

Réponses aux questions posées dans la lettre de Monique
Gélinas à Nathalie Martel du 14 décembre 2001

1. *Question : Le document déposé DB14 fait état de produit de combustion des biogaz sur la base des réactions attendues.*

Il existe au Québec plusieurs LES qui traitent leur biogaz par destruction thermique, par l'utilisation de torchères ou d'incinérateur à flamme invisible. Est-il possible de fournir des données sur les concentrations réelles trouvées dans les produits de combustion pour les paramètres déjà fournis (document déposés DB14) et pour les paramètres des articles 8 et 67 (a. 2 et a.6) du « Projet de règlement modifiant le règlement sur la qualité de l'atmosphère » (r. 20), version technique de juillet 1998 et de l'article 133, 4^o du « Projet de règlement sur l'élimination des matières résiduelles », version pour prépublication, octobre 2000?

Réponse : Il n'existe pas encore de données québécoises sur les émissions réelles des incinérateurs à flamme invisible. Pour la plupart d'entre eux, soit qu'il n'y a pas d'obligation de suivi prévu au décret les autorisant et que ceux-ci devront en produire seulement lorsque le Règlement sur l'élimination des matières résiduelles sera en vigueur, soit que le système de captage et de destruction des biogaz n'est pas encore en place (il existe un délai de 5 ans après le début des opérations). Vous trouverez ci-joint, un document récent d'Environnement Canada présentant une caractérisation des émissions d'une torchère à flamme invisible.

Pour ce qui est des LES à flamme visible, il n'y a pas non plus de données réelles sur leurs produits de combustion, car il n'existe pas de façon pratique et efficace de les mesurer *in situ*.

2. *Le Ministère a-t-il fait une analyse comparative des avantages et des inconvénients associés au brûlage des biogaz ? Et si oui, pourriez-vous nous la présenter?*

Réponse : Non, mais voici quelques éléments comparatifs qui devraient apparaître dans une telle étude :

Selon le projet de règlement sur l'élimination des matières résiduelles (PREMR), tout lieu d'enfouissement technique (LET) doit être conçu et

opéré de façon à empêcher la migration des biogaz au-delà des limites de propriété et suivant des normes maximales d'émission pour le méthane.

Les biogaz, comme les lixiviats, sont un sous-produit de la décomposition des déchets et constituent une nuisance s'ils ne sont pas contrôlés. Les impacts qui leur sont associés sont : l'émission de gaz à effet de serre, le stress végétal qui est une indication de déplacement des biogaz sous la surface du sol, l'émission d'odeurs désagréables associées aux composés retrouvés à l'état de trace dans les biogaz, les risques d'explosion lorsque la concentration de méthane dépasse 5 % par volume d'air et qu'il s'accumule dans des espaces mal ventilés (migration non contrôlée), la cause de problèmes reliés à la santé par asphyxie ou la présence de gaz à l'état de trace comme le chlorure de vinyle et l'hydrogène sulfuré en cas d'exposition prolongée.

Les raisons principales (les avantages) de mettre en place des équipements de contrôle des biogaz sont donc la protection de la qualité de vie, la limitation des impacts sur l'environnement et la réduction des risques pour la santé et la sécurité. Dorénavant, tous les LET devront assurer une saine gestion des biogaz générés, s'assurer du respect des normes maximales d'émission et du bon fonctionnement des équipements mis en place.

Pour les lieux de faible tonnage annuel ou de faible volume qui génèrent peu de biogaz, les obligations se limitent à capter et à évacuer les biogaz vers l'atmosphère par des puits verticaux de ventilation qui peuvent être équipés de brûleurs à flamme visible. Ce système a l'avantage de constituer une option à faible coût pour empêcher leur accumulation sans risque d'explosion tout en permettant de les éliminer sans créer d'odeurs désagréables. Les torchères à flamme visible ne sont pas équipées pour mesurer les débits générés ou les taux d'émission dans l'atmosphère.

S'il existe un secteur résidentiel à proximité et compte tenu des préoccupations de plus en plus grandes des citoyens concernant leur qualité de vie qui pourrait être affectée, il y a lieu de s'interroger sur l'efficacité réelle de destruction et de contrôle des émissions associés à ces mesures minimales. En fait, ces petits lieux peuvent se voir dans l'obligation de mettre en place un système performant de captage et de brûlage du biogaz, au même titre que les lieux de grande capacité s'il s'avère que les normes maximales d'émission pour le méthane ou les impacts négatifs associés aux émissions de biogaz sont significatifs.

Pour les lieux importants en termes de capacité d'enfouissement ou de volume annuel d'enfouissement, le brûlage à l'aide de torchères à flamme invisible sont obligatoires. Le taux de destruction du méthane et du CO₂ est complet tandis que leur efficacité à détruire les composés organiques volatils (COV) atteint ou dépasse 98 %. Cela est possible parce que la torchère est conçue pour atteindre une température de combustion élevée et pour conserver les gaz à cette température pendant un certain temps afin d'optimiser leur destruction. Pareil système possède l'avantage de permettre le suivi de la qualité de l'air et de mesurer le taux d'efficacité réelle de l'appareil.

Des essais d'émission ont montré que les torchères à flamme invisible permettent un contrôle efficace des émissions de contaminants dans l'atmosphère. L'on s'assure ainsi du contrôle des nuisances associés aux biogaz tout en permettant de réduire considérablement le potentiel de réchauffement atmosphérique relié au biogaz. En terme de prévention contre les changements climatiques, brûler le biogaz permet de réduire de 21 fois l'émission de gaz à effet de serre émis par les LET dans l'atmosphère.

Dans le cas des torchères à flamme invisible, la configuration du réseau de captage nécessaire pour atteindre l'efficacité recherchée, le coût des équipements de même que leur installation et leur entretien nécessitent des coûts additionnels et des investissements plus élevés que pour les petits lieux.

3. *Quelle est la précision recherchée par le centre d'expertise hydrique du Québec dans la détermination de l'élévation de la ligne d'inondation de récurrence de 100 ans dans son Programme de détermination des cotes de crues de récurrences de 20 ans et de 100 ans (PDCC) ?*

Réponse : Dans le cadre du PDCC, deux méthodes de détermination des cotes de crues sont utilisées en rivière, soit :

- a) les relations niveau-niveau ;
- b) la modélisation hydraulique.

La méthode des relations niveau-niveau se base exclusivement sur des observations de niveau et de débit. Elle consiste à faire la transposition de relations d'une section témoin où la relation niveau-débit est connue vers d'autres sections où seuls les niveaux sont connus. Partant des débits et

niveaux mesurés, on extrapole ensuite les relations de niveau pour les débits de récurrences 20 ans et 100 ans. Cette méthode est utilisée pour les cours d'eau dont la pente d'écoulement est généralement faible et constante. Pour les cours d'eau dont la pente d'écoulement peut varier et dont le profil hydraulique est plus difficile à déterminer, on utilise la modélisation.

Utilisées dans les conditions appropriées et appliquées selon les règles de l'art, les deux méthodes sont réputées donner des résultats satisfaisants. Bien qu'il ne soit pas possible de quantifier cette précision dans le cas de la méthode par relation niveau-niveau, on peut l'apprécier pour le cas de la méthode par modélisation en comparant les résultats du modèle à ceux observés sur le terrain. Évidemment, de telles observations ne correspondent presque jamais à la cote de la crue 100 ans, compte tenu de la rareté de l'événement. En effet, avant de procéder aux calculs des cotes 20 ans et 100 ans, on calibre le modèle à partir de mesures de débits et de niveaux effectuées sur le terrain en conditions de crue. La précision alors recherchée, soit l'écart entre le niveau d'eau mesuré et celui calculé avec le modèle, est d'environ 10 centimètres. Bien que les crues utilisées sont, en général, des crues plutôt normales qu'exceptionnelles, on peut dire que les règles de l'art ont été appliquées et on juge ainsi que le modèle, calibré dans de telles conditions de crues, est représentatif des conditions de crues de récurrences 20 ans ou 100 ans recherchées.

