton Transit busses. Unlike other Edmonton Transit garages, busses are re-fuelled at the entrance to the garage as opposed to inside the garage and most cleaning of busses is done where the busses are parked, as opposed to a central location.

1.1 Study Rationale

This assessment was conducted due to concerns brought forth by workers and management, but primarily for due diligence purposes. The survey roughly follows a similar sampling protocol conducted in 2002 and 2004.

1.2 Scope of Work

This assessment involved the following activities:

- Sampling for coal tar pitch volatiles, diesel particulate, carbon monoxide, nitrogen dioxide (as components of diesel exhaust) and silica on selected workers and locations;
- Analysis for all samples;
- Provision of this report detailing results, as well as comparisons to applicable standards and guidelines.

2.0 METHODOLOGY AND FINDINGS

2.1 Interviews

Site information was collected by through informal discussion with onsite supervisors and workers, as well as through information gained from historical sampling.

An initial meeting with the overnight shift foreman and Mr. Doug Dowell was conducted prior to arrival where the sampling strategy was discussed.

2.2 Worker Activities

Worker activities were observed during the assessment. Table 1 on the following page summarizes the findings.

Table 1: Observations of Worker Activities

Job Function (Job title)	Job Activities	Frequency and duration of tasks	Observed use of controls and PPE	General Observations
Cleaner	Work throughout the garage moving from bus to bus sweeping the bus out of all dust and debris. Other types of cleaning observed during the survey included wet-wiping the interior of the bus, external washers hosing down busses and those whose activities also involved emptying garage trash or running the interior floor sweeper.	Continuous throughout shift	Some workers wear ½ mask respirators with combo P-100 /acid gas/OV cartridge respirators, some wear N-95 style disposable respirators. No worker was observed wearing PPE throughout shift.	Workers on days of survey indicated that work load was higher than usual and air quality perception was that air quality was roughly average.
Booker	Coordination & distribution of incoming busses to appropriate parking locations, typically from “Booker Shack”.	Continuous throughout shift	Booker shack is semi-enclosed with dedicated supply ventilation.	Worker on day of survey indicated that work load was average and air quality perception was average.
Dispatcher	Collect and deposit money boxes from incoming busses into the collection system, primarily from west end of booker shack.	Roughly 2/5 to 2/3 of shift out at station, remainder in office area.	Station has dedicated blow down ventilation, but is open to area; ventilation most likely re-entraining contaminants.	Worker on day of survey indicated that work load was average and air quality perception was average.

2.3 Analytical Results

The methodology employed for this assessment is detailed in Appendix I. Detailed results can be found in Appendix II. A summary of results by compound are presented on the following pages.

2.3.1 Coal Tar Pitch Volatiles

Worker exposures to coal tar pitch volatiles were all below the maximum criteria except for the area sample taken in Area 2 which would be above the 8 hour criteria, but below the excursion limit criteria (which, based on a 2 hour sample, would be more

appropriate). However all samples were above 50% of the criteria, often called the “action limit”. Please refer to Table 3 below for a summary of the sampling results. Please see Figure 1 in Appendix V for area sample locations.

Table 3: Summary of Coal Tar Pitch Volatiles Sampling Results

Sample #	Name and Title or Area	Shift Length (hours)	Sample Result (mg/m ³)	Exposure Limits (mg/m ³)
C-1	Booker – Robert K	8	0.11	8 hr. = 0.2 30 min.* = 0.6
C-2	Service Person – Michael N.	8	0.14	
C-3	Area 1 (Track 30)	8	0.10	
C-4	Area 2 (Track 11)	8	0.58	
C-5	Cleaner – Hugh M.	8	0.15	
C-6	Dispatcher (Area)	8	<0.04	

Note: < = less than the limit of detection for the methodology used

*as no 15 minute and ceiling limit is stated for coal tar pitch volatiles, the use of an “excursion limit” is required under the code

2.3.2 Diesel Particulate

Worker exposures to diesel particulate were all below the guideline criteria. However, the two area samples were above 50% of the criteria, often called the “action limit” with the sample taken on Jen E. just slightly below the action limit. Please refer to Table 4 below for a summary of the sampling results and Figure 1 in Appendix V for area sample locations.

Table 4: Summary of Diesel Particulate Sampling Results

Sample #	Name and Title or Area	Shift Length (hours)	Sample Result (mg/m ³)	8-hour Exposure Limit Guideline (mg/m ³)
D-1	Service Person – Jen E.	8	0.009	0.02
D-2	Area 1 (Track 30)	8	0.015	
D-3	Area 2 (Track 11)	8	0.019	
D-4	Cleaner – Lotte L.	8	0.001	

2.3.3 Silica

Worker exposures to silica were all well below the criteria. Please refer to Table 5 below for a summary of the sampling results.