Dans le cas de l'étude de la rivière Kinojévis, pour le projet du lieu d'enfouissement sanitaire, on a vu que les différentes évaluations et estimations comparatives qui ont été effectuées affichent entre elles des écarts de résultats qui sont bien supérieurs à 10 cm. Tel que l'étude le faisait ressortir, la relative imprécision des mesures de terrain associée à la faible pente du cours d'eau constituant, à la base, un facteur limitant la précision globale de l'analyse elle-même. L'analyse sommaire que j'ai faite de mon côté indiquait que de relativement faibles écarts dans les mesures de niveau pouvaient entraîner des écarts tout de même importants sur la valeur de la cote d'inondation calculée. Dans de telles conditions, il est compréhensible que l'évaluation de la cote de crues 100 ans ait été faite avec prudence.

Les analyses comparatives présentées dans l'étude ont tenté de situer l'importance de la marge de sécurité procurée par le calcul initial. Notons que les éléments de comparaison présentés ne comportent pas plus de précision que n'en contient le calcul initial lui-même. Cependant, l'étude conclut que le calcul initial conduit bien à un choix sécuritaire et certains

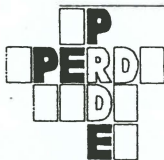
éléments de comparaison donnent à penser que la marge de sécurité obtenue est importante.

Cela dit, il s'agit sans doute là du maximum d'information pouvant être tiré de l'étude. Si plus de précisions sur l'évaluation de la cote de crues 100 ans était requise dans le cadre du projet, des éléments additionnels d'évaluation seraient nécessaires. Ces éléments comprendraient des observations de niveaux d'eau et de débit en conditions de crue et des relevés de terrain (bathymétriques et topographiques) plus détaillés, de façon à pouvoir établir un profil hydraulique relativement détaillé du cours d'eau. On convient bien sûr que *détail* n'équivaut pas nécessairement à *précision*, mais de telles données et analyses additionnelles, basées sur des observations en temps de crue, pourraient procurer des éléments de vérification qui seraient fort valables.

Characterization of Emissions from an Enclosed Flare

Trail Road Landfill Ottawa-Carleton, Ontario

Dominic Cianciarelli
Jeremy Mann



Report ERMD 2000-02

August 2000

Emissions Research and Measurement Division
Environmental Technology Advancement Directorate



Environment
Canada

Environnement
Canada

Environmental
Technology
Centre



Centre de
Technologie
Environnementale



TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF FIGURES	ii
LIST OF TABLES	iii
ACKNOWLEDGEMENTS.....	iv
1. INTRODUCTION.....	1
2. SAMPLING SITE AND LOCATION	2
3. SAMPLING METHODS	3
3.1 General.....	3
3.2 Particulate/Acid Gases Train Description.....	3
3.3 Semi-volatile Organic Compounds (SVOC) Train.....	3
3.3.1 SVOC Train Description	3
3.3.2 Glassware Cleaning and Proofing	5
3.3.3 Sample Recovery	5
3.4 Volatile Organic Compounds (VOCs).....	6
4. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)	7
5. ANALYTICAL METHODS.....	7
5.1. Particulate/Acid Gases.....	7
5.2. Semi-volatile Organic Compounds.....	7
5.3 Volatile Organic Compounds (VOCs).....	7
6. RESULTS	8
6.1. General Sampling Data	8
6.2 Particulate/Acid Gases.....	9
6.3 Oxygen, Sulphur Dioxide, Carbon Oxides and Nitrogen Oxides	10
6.4 Dioxins, Furans, Hexachlorobenzene and Octachlorostyrene.....	11
6.5 Polycyclic Aromatic Hydrocarbons (PAHs)	13
6.6 Volatile Organic Compounds (VOCs).....	16
7. SUMMARY.....	19
APPENDIX I	
APPENDIX II	

LIST OF FIGURES

Figure	Page
1 Flare Sampling Location.....	2
2 Particulate/Acid Gases and Semi-volatile Organics Sampling Trains.....	4
3 Inlet SVOC Train.....	4
4 Recovery Procedure for Semi-volatile Organic Compounds.....	5
5 Volatile Organic Compounds Sampling Train	6

LIST OF TABLES

Table	Page
1 Summary of General Sampling Data	8
2 Summary of Particulate/Acid Gases	9
3 Summary of O ₂ , CO, CO ₂ , SO ₂ and NO _x Concentrations	10
4 Concentrations and Emission Rates of Dioxins and Furans	12
5 Concentration of PAHs (ng/m ³)	14
6 Mass Emission Rates of PAHs (mg/day)	15
7 VOC Concentrations at the Inlet and Outlet (µg/m ³)	16
8 Summary of Destruction Efficiencies and VOC Emissions	17
9 Destruction Efficiencies of Selected VOCs (%)	18

ACKNOWLEDGEMENTS

The Emissions Research and Measurement Division would like to express their appreciation to Mr. Dave Ryan of the Regional Municipality of Ottawa Carleton for his cooperation and assistance during the test program. Special thanks are extended to the Analysis and Ambient Air Quality Division at the Environmental Technology Centre for performing the dioxin, furan, hexachlorobenzene, octachlorostyrene, PAH and VOC analyses.

1. INTRODUCTION

The Kyoto Protocol encourages the reduction of emissions of greenhouse gases. Landfill gas, a product of the decomposition of organic waste in landfills, is roughly 50% methane, a potent greenhouse gas having 21 times the global warming potential of carbon dioxide. In Canada, six million tonnes of carbon dioxide equivalent is being reduced annually through the combustion of landfill gas. The potential exists to double this capture rate in Canada.

While the combustion of landfill gas greatly reduces the impact of greenhouse gases, landfill gas contains numerous aliphatic, aromatic and halogenated compounds. These volatile organic compounds (VOCs) which are present in the order of a few hundred ppm are major precursors for smog formation while Freons are known ozone-depleting substances. The volatile organic compounds also contain vinyl chloride and 1,3-butadiene which are known carcinogenic compounds.

The effectiveness of flares, engines and boilers in the destruction of non-methane components of landfill gas has only been studied in a preliminary fashion in Canada. As a result, a joint program was initiated among the Waste Prevention Division (NOPP), landfill operators/developers and ERMD. The objective of this program is to evaluate the effectiveness of landfill gas combustors for the destruction of VOCs and the potential formation of significant substances such as criteria air contaminants (NO_x , SO_2 and CO), polycyclic aromatic hydrocarbons (PAHs), dioxins and furans (PCDDs/PCDFs), hexachlorobenzene (HCB) and octachlorostyrene (OCS). Sampling also included measurement of particulate, hydrogen chloride (HCl) and hydrogen fluoride (HF) emissions.

The testing program encompasses three mechanisms for landfill gas combustion including engines, flares and enclosed flares. This report documents testing at an enclosed flare burning approximately 1500 CFM of landfill gas. In addition to this document, detailed reports are available for testing of landfill gas combustion in a reciprocating engine and a boiler.

ERMD conducted sampling to test for the presence of PCDDs/PCDFs, PAHs, HCB, OCS, VOCs, acid gases, particulate, NO_x , SO_2 , CO and O_2 . In the case of VOCs, landfill gas and exhaust data was used to determine the destruction efficiency of selected VOCs across the flare.

2. SAMPLING SITE AND LOCATION

Sampling was conducted on the enclosed flare exhaust. The sampling location is illustrated in Figure 1. The stack sampling platform was located approximately 20 feet above the ground. Sampling was conducted from two 4" ports located at 90° to each other around the stack and approximately 45" above the top deck of the scaffolding. Due to the close proximity of the flame, as well as air baffles, 24 points were sampled to ensure a representative sample. A water-cooled probe was used to collect the samples due to the high stack gas temperatures.

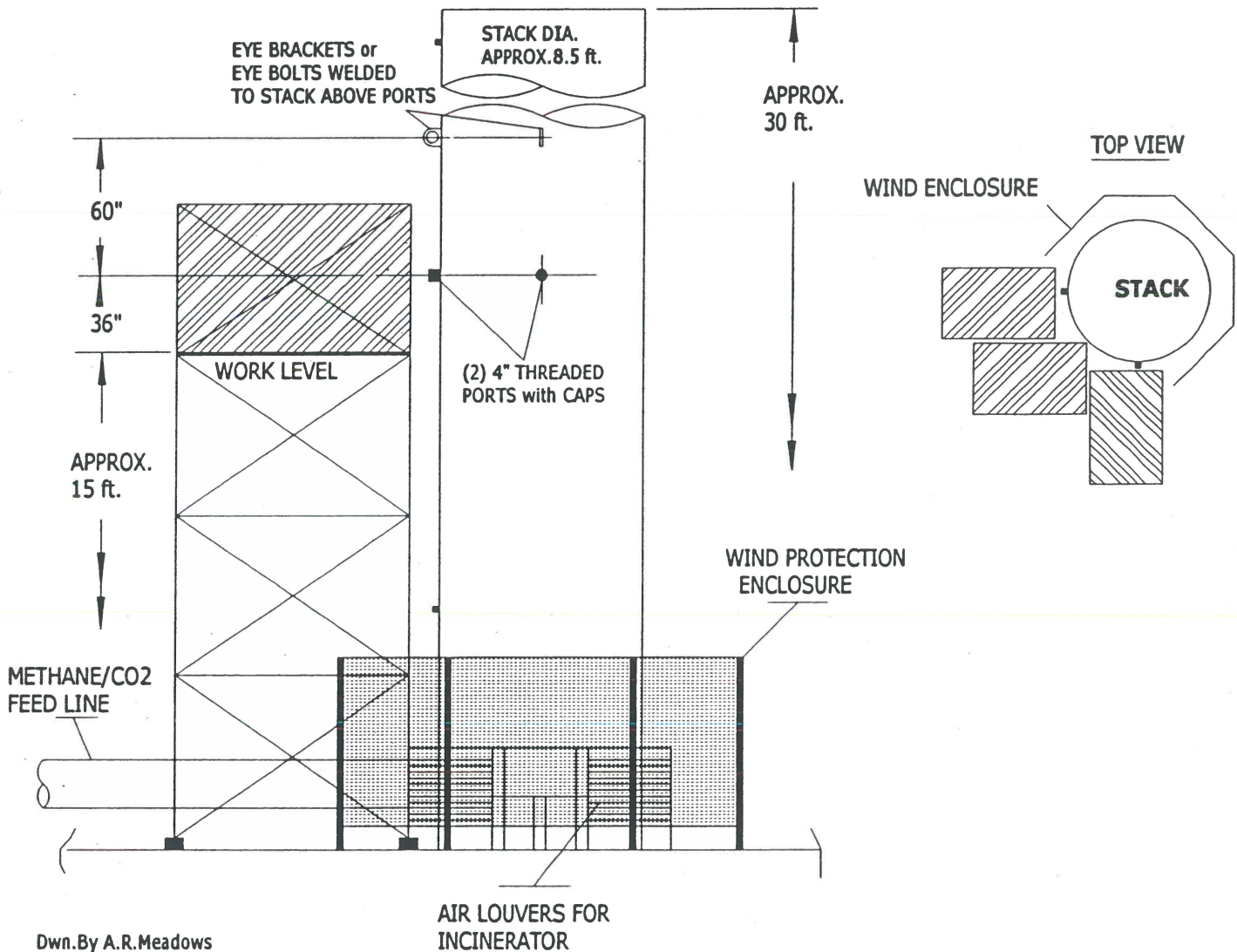


Figure 1 – Flare Sampling Location

3. SAMPLING METHODS

3.1 General

The Method 5 train formed the basis of the manual methods used during the sampling phase. The train consisted of a heated probe, heated filter enclosure, leak-free vacuum line, vacuum gauge, flow control valves, vacuum pump and a dry gas and orifice meter. Stack gas and orifice pressures were measured with an inclined manometer. Temperatures were measured in the hot box, impinger train outlet and at the inlet and outlet of the dry gas meter. In the case of the SVOCs, the temperature was also monitored at the Amberlite XAD-2 inlet. All trains were assembled in the ERMD lab.

Leak-checks were conducted at the beginning and at the end of each run or whenever a train joint was opened. Sampling was conducted isokinetically along two 12-point traverses. Sampling duration at each point was 10 minutes with readings and flow adjustments every 5 minutes. Sampling duration for the particulate and organic runs was 2 hours and 4 hours respectively. Due to the extremely low particulate loading during a 2-hour test, the three particulate runs (6 hours) were conducted contiguously and collected on the same train to improve the gravimetric determination of the filter and acetone rinse.

3.2 Particulate/Acid Gases Train Description

The Environment Canada Report EPS 1/RM/8 *"Reference Method for Source Testing: Measurement of Releases of Particulate from Stationary Sources"* was used to determine the emissions of particulate and acid gases from the flare. Particulate in the flue gas was collected on a glass fibre filter. The acid gases were trapped by the first two impingers containing deionized water. A schematic of the sampling train is shown in Figure 2. Blanks for the glass fibre filter, acetone and deionized water were also submitted for analysis.

3.3 Semi-volatile Organic Compounds (SVOC) Train

3.3.1 SVOC Train Description

The Environment Canada Report EPS 1/RM/2 *"Reference Method for Source Testing: Measurement of Releases of Semi-volatile Organic Compounds from Stationary Sources"* was used to determine the emissions of PCDDs/PCDFs, HCB, OCS and PAHs from the stack. This method is the most widely accepted for the measurement of organic compounds with boiling points above 100°C. Gaseous organics were trapped in a single adsorbent tube containing about 40 grams of Amberlite XAD-2 resin. As the temperature of the resin must be kept below 20°C for optimal collection efficiency, the hot gases leaving the filter enclosure were cooled by passing them through a condenser cooled with ice bath water. The tube containing the XAD-2 resin was also water-cooled. Condensate formed in the cooling coil percolated through the resin bed and was collected in a condensate trap. An impinger containing ethylene glycol inserted downstream of the Amberlite acted as a back-up collection media in the event of breakthrough of organics through the resin. The resin tube was covered with aluminium foil during sampling and storage to

prevent photo degradation of the trapped organics. All glassware joints were wrapped with Teflon tape as vacuum greases are not permitted for organic sampling. A schematic of the sampling train is shown in Figure 2.