Table 5: Summary of Silica Sampling Results

Sample #	Name and Title or Area	Shift Length (hours)	Sample Result (mg/m ³)	8-hour Exposure Limit (mg/m ³)
S-1	Cleaner – Vittorio C.	8	<0.01	0.1
S-2	Cleaner – Lyan T.	8	<0.01	
S-3	Cleaner – Guyle H.	8	<0.01	
S-4	Cleaner – Marlen M.	8	0.03	

Note: < = less than the limit of detection for the methodology used

2.3.4 Carbon Monoxide and Nitrogen Dioxide

Worker exposures to carbon monoxide and nitrogen dioxide were all below the criteria. However the 15 minute exposure limit of 5 ppm for nitrogen dioxide had levels exceed 50% of the criteria during a 15 minute period at Area 2 around 14:30 on February 13 and at Area 3 around 07:30 on February 13. Please refer to Tables 6 & 7 below and on the following page for a summary of the sampling results and Figure 1 in Appendix V for designated sample locations.

Table 6: Summary of Carbon Monoxide Sampling Results

Sample #	Area	Maximum Result (ppm)	Average Result (ppm)	Exposure Limits (ppm)
260	Area 1	3.0	0.02	8 hr. = 25 30 min.* = 75
261	Area 2	9.0	0.46	
262	Area 3	3.8	0.06	
263	Area 4	4.3	0.21	

*as no 15 minute and ceiling limit is stated for carbon monoxide, the use of an “excursion limit” is required under the code

Table 7: Summary of Nitrogen Dioxide Sampling Results

Sample #	Area	Maximum Result (ppm)	Average Result (ppm)	Exposure Limits (ppm)
260	Area 1	2.3	0.08	8 hr. = 3 15 min. = 5
261	Area 2	3.1	0.16	
262	Area 3	3.0	0.35	
263	Area 4	1.0	0.07	

2.3.5 Exposure to Multiple Compounds

While exposure to diesel exhaust does involve exposure to a mixture of compounds, the effect on the body that these compounds have are different for each compound. Based on a review of the compound target organs as per the Alberta Code there is no mixture calculation necessary.

3.0 CONCLUSIONS & RECOMMENDATIONS

1. Levels of coal tar pitch volatiles were all below their applicable criteria, although levels consistently exceeded 50% of the criteria and the area sample taken during the morning peak period approached the excursion limit criteria.
2. Levels of diesel particulate were all below the guideline criteria, although the area samples exceeded 50% of the guideline criteria.
3. Levels of silica were all well below the applicable criteria.
4. Levels of carbon monoxide were all well below the applicable criteria.
5. Levels of nitrogen dioxide were all below the applicable criteria, although levels at one location exceeded 50% of the 15 minute criteria during the morning rush period and one location exceeded 50% of the 15 minute criteria during the afternoon rush period.
6. Based on these results PHH ARC recommends ensuring that workers out in the main barn area wear appropriate respiratory protection during the morning rush hour period and that the city investigate options in improving ventilation (either capture or dilution) during the morning and afternoon rush periods.

7. PHH ARC also recommends informing all appropriate workers of the results of this survey as per Alberta regulatory requirements.

4.0 LIMITATIONS

The work performed by PHH ARC Environmental Ltd. was conducted in accordance with generally accepted industrial hygiene, engineering, or scientific practices current in this geographical area at the time the work was performed. No warranty is either expressed or implied by furnishing written reports or findings. The Client acknowledges that subsurface and concealed conditions may vary from those encountered or inspected. PHH ARC Environmental Ltd. can only comment on the environmental conditions observed on the date(s) the assessment is performed. The work is limited to those areas of concern identified by the Client or outlined in our proposal. Other areas of concern may exist but were not investigated within the scope of this assignment.

Samples that were collected and found to be other than non-hazardous waste may be returned to the Client at the sole discretion of PHH ARC Environmental Ltd.

PHH ARC Environmental Ltd. makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. PHH ARC Environmental Ltd. accepts no responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The liability of PHH ARC Environmental Ltd. or its staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. PHH ARC Environmental Ltd. will not be responsible for any consequential or indirect damages. PHH ARC Environmental Ltd. is only liable for damages resulting from negligence of PHH ARC Environmental Ltd. All claims by the Client shall be deemed relinquished if not made within two years after last date of services provided. Information provided by PHH ARC Environmental Ltd. is intended for Client use only. PHH ARC Environmental Ltd. will not provide results or information to any party unless disclosure by PHH ARC Environmental Ltd. is required by law. Any use by a third party of reports or documents authored by PHH ARC Environmental Ltd. or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. PHH ARC Environmental Ltd. accepts no responsibility for damages suffered by any third party.