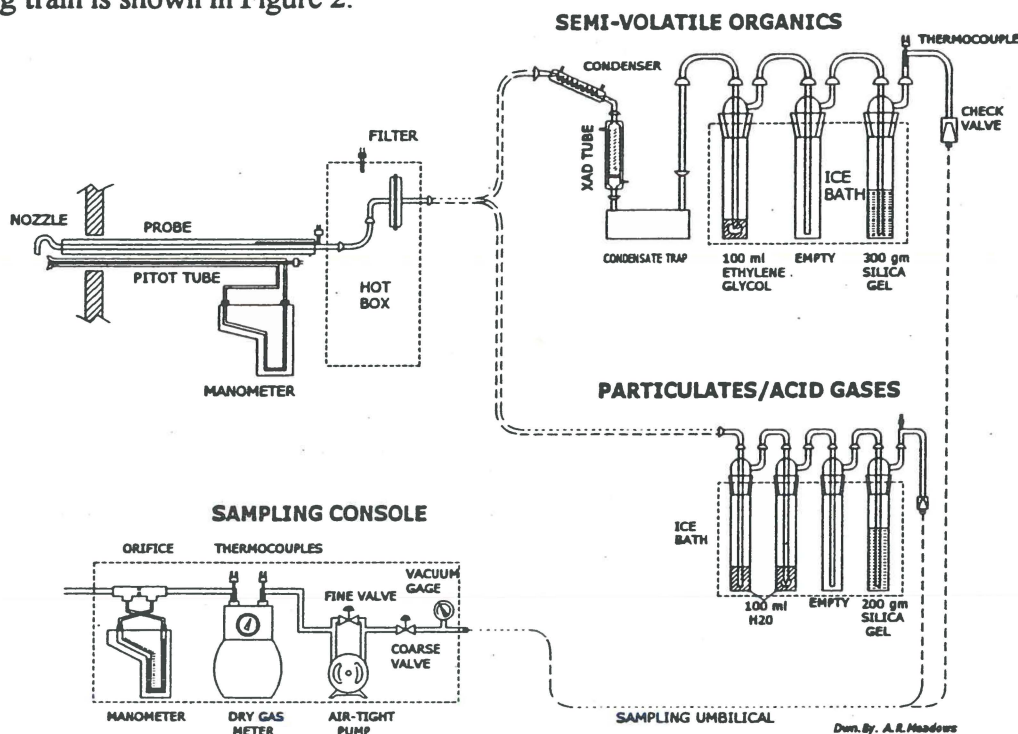


Figure 2 – Particulate/Acid Gases and Semi-volatile Organics Sampling Trains

A simple train was utilized at the inlet to sample the landfill gas for semi-volatile organic compounds. The pressure in the manifold was used to push the landfill gas through a resin tube filled with Amberlite. The volume was recorded on a dry gas meter. Water was collected in an impinger to determine the raw gas moisture level. A schematic of this train is shown in Figure 3.

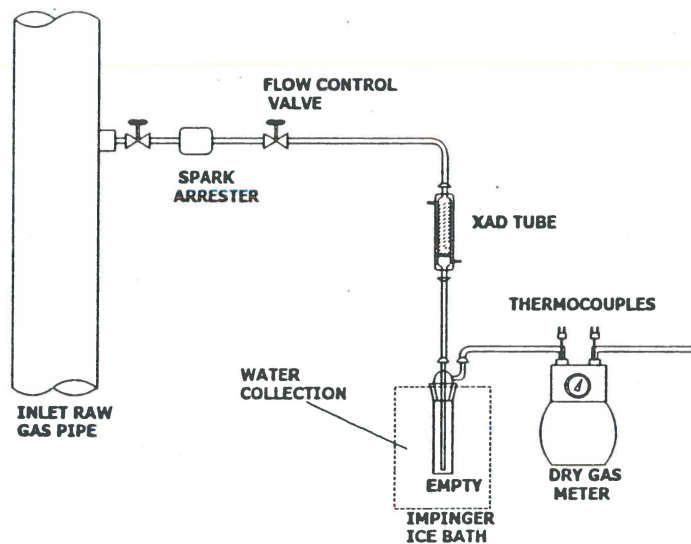


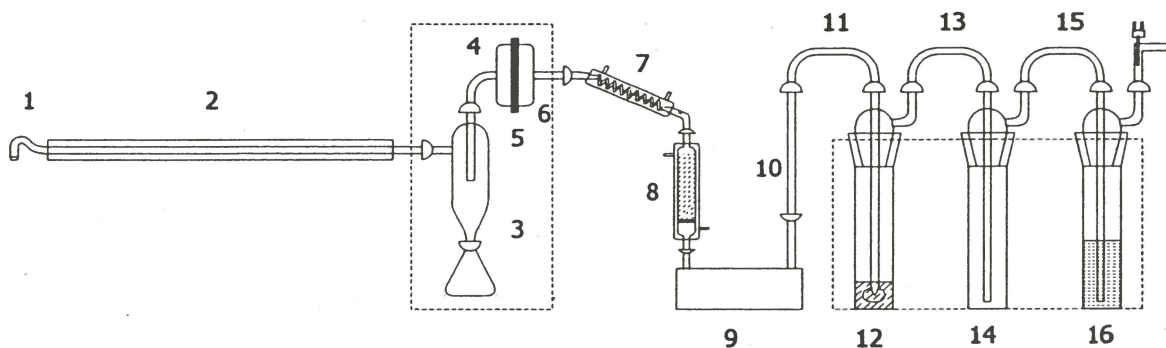
Figure 3 – Inlet SVOC Train

3.3.2 Glassware Cleaning and Proofing

Prior to the test program, all train glassware, probe brushes, glass wool and aluminium foil were cleaned following a rigorous procedure. The glassware cleaning procedures were verified by analyzing the proofing rinses of the sampling trains. Pre-cleaned and proofed commercial sample storage bottles were used for this test. Four complete sets of train glassware were prepared for this survey. The XAD-2 was pre-cleaned and analyzed for contamination prior to the survey. All reagents were distilled-in-glass grade. Details of the cleaning and proofing procedures are given in Report EPS 1/RM/2.

3.3.3 Sample Recovery

Following the completion of each run, the organic train was recovered in the ERMD laboratory. During the transportation between the sampling site and the lab, all openings were sealed with pre-cleaned glass plugs or caps or aluminium foil. The recovery procedures involved the brushing and rinsing of the train components with acetone and hexane. Only Teflon wash bottles were used during sample recovery. Amberlite tubes were capped and re-wrapped in aluminium foil. Liquid samples were stored in pre-cleaned amber bottles to prevent photodegradation of the organics. Bottle lids were lined with Teflon. All samples were kept refrigerated following recovery. The sample recovery procedures are detailed in Figure 4. All samples were forwarded to the Analysis and Air Quality Division (AAQD) of Environment Canada for organic analysis.



Dwn. By A.R.M.

Sample	Component(s)	Recovery Procedure
1	1,2,3,4	Wash and brush 3 times each with acetone (A) and hexane (H). Rinse 3 times each with A and H.
2	5	Remove carefully from filter holder. Place on pre-cleaned foil. Fold in half and crimp the foil edges. Place in pre-cleaned petri dish. Seal petri dish.
3	6,7	Soak 5 minutes each with A and H. Rinse 3 times each with A and H.
4	8	Cap ends and wrap in foil.
5	9,10,11,12	Empty contents into container and rinse 3 times with HPLC water.
6	6 to 15 except 8	Rinse three times each with A and H.

Mark liquid levels on all bottles and wrap all the caps with tape.

All sample containers are pre-cleaned amber glass bottles with pre-cleaned Teflon lid liners.

Figure 4 – Recovery Procedure for Semi-volatile Organic Compounds

In addition to the regular sampling trains, a blank train was assembled for the tests. The blank train was treated in the same manner as the sampling trains except that no stack gases were

sampled. However, a volume of ambient air, equal to that drawn during the leak checks was drawn through the blank train. Essentially, the blank train serves as a check for background levels of organics originating from ambient air, handling of train glassware and rinsing agents.

3.4 Volatile Organic Compounds (VOCs)

VOCs are classified as those organics having saturated vapour pressures at 25°C greater than 10^{-1} mm Hg. The method is based on the collection of a gaseous sample in a previously cleaned, verified and evacuated, 6-liter, stainless-steel canister. The canister's interior surface is covered by pure chrome-nickel oxide which is formed during the SUMMA[®] passivating process. This type of vessel provides sample collection and storage stability for many organic compounds. A schematic of the sampling train is shown in Figure 5.

The samples for VOCs were collected at the inlet to the flare (raw gas) and at the exhaust stack of the flare. Four canisters were collected for each SVOC run. Sampling duration for the VOC samples was variable ranging from 20 to 29 minutes at the inlet and 65 to 78 minutes at the outlet. The sample was collected into the evacuated canister to a final pressure of 5 to 10 psig at the inlet and 30 to 32 psig for the exhaust samples. Following sample collection, the canister valve was closed and the canisters were transported to the AAQD laboratory for analysis.

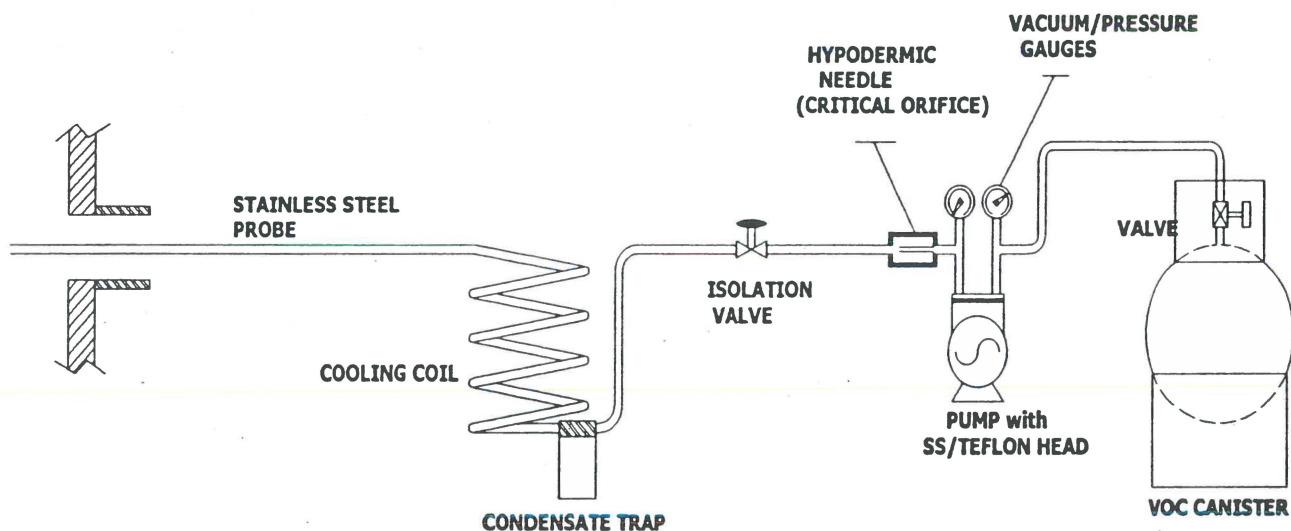


Figure 5 – Volatile Organic Compounds Sampling Train

A modified method TO-14 (*Compendium Method TO-14 Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. EPA, May 1988*) was used as the basis for the VOC sampling train. The train consisted of an in-stack sintered filter, stainless-steel probe connected by Teflon tubing to the canister. The gases were drawn by a Teflon-coated pump through a critical orifice (hypodermic needle) into the canister (Figure 5). In the case of the raw gas samples, the pressure in the manifold as well as a manual hand pump were used to fill the canisters.

4. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All stack sampling equipment was calibrated prior to sampling using accepted techniques. Items that were calibrated included:

- Dry Gas Meter (γ)
- Pitot Tubes (C_p)
- Inclined Gauges (Δp)
- Temperature Readers (T)
- Orifice (K_0)
- Barometers (P_{bar})
- Nozzle Diameters (N_d)

The dry gas and orifice meters were calibrated using a spirometer. Pitot tubes were calibrated at the National Research Council wind tunnel. Barometers and inclined gauges were calibrated against a standard reference mercury barometer and an inclined manometer respectively. Thermocouple readers were calibrated using an ice bath and boiling water. Nozzle openings were measured by averaging three measurements with a vernier calliper. In addition to the above, the sampling consoles and inclined gauges were checked for leaks and the operation of all probe and box heaters were verified. The Ecom-KL combustion gas analyzer was verified before the program and daily during the sampling program with calibration gases.

5. ANALYTICAL METHODS

5.1. Particulate/Acid Gases

Particulate was determined gravimetrically following desiccation of the front-half acetone rinse and loaded filter. Acid gases were determined from the impinger solutions using ion chromatography.

5.2. Semi-volatile Organic Compounds

Stack samples were analyzed by the AAQD at the Environmental Technology Centre for dioxins, furans, hexachlorobenzene, octachlorostyrene and polycyclic aromatic hydrocarbons using HRGC/HRMS/MS. The recovered stack samples were spiked with surrogates to monitor recoveries followed by extraction by a mixture of 80:20 cyclohexane/toluene. Sample clean-up followed to separate target from non-target species. A detailed summary of the analytical procedure for the determination of PCDDs/PCDFs, HCB, OCS and PAHs is included in Appendix II.

5.3 Volatile Organic Compounds (VOCs)

VOCs were analyzed by the Air Toxics lab of AAQD. The canister samples were quantitatively analyzed by GC/MSD (Hewlett-Packard 5890 GC and 5971 MSD) using a cryogenic pre-concentration technique. One hundred and forty-four VOC species (from C_2 to C_{10}) were quantified in the samples. The VOCs were separated on a 50 meter HP-1 liquid phase, 0.31 mm fused silica capillary column with 1.0 μm film thickness.

6. RESULTS

6.1. General Sampling Data

The general sampling data for the flare test program is presented in Table 1. This table includes the average velocity, volumetric flow rate (referenced to 25°C and 101.3 kPa), average stack temperature and average moisture. Average oxygen and carbon dioxide levels were determined by analyzing the stack gas from the console discharge with a Nova Model 376WP combustion gas analyzer. The traverse data for each run and summaries are presented in Appendix I.

Table 1 - Summary of General Sampling Data

Run Number	Combined Part/AG 1-3	Semi-volatile Organics		
		SVOC 1	SVOC 2	SVOC 3
Process Conditions				
Fuel Type / Methane (%)	LFG / 45.2	LFG / 35.3	LFG / 33.7	LFG / 36.0
Run Conditions				
Date (April 2000)	25	18	19	20
Sampling Time (local)	10:29 – 16:38	10:45 – 14:51	10:18 – 14:25	9:54 – 14:00
Test Duration (min)	360	240	240	240
Isokineticity (%)	96.8	97.1	98.8	98.4
Sample Volume (m³)	6.454	4.242	3.961	4.162
Stack Gas Characteristics				
Flow Rate (m³/min)	342.59	337.63	309.59	326.27
Actual Velocity (m/s)	4.16	4.40	4.10	4.34
Temperature (°C)	784	851	861	865
Moisture (%)	7.19	8.36	8.67	8.88
Oxygen (%)	13.85	12.15	13.15	13.15
Carbon Dioxide (%)	6.10	7.45	7.05	7.05
Molecular Weight (lb/lb-mole)	29.53	29.68	29.65	29.65

All values are expressed on a dry basis referenced to 25°C and 101.325 kPa.

6.2 Particulate/Acid Gases

Particulate and acid gas results for the flare are summarized in Table 2, along with the emissions of particulate, HCl and HF expressed in terms of the fuel input. Particulate loading was based on the filter catch and the acetone rinses of the front-half glassware of the sampling train. Particulate loading was low at this source. A concentration at the stack of 0.64 mg/m^3 was observed, with an emission rate of 13.06 g/hr for the combined particulate run.

Chlorides and fluorides were determined on the catch of these ions in the water impingers in the particulate train. Chlorine and fluorine are present in the raw landfill gas as halogenated hydrocarbons. The water samples were analyzed by ion chromatography. Chlorides and fluorides are expressed as HCl and HF respectively. The HCl concentration observed was 0.5 mg/m^3 while HF was 0.03 mg/m^3 . The corresponding emission rates were 10.62 g/hr and 0.56 g/hr for HCl and HF respectively.

Table 2 - Summary of Particulate/Acid Gases

	Combined Part/AG 1-3
Date (April 2000)	25
Stack Gas Characteristics	
Sample Volume (m^3)	6.454
Flow Rate (m^3/min)	342.59
Train Catches (mg)	
Particulate (mg)	4.10
Chloride (mg)	3.24
Fluoride (mg)	0.17
Concentrations (mg/m^3)	
Particulate	0.64
Chloride as HCl	0.52
Fluoride as HF	0.03
Emissions (g/m^3 methane)	
Particulate	0.0196
Chloride as HCl	0.0159
Fluoride as HF	0.0008
Emission Rate (g/hr)	
Particulate	13.06
Chloride as HCl	10.62
Fluoride as HF	0.56

All values are expressed on a dry basis referenced to 25°C and 101.325 kPa

6.3 Oxygen, Sulphur Dioxide, Carbon Oxides and Nitrogen Oxides

A summary of the concentrations for oxygen, carbon monoxide, carbon dioxide, sulphur dioxide and nitrogen oxides for the exit of the flare and the raw landfill gas is given in Table 3. The raw landfill gas was analyzed by plant analyzers as well as a LandTec Gem500 multi-gas analyzer. The exit gases were analyzed by a Nova 302 (CO₂) and an Ecom-KL (O₂, CO, SO₂, NO_x) portable combustion gas analyzers. The individual readings for the particulate and organic runs are detailed in Appendix I.