Authored by:

PHH ARC Environmental Ltd.

Per:

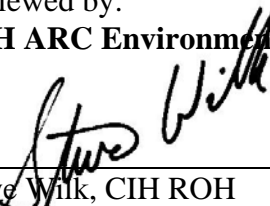


Chris Taylor, EET
Project Manager

Reviewed by:

PHH ARC Environmental Ltd.

Per:



Steve Wilk, CIH ROH
Vice President

APPENDIX I

METHODOLOGY

METHODOLOGY

Parameter	Methodology	Duration & Flow Rate	Laboratory
Coal Tar Pitch Volatiles	NIOSH 5042	~ 2 or 8 hours @ 2.0 or 2.5 L/min	Envirotest Laboratories Edmonton, Alberta
Diesel Particulate	NIOSH 5040	~2 or 8 hours @ 2.0 or 2.5 L/min	CanMet Laboratories Sudbury, Ontario
Silica	NIOSH 7602	~8 hours @ 2.5 L/min	Envirotest Laboratories Edmonton, Alberta
Carbon Monoxide	Q-RAE 4 gas monitor, direct reading, datalogging	Full survey period, 5 minute averaging.	NA
Nitrogen Dioxide	Q-RAE 4 gas monitor, direct reading, datalogging	Full survey period, 5 minute averaging.	NA

APPENDIX II

ANALYTICAL RESULTS

**Coal Tar Pitch Volatile Results
Westwood Transit Garage**

Sample #	Worker/Area	Elapsed Time	Volume (L)	Result (ug)	Conc. (mg/m³)
C-1	Booker – Robert K	470	940	100	0.11
C-2	Service Person – Michael N.	488	829.5	120	0.14
C-3	Area 1 (Track 30)	465	930	90	0.10
C-4	Area 2 (Track 11)	120	240	140	0.58
C-5	Cleaner – Hugh M.	480	960	140	0.15
C-6	Dispatcher (Area)	580	1160	<50	<0.04