During the organic runs, the raw landfill gas was analyzed for O₂, CO₂, CO and NO_x from the VOC canister samples and portable analyzers. CO was found at levels ranging from 21 to 31 ppm, 1 to 2 ppm of NO_x (NO₂ of 0-2 ppm) was observed and carbon dioxide levels ranged from 26.3% to 28.2%. Oxygen levels were between 4.9 and 6.2%.

Table 3 - Summary of O₂, CO, CO₂, SO₂ and NO_x Concentrations

Compound	O ₂ (%)	CO (ppm)	CO ₂ (%)	SO ₂ (ppm)	NO _x (ppm)
Enclosed Flare					
Particulate/Acid Gases					
Average of 3 Part/AG runs	13.9	1093	6.7	0	4.1
Semi-volatile Organics					
SVOC 1	13.3	620	7.0	0	8.1
SVOC 2	12.8	481	7.7	0	9.3
SVOC 3	13.4	392	7.2	0	6.6
Particulate/Acid Gases and Semi-volatile Organics					
Average	13.3	646	7.1	0	7.0
Std Dev	0.5	312	0.5	0	2.3
Landfill Gas					
Plant / Portable Analyzers	4.5	25	27.1	n.d.	1
Average of 6 canisters	5.7	24	28.7	n.d.	1
Average	5.4	24	28.2	n/a	1
Std Dev	1.3	5	3.1	n/a	0.4

The CO, SO₂ and NO_x emissions in the exhaust were expressed in terms of the methane input to the flare. The average flow of LFG to the flare for each run ranged from 870 to 1210 CFM. Methane concentration in the landfill gas ranged from 33.7 to 45.2 percent. The methane flow was calculated based on the average flow of LFG and the average methane concentration for each organic and particulate run. CO and NO_x emissions in the exhaust are summarized below. No SO₂ emissions were observed.

Summary of CO, SO₂ and NO_x Emissions

Run	Methane in (m ³ /hr)	CO	NO _x * (g/m ³ CH ₄)
		(g/m ³ CH ₄)	(g/m ³ CH ₄)
Part/AG	668	38.54	0.24
SVOC 1	726	19.81	0.43
SVOC 2	678	15.08	0.48
SVOC 3	695	12.65	0.35

* Expressed as NO₂

6.4 Dioxins, Furans, Hexachlorobenzene and Octachlorostyrene

PCDD/PCDF data is reported on the basis of the seventeen 2,3,7,8-substituted dioxin and furan congeners. This data is further transformed by multiplying each of the 17 congeners by their respective toxicity equivalency factors (I-TEFs). The factors range from 1.0 for 2,3,7,8-TCDD to 0.001 for OCDD and OCDF. Analytical results of the loaded trains, blank train, proofing and control samples are presented in Appendix II.

The emission summaries of the TEQ dioxins and furans for the flare are given in Table 4. Typically, the front and back half components of the SVOC train which correspond to the particulate and gaseous fractions respectively in the sample gas are analyzed separately. In this project, both fractions were combined as low levels of PCDD/PCDF were expected in the train samples. Train catches are corrected for the blank train (which consisted of OCDD) and all concentrations are corrected to 11% O₂.

Concentration levels were low and varied slightly between the three runs, ranging between 0.78 and 2.82 µg TEQ/m³. Three congeners (2378-T4CDF, 23478-P5CDF and 123478-H6CDF) accounted for the majority of the TEQ. The TEQ contribution from the dioxin congeners was minimal. Emission rates ranged between 104 to 443 µg TEQ per year.

A sample of the landfill gas was collected for dioxin and furan analysis and no PCDDs/PCDFs were detected.

An analysis for hexachlorobenzene and octachlorostyrene was also conducted for the train samples and the landfill gas. Neither hexachlorobenzene nor octachlorostyrene was detected in either the landfill gas sample or the train samples.

Table 4 – Concentrations and Emission Rates of Dioxins and Furans

Congener	SVOC 1		SVOC 2		SVOC 3	
	Conc.	Emission Rate	Conc.	Emission Rate	Conc.	Emission Rate
	pg TEQ/m ³ @ 11% O ₂	µg TEQ / year	pg TEQ/m ³ @ 11% O ₂	µg TEQ / year	pg TEQ/m ³ @ 11% O ₂	µg TEQ / year
2378-T4CDD	0.000	0	0.000	0	0.000	0
12378-P5CDD	0.000	0	0.000	0	0.000	0
123478-H6CDD	0.000	0	0.000	0	0.000	0
123678-H6CDD	0.000	0	0.000	0	0.000	0
123789-H6CDD	0.000	0	0.000	0	0.000	0
1234678-H7CDD	0.021	3	0.042	5	0.058	8
OCDD	0.004	1	0.010	1	0.020	3
2378-T4CDF	1.078	169	0.684	87	0.700	94
12378-P5CDF	0.085	13	0.045	6	0.000	0
23478-P5CDF	1.120	176	0.774	99	0.000	0
123478-H6CDF	0.267	42	0.129	16	0.000	0
123678-H6CDF	0.128	20	0.000	0	0.000	0
234678-H6CDF	0.085	13	0.000	0	0.000	0
123789-H6CDF	0.000	0	0.000	0	0.000	0
1234678-H7CDF	0.035	5	0.019	2	0.000	0
1234789-H7CDF	0.000	0	0.000	0	0.000	0
OCDF	0.000	0	0.002	0	0.000	0
TOTAL	2.823	443	1.705	217	0.778	104

Concentrations are expressed on a dry basis referenced to 25°C and 101.325 kPa and corrected to 11% O₂.

"0" denotes not detected.

Totals may not add due to rounding.

6.5 Polycyclic Aromatic Hydrocarbons (PAHs)

PAH emissions are summarized in Tables 5 and 6. As mentioned previously, the front and back halves of the sampling train were combined into one extract. Train catches were corrected for the PAHs detected in the blank train. Eight compounds were detected in the blank but many of these were at or slightly above the detection limit. PAH analytical results of the loaded trains, blank train, proofing and control samples are presented in Appendix II.

PAH concentrations at the flare and in the landfill gas are detailed in Table 5. The total for each train ranged from 103 to 821 ng/m³. These concentrations are not corrected to 11% oxygen. The lighter half of the target PAH compounds were detected in all three runs. Benzo(g,h,i)Perylene was the heaviest compound detected in the list of PAHs. Phenanthrene was the most abundant compound (26-34%) for each of the three SVOC runs.

PAHs were also determined on the raw landfill gas prior to combustion. PAHs were detected in the raw landfill gas. A concentration of 1294 ng/m³ was detected, with a corresponding flare input rate of 62 mg/day. Since the emission rate found at the outlet was higher than from the raw landfill gas, PAHs were being formed in the flare.

Mass emission rates for each PAH from the flare and the landfill gas are given in Table 6. Total rates ranged from 50 to 386 mg/day. PAH emissions in terms of methane input for each SVOC run are summarized below.