< - less than the method detection limit

**Diesel Particulate (Elemental Carbon) Results
Westwood Transit Garage**

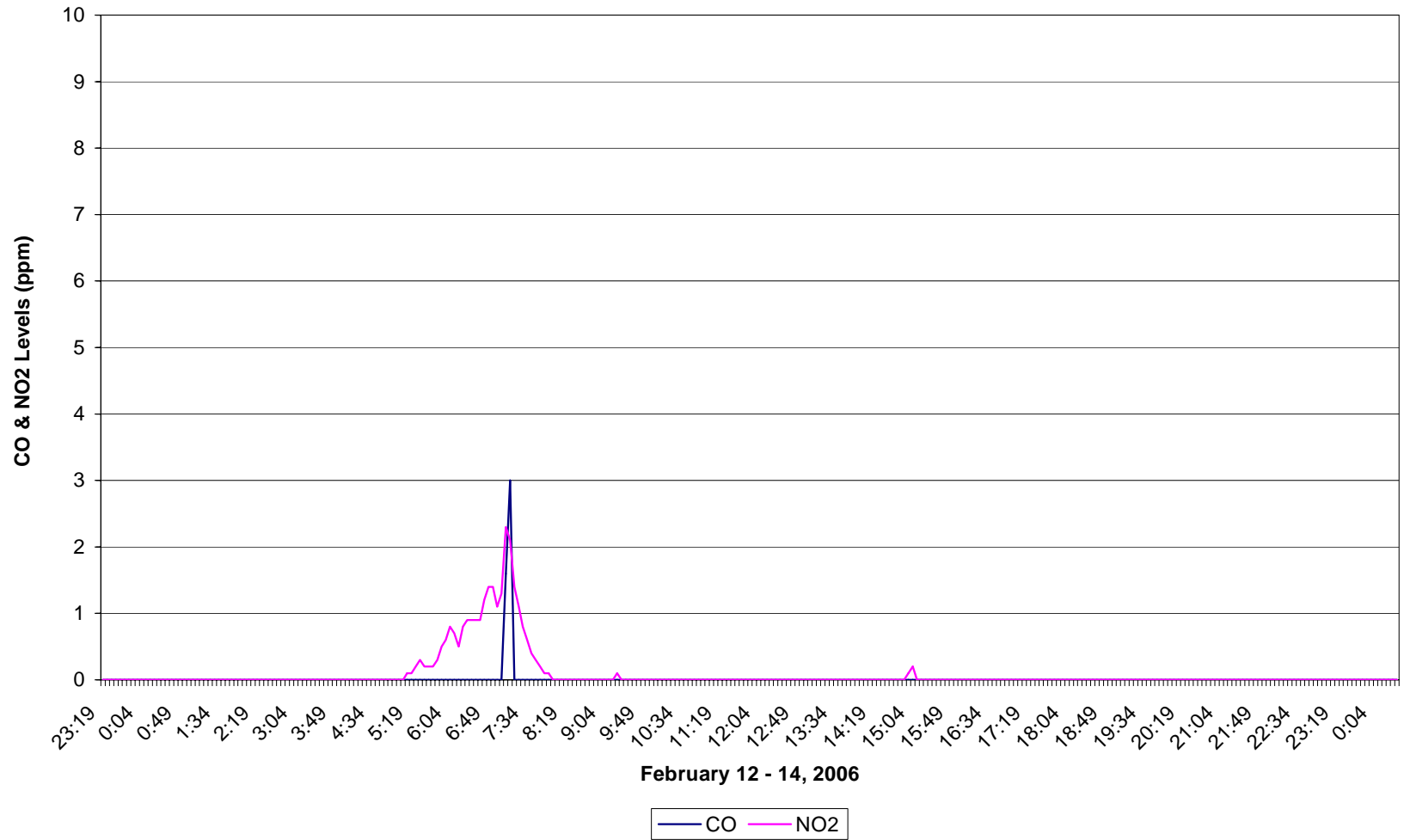
Sample #	Area	Elapsed Time	Volume (L)	Result (ug)	Conc. (mg/m³)
D-1	Service Person – Jen E.	448	934	8.6	0.009
D-2	Area 1 (Track 30)	465	930	13.5	0.015
D-3	Area 2 (Track 11)	120	240	4.5	0.019