Summary of PAH Emissions

Run	Methane in (m ³ /hr)	PAHs (μg/m ³ CH ₄)
SVOC 1	726	2.9
SVOC 2	678	5.7
SVOC 3	695	23.1

Table 5 - Concentration of PAHs (ng/m³)

Compound	Landfill Gas	Enclosed Flare Exhaust		
		SVOC 1	SVOC 2	SVOC 3
Acenaphthylene	33.7	1.7	1.3	6.5
Acenaphthene	697.4	0.7	0.3	2.6
Fluorene	389.7	1.9	3.3	10.8
2-Methyl-Fluorene	54.7	1.9	4.0	19.0
Phenanthrene	104.7	35.4	53.3	230.2
Anthracene	5.4	1.4	1.8	9.9
Fluoranthene	5.4	14.4	30.3	106.9
Pyrene	3.1	15.3	30.5	136.0
Benzo(a)Fluorene	0	3.5	11.6	51.2
Benzo(b)Fluorene	0	0.9	2.8	11.5
1-Methyl-Pyrene	0.3	3.3	7.1	44.4
Benzo(g,h,i)Fluoranthene	0	2.1	4.3	16.8
Benzo(a)Anthracene	0	1.4	3.8	15.6
Chrysene	0	6.8	14.4	47.6
Triphenylene	0	5.4	10.9	35.6
7-Methyl-Benzo(a)Anthracene	0	0	0	0
Benzo(b)Fluoranthene	0	2.6	13.1	19.0
Benzo(k)Fluoranthene	0	0	2.8	3.6
Benzo(e)Pyrene	0	3.8	9.8	33.6
Benzo(a)Pyrene	0	0	1.3	3.1
Perylene	0	0	0	0
3-Methyl-Cholanthrene	0	0	0	0
Indeno(1,2,3-cd)Pyrene	0	0	0	3.1
Dibenzo(a,h)Anthracene	0	0	0	0
Benzo(b)Chrysene	0	0	0	0
Benzo(g,h,i)Perylene	0	0	0	13.5
Anthanthrene	0	0	0	0
TOTAL	1294	103	207	821

Values expressed on a dry basis referenced to 25°C and 101.325 kPa.,
 "0" denotes not detectable

Table 6 - Mass Emission Rates of PAHs (mg/day)

Compound	Landfill Gas	Enclosed Flare Exhaust		
		SVOC 1	SVOC 2	SVOC 3
Acenaphthylene	1.6	0.8	0.6	3.0
Acenaphthene	33.3	0.3	0.1	1.2
Fluorene	18.6	0.9	1.5	5.1
2-Methyl-Fluorene	2.6	0.9	1.8	8.9
Phenanthrene	5.0	17.2	23.7	108.1
Anthracene	0.3	0.7	0.8	4.6
Fluoranthene	0.3	7.0	13.5	50.2
Pyrene	0.1	7.4	13.6	63.9
Benzo(a)Fluorene	0	1.7	5.2	24.0
Benzo(b)Fluorene	0	0.5	1.2	5.4
1-Methyl-Pyrene	0	1.6	3.2	20.9
Benzo(g,h,i)Fluoranthene	0	1.0	1.9	7.9
Benzo(a)Anthracene	0	0.7	1.7	7.3
Chrysene	0	3.3	6.4	22.4
Triphenylene	0	2.6	4.8	16.7
7-Methyl-Benzo(a)Anthracene	0	0	0	0
Benzo(b)Fluoranthene	0	1.3	5.9	8.9
Benzo(k)Fluoranthene	0	0	1.2	1.7
Benzo(e)Pyrene	0	1.8	4.4	15.8
Benzo(a)Pyrene	0	0	0.6	1.5
Perylene	0	0	0	0
3-Methyl-Cholanthrene	0	0	0	0
Indeno(1,2,3-cd)Pyrene	0	0	0	1.5
Dibenzo(a,h)Anthracene	0	0	0	0
Benzo(b)Chrysene	0	0	0	0
Benzo(g,h,i)Perylene	0	0	0	6.3
Anthanthrene	0	0	0	0
TOTAL	61.7	49.9	92.1	385.5

"0" denotes not detectable, Totals may not add due to rounding

6.6 Volatile Organic Compounds (VOCs)

Samples for VOCs were collected from the processed landfill gas and the flare exhaust. Two samples were collected at the inlet and outlet for each SVOC run. In total, 12 canister samples were submitted for VOC analysis. The determination of the VOC destruction efficiency (DE) was based on an average of the six canisters at each location. As illustrated in Table 7, the VOC variation at the inlet to the flare was minimal, with some variation in the VOC outlet levels.

Table 7 - VOC Concentrations at the Inlet and Outlet ($\mu\text{g}/\text{m}^3$)

Location	SVOC 1		SVOC 2		SVOC 3	
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Inlet	233425	249387	247285	250186	273570	285720
Outlet	149	169	313	480	190	425

The full VOC target list contains 144 compounds, however this list was pared down as many of the species are of lesser interest. For this exercise, the reported VOCs include ODS (ozone depleting substances) such as Freons, BTEX (benzene, ethylbenzene, toluene and xylenes) and halogenated hydrocarbons. Halogenated hydrocarbons include vinyl chloride, dichloromethane, tri and tetrachloroethene, chlorobenzene and dichlorobenzene. An additional compound (1,3-Butadiene) did not fall under any of the above categories, but was added to the reported compounds as it is classified as a potentially carcinogenic substance. Where applicable, compounds have been listed as Schedule 1, CEPA-toxic and IARC 1 and IARC 2¹. Benzene is both an IARC 1 and CEPA-toxic compound. Naphthalene, a PAH compound was also included since it is not reliably determined using the modified Method 5 type train. The full list of VOC concentrations and emission rates for the inlet and outlet locations is given in Appendix II.

VOC destruction efficiencies (based on mass emissions) for selected compounds are summarized in Table 8. Destruction efficiencies were calculated using the following equation:

$$DE = \frac{VOC_{inlet} - VOC_{outlet}}{VOC_{inlet}} \times 100$$

Carbon tetrachloride, a Schedule 1 substance was not detected in any of the landfill gases. In the case of 1,3-Butadiene, the results are displayed as “formed” since it was not observed in the inlet sample and some was observed in the outlet sample. In general, the destruction efficiency for each of the VOCs was above 90%, with the majority above 99%. The exceptions were

¹ IARC denotes International Agency for Cancer. Group 1 and 2A denote “carcinogenic” and “probably carcinogenic” respectively.

chloromethane and 1,2,4-Trichlorobenzene with DEs of 77 and 85 percent, respectively. More specifically, the destruction efficiency for all the 144 VOCs was 98.9%. The destruction efficiencies for the selected VOCs was 96.9%. Table 8 shows individual destruction efficiencies for the three groups of selected VOCs and the emissions per unit of methane, based on an average methane input of 700 m³/hr.

Table 8 - Summary of Destruction Efficiencies and VOC Emissions

Substance	DE (%)	VOCs (mg/m ³ CH ₄)
Ozone Depleting Substances	99.84	0.049
Benzene, Toluene, Ethylbenzene, Xylenes	95.47	7.175
Halogenated Hydrocarbons**	99.62	0.184
Total all VOCs (144 compounds)	98.91	8.004

*Average of three SVOC runs, **excluding Ozone depleting substances

The selected VOCs reported in Table 9 represent 93% of the total VOCs reported at the outlet. BTEX, of which toluene was the largest component, accounted for the majority of the selected VOCs in the flare exhaust. Of all the 144 VOC compounds in the exhaust, toluene was by far the most prominent species accounting for 89% of the total VOCs.