D-4	Cleaner – Lotte L.	480	960	1.2	0.001

**Silica Results
Westwood Transit Garage**

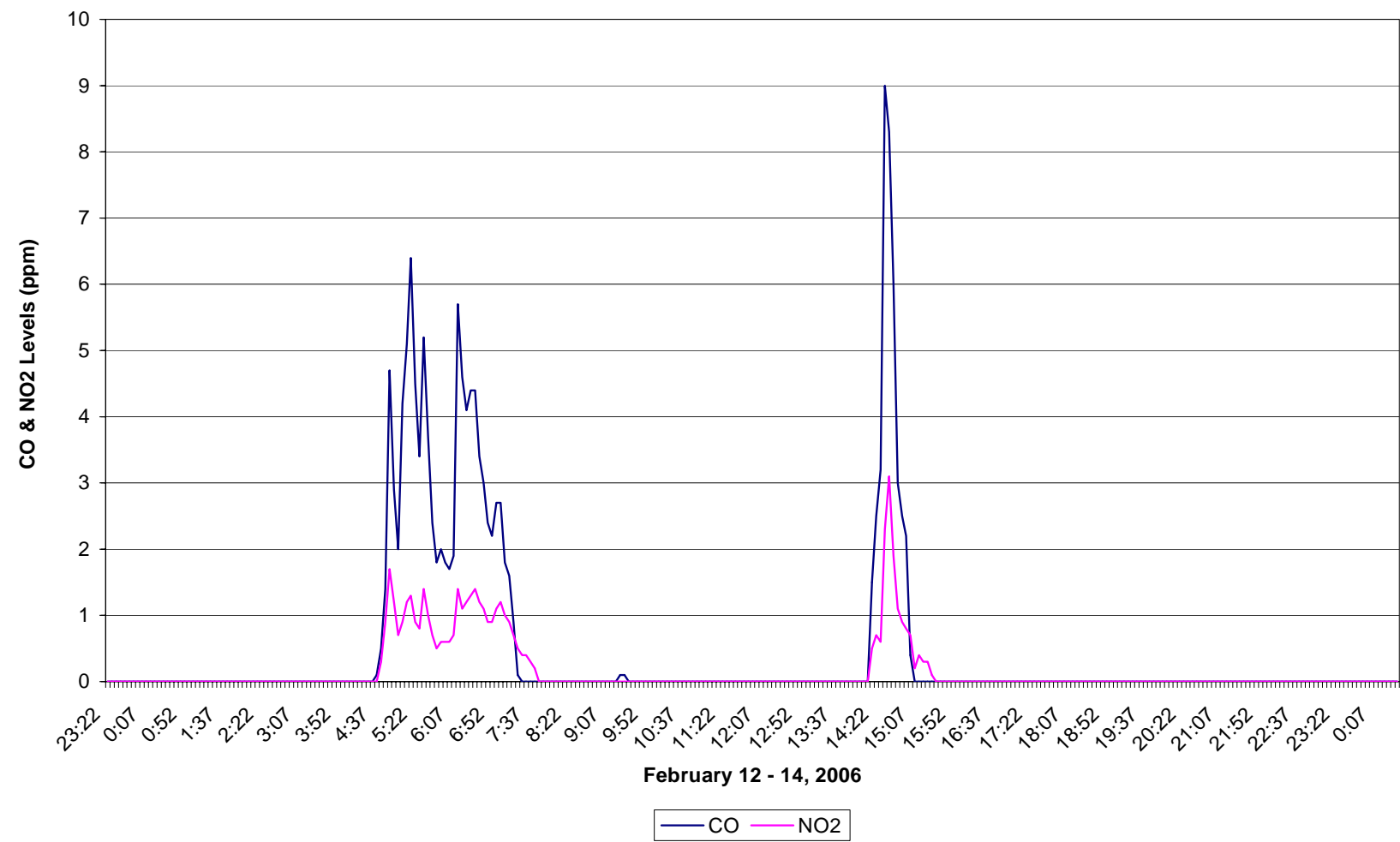
Sample #	Area	Elapsed Time	Volume (L)	Result (ug)	Conc. (mg/m³)
S-1	Cleaner – Vittorio C.	480	1200	<10	<0.008
S-2	Cleaner – Lyan T.	434	1085	<10	<0.009
S-3	Cleaner – Guyle H.	430	1075	<10	<0.009
S-4	Cleaner – Marlen M.	435	1087.5	30	0.028
S-5	Blank	-	-	<10	-

< - less than the method detection limit

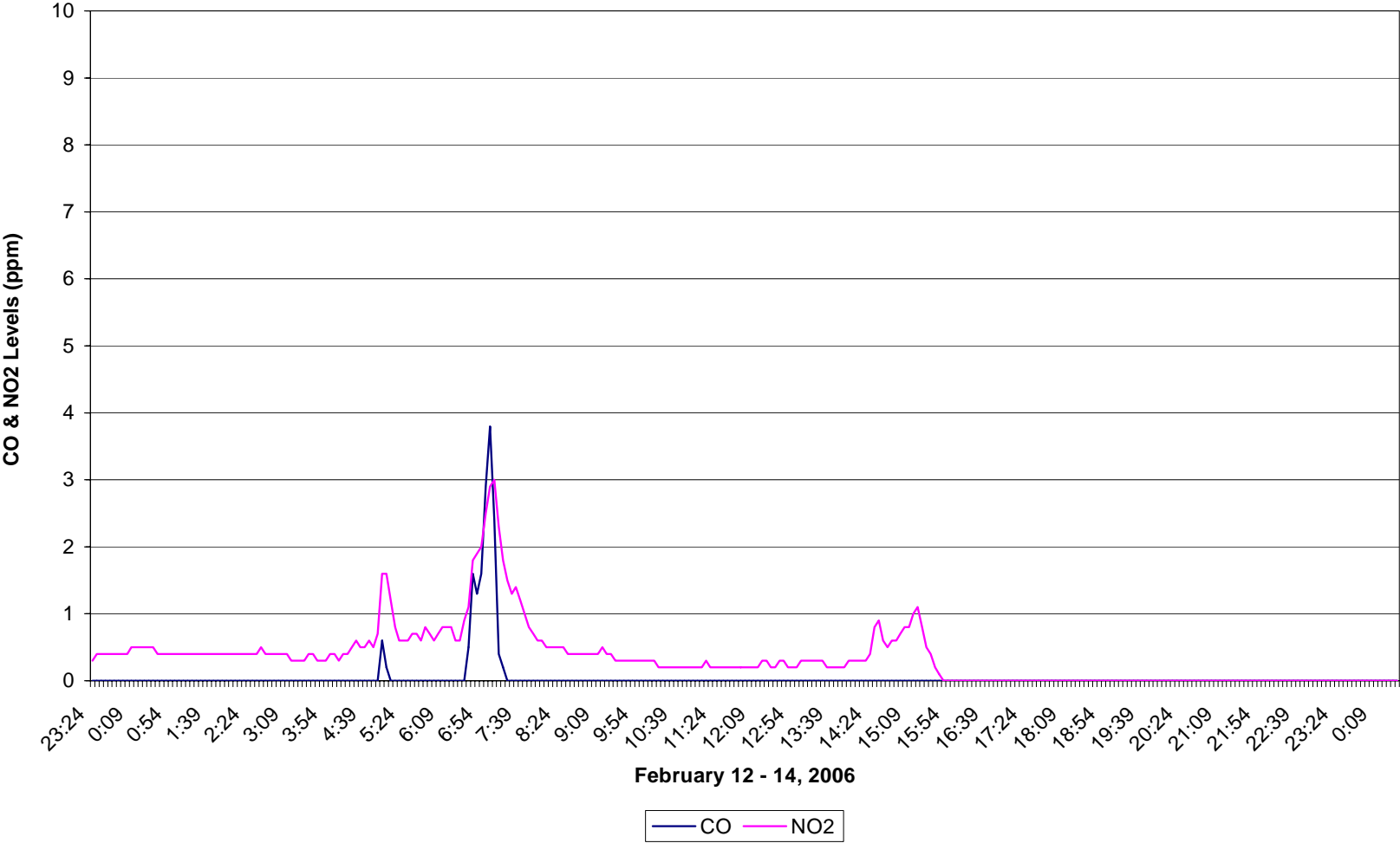
CO & NO2 Levels - Location 1



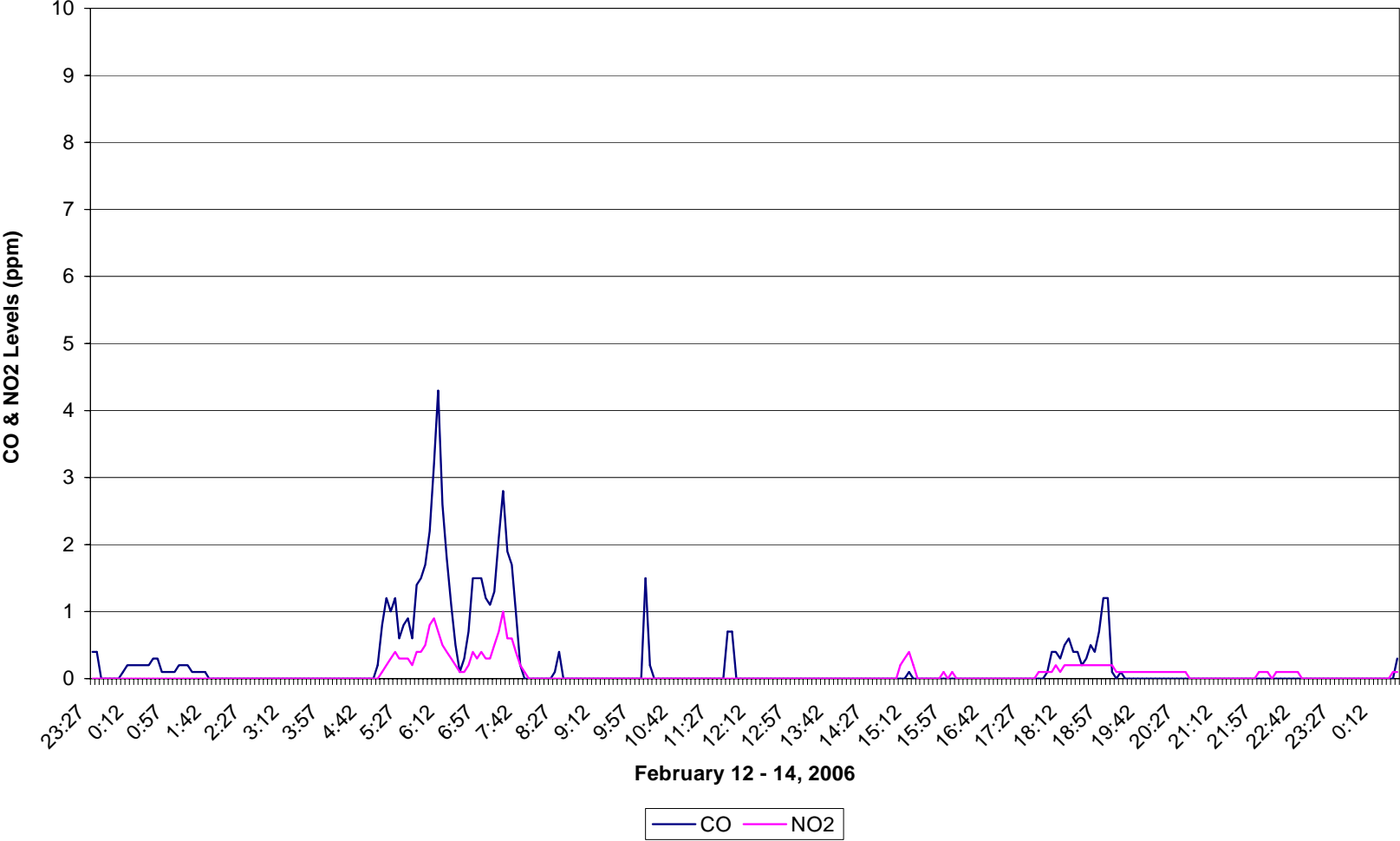
CO & NO2 Levels - Location 2



CO & NO2 Levels - Location 3



CO & NO2 Levels - Location 4



APPENDIX III

LEGISLATION

LEGISLATION

ALBERTA

The *Occupational Health and Safety Code* October 2003 (OHS Code) provides detailed technical requirements that support the *Occupational Health and Safety Act* December 2002 (OHS Act) and *Occupational Health and Safety Regulation* March 2003 (OHS Regulation).

Part 4 Chemical Hazards, Biological Hazards and Harmful Substances of the OHS Code require employers to assess worker's exposure to harmful substances and follow set monitoring requirements for the assessment.

The employer must ensure that worker exposure to any substance listed in Schedule 1, Table 2 is kept as low as reasonably practicable and does not exceed the substance's Occupational Exposure Limit (OEL).

These limits refer to airborne concentrations of substances and represent conditions under which workers can be exposed day after day without adverse health effects. They are maximum allowed concentrations that are not intended to define fine lines between safe and dangerous concentrations. The 8-hour OEL is the legal maximum allowable exposure for any 8-hour work period. However, due to differences in individual susceptibility, a small number of workers may experience discomfort from some substances at concentrations at or below the OEL. Others may be more seriously affected by aggravation of a pre-existing condition, or by development of an occupational illness. Other individuals may be hyper-responsive to some industrial chemicals due to genetic factors, age, personal habits (i.e. smoking, drugs etc.), medication or previous exposures.

Short term excursion limits (15-minute or Ceiling) are concentrations of a substance to which it is believed that most workers may be exposed for a short period of time without suffering from adverse health effects such as irritation and chronic or irreversible tissue damage. The worker also should not be physically impaired to such a degree that could cause accidental injury, impair self-rescue or decrease work efficiency. It is not a separate exposure limit. These limits are meant to supplement the 8-hour OEL.

Table I: Relevant Occupational Exposure Limits

Substance	Occupational Exposure Limits	Occupational Exposure Limits	Occupational Exposure Limits	Substance Interaction
	8-hour	15-minute	Ceiling	1,2,3
Carbon Monoxide	25 ppm	-	-	-
Coal Tar Pitch Volatiles	0.2 mg/m ³	-	-	-
Diesel Particulate	0.02 mg/m ³ *	-	-	-
Nitrogen Dioxide	3 ppm	5 ppm	-	-
Silica (respirable, quartz)	0.1 mg/m ³	-	-	-

Note: Numerous substances listed in Table 2 Schedule 1 appear with the numbers 1, 2 and 3 in the column entitled "Substance Interaction". The meanings of each number are as follows:

- 1- substance may be readily absorbed through intact skin
- 2- substance is a simple asphyxiant that may create an atmosphere deficient in oxygen. Available oxygen in the range of 19.5 percent to 23 percent by volume must be present.
- 3- occupational exposure limit is based on irritation effects and its adjustment to compensate for unusual work schedules is not required.

*See Diesel Particulate Guideline note

Diesel Particulate Guideline

An OEL for Diesel Particulate does not exist under the Alberta Code and a TLV for Diesel Particulate was never adopted by the ACGIH; the numbers listed reference listings under the Notice of Intended Changes (NIC) for the compound. The listing for total carbon was in the 2000 NIC and the listing for elemental carbon was in the 2001 NIC. Diesel Particulate was removed from the NIC in 2003. It is included here to allow for reference to previous survey data.

Exposure to multiple substances

An employer must ensure if a worker is exposed to multiple substances during a single work shift and the toxic effects have similar modes of toxic action, the value of D in the formula

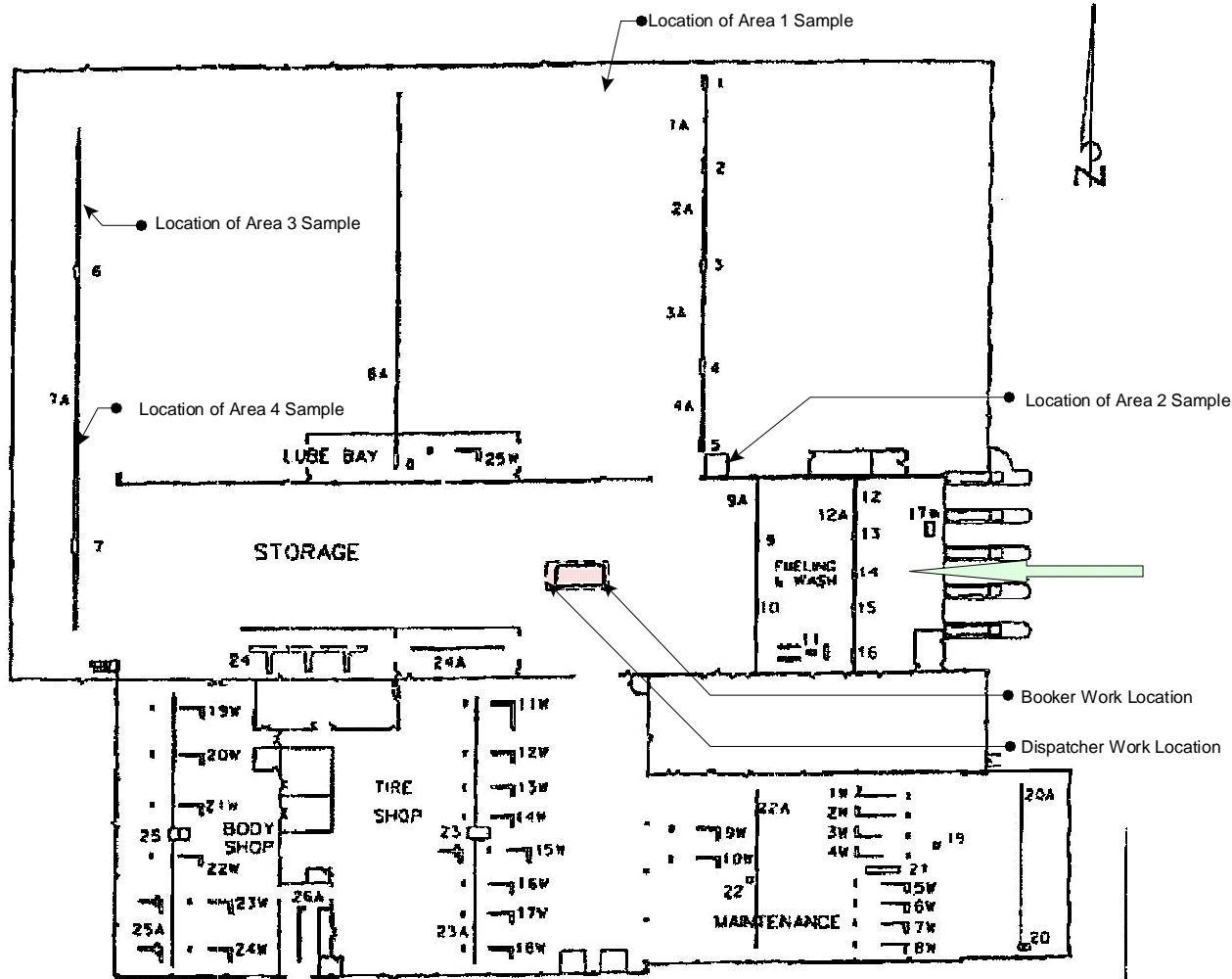
$$D = C_1/T_1 + C_2/T_2 + C_3/T_3 + \dots + C_n/T_n$$

Does not exceed 1, where $C_1, C_2 \dots C_n$ refer to the airborne concentrations during exposure to contaminants 1, 2, ..., n, and $T_1, T_2 \dots T_n$ are their respective occupational exposure limit values expressed in the same units as C_n .

APPENDIX IV
PHOTOS

PHOTOS NOT AVAILABLE

APPENDIX V DRAWINGS



DESCRIPTIVE NOTES

! Drawing supplied by Client - should be used for general descriptive purposes only.

FIGURE 1

GENERAL LAYOUT & SAMPLE
LOCATIONS
WESTWOOD GARAGE

PREPARED FOR
THE CITY OF EDMONTON
FEBRUARY 2006



NOTE: DRAWING IS FOR REFERENCE PURPOSES ONLY