Table 9 - Destruction Efficiencies of Selected VOCs (%)

Compound	Type	Inlet VOCs (µg/min)	Outlet VOCs (µg/min)	Destruction Efficiency (%)
Ozone Depleting Substances				
Freon 22	ODS	138970	14	99.99%
Freon 12	ODS	173391	interference	n/a
Freon 114	ODS	21864	512	97.66%
Freon 11	ODS	16186	26	99.84%
Freon 113	ODS	4254	25	99.42%
Total ODS		354665	577	99.84%
BTEX				
Benzene	CEPA-toxic	36296	717	98.02%
Toluene		846703	82682	90.23%
Ethylbenzene		266306	84	99.97%
m/p-Xylene		547901	149	99.97%
o-Xylene		151688	51	99.97%
Total BTEX		1848894	83684	95.47%
Halogenated Hydrocarbons				
Chloromethane		3185	724	77.28%
Vinylchloride (Chloroethene)	Schedule 1	115352	48	99.96%
1,3-Butadiene	CEPA-toxic	0	293	Formed
Chloroethane		28129	0	100.00%
1,1-Dichloroethene		1079	16	98.50%
Dichloromethane		35896	84	99.76%
t-1,2-Dichloroethene		4930	17	99.65%
1,1-Dichloroethane		25089	0	100.00%
c-1,2-Dichloroethene		133407	19	99.99%
1,2-Dichloroethane		1278	35	97.29%
1,1,1-Trichloroethane		11650	6	99.94%
Trichloroethene	CEPA-toxic	50029	40	99.92%
Tetrachloroethene	CEPA-toxic	111857	200	99.82%
Chlorobenzene		10370	37	99.65%
1,3-Dichlorobenzene		4253	35	99.19%
1,4-Dichlorobenzene		21213	89	99.58%
1,2-Dichlorobenzene		1454	38	97.40%
1,2,4-Trichlorobenzene		808	124	84.61%
Naphthalene		3734	193	94.84%
Hexachlorobutadiene		0	145	Formed
Total halogenated		563713	2143	99.62%
Total (all of the above)				
		2767271	86403	96.88%
TOTAL (all VOCs)				
		8548881	93346	98.91%

"0" denotes not detectable, totals may not add due to rounding, significant digits ignored

7. SUMMARY

The target compounds identified in the landfill gas and flare exhaust are summarized in the following table. Particulate and acid gases were not determined in the landfill gas to the flare. The emissions of the various components detected in the exhaust from the flare are expressed in terms of methane input to the flare.

Detection and Quantification of Target Compounds

LANDFILL GAS			ENCLOSED FLARE EXHAUST		
Component	Detected?		Component	Detected?	(g/m ³ CH ₄)
CO	Yes	Enclosed Flare	CO	Yes	21.52
SO ₂	No		SO ₂	No	
NO/NO ₂ /NO _x	Yes		NO _x *	Yes	0.37
PCDDs/PCDFs	No		PCDDs/PCDFs	Yes	
PAHs	Yes		PAHs	Yes	1.05 • 10 ⁻⁵
HCB	No		HCB	No	
OCS	No		OCS	No	
VOCs	Yes		VOCs	Yes	8.00 • 10 ⁻³
Particulate	Not Done		Particulate	Yes	1.96 • 10 ⁻²
HCl	Not Done		HCl	Yes	1.59 • 10 ⁻²
HF	Not Done		HF	Yes	8.45 • 10 ⁻⁴

*as NO₂

Dioxin and furan emissions were 1.77 pg TEQ/m³ corrected to 11% oxygen. No HCB or OCS was found and the average PAH concentration was 377 ng/m³. The average destruction efficiency for the 144 VOC compounds was 98.91% for the three SVOC runs. The DEs ranged from 95.47% to 99.84% for the three selected groups of VOC compounds.

APPENDIX I

- **Particulate Traverse Data**
- **SVOC Traverse Data**
- **ECOM KL Readings**

TRAIL RD LANDFILL SITE, INCINERATOR TESTING
 PARTICULATE RUN
 DATE: APR. 25/00 TIME: 10:29 - 16:38

PORT	TRAVERSE POINT (NO.)	SAMPLING TIME (min)	STACK GAS TEMP. (oF)	VELOCITY PRESSURE (DPI) (in H2O)	ORIFICE PRESSURE (DHI) (in H2O)	STACK GAS VELOCITY (ft/sec)	INITIAL METER VOLUME (ft3)	FINAL METER VOLUME (ft3)	METER VOLUME SAMPLED (ft3)	INLET METER TEMP. (oF)	OUTLET METER TEMP. (oF)	ISOKIN- ETICITY %	
NORTH	1	5.00	1430	0.02	1.270	12.73	342.845	345.910	3.065	79	76	98.85	
		5.00	1380	0.02	1.240	12.19	345.910	348.910	3.000	82	78	97.84	
		5.00	1380	0.02	1.240	12.19	348.910	351.900	2.990	85	78	97.34	
	2	5.00	1400	0.02	1.380	13.00	351.900	355.020	3.120	89	79	95.88	
		5.00	1460	0.02	1.260	12.83	355.020	358.030	3.010	91	80	98.41	
		5.00	1450	0.02	1.350	13.17	358.030	361.080	3.030	94	82	93.66	
	3	5.00	1450	0.02	1.350	13.17	361.080	364.270	3.210	97	83	98.86	
		5.00	1450	0.02	1.350	13.17	364.270	367.400	3.130	98	84	96.22	
		5.00	1450	0.02	1.350	13.17	367.400	370.530	3.130	99	86	95.96	
	4	5.00	1500	0.02	1.820	14.75	370.530	373.970	3.440	99	87	96.62	
		5.00	1485	0.02	1.820	14.89	373.970	377.380	3.410	100	88	95.23	
		5.00	1489	0.02	1.640	14.71	377.380	380.820	3.440	100	89	96.09	
	5	5.00	1550	0.03	2.020	16.85	380.820	384.630	3.810	101	90	95.72	
		5.00	1580	0.03	2.000	16.98	384.630	388.470	3.840	102	91	97.01	
		5.00	1570	0.03	2.000	16.94	388.470	392.270	3.800	103	91	95.68	
	6	5.00	1580	0.04	2.490	18.98	392.270	396.450	4.180	102	91	94.56	
		5.00	1625	0.03	2.300	18.63	396.450	400.610	4.160	102	92	97.85	
		5.00	1610	0.03	2.320	18.57	400.610	404.700	4.090	102	92	95.86	
	7	5.00	1450	0.02	1.370	13.17	404.700	407.890	3.190	101	92	97.10	
		5.00	1480	0.02	1.350	13.27	407.890	411.040	3.150	100	92	96.72	
		5.00	1450	0.02	1.370	13.17	411.040	414.240	3.200	98	92	97.67	
	8	5.00	1440	0.02	1.350	13.14	414.240	417.440	3.200	98	92	97.41	
		5.00	1475	0.02	1.350	13.26	417.440	420.680	3.240	98	92	99.53	
		5.00	1480	0.02	1.350	13.27	420.680	423.850	3.170	98	92	97.51	
	9	5.00	1470	0.02	1.350	13.24	423.850	427.030	3.180	98	92	97.56	
		5.00	1480	0.02	1.350	13.27	427.030	430.150	3.120	98	92	95.97	
		5.00	1450	0.02	1.410	13.17	430.150	433.350	3.200	97	91	97.88	
	10	5.00	1420	0.02	1.390	13.07	433.350	436.500	3.150	97	91	95.56	
		5.00	1420	0.02	1.390	13.07	436.500	439.660	3.180	96	91	95.95	
		5.00	1440	0.02	1.380	13.14	439.660	442.790	3.130	96	91	95.54	
	11	5.00	1450	0.02	1.370	13.17	442.790	445.900	3.110	97	90	95.18	
		5.00	1480	0.02	1.350	13.27	445.900	449.020	3.120	97	90	96.23	
		5.00	1470	0.02	1.350	13.24	448.020	452.150	3.130	97	90	96.29	
	12	5.00	1470	0.02	1.350	13.24	452.150	455.280	3.110	96	90	95.76	
		5.00	1480	0.02	1.350	13.27	455.280	458.370	3.110	96	90	96.01	
		5.00	1480	0.02	1.350	13.27	458.370	461.520	3.150	96	90	97.24	
	WEST	1	5.00	1450	0.02	1.370	13.17	461.520	464.650	3.130	92	89	98.32
			5.00	1400	0.01	0.933	10.81	464.650	467.390	2.740	91	88	101.88
			5.00	1420	0.01	0.930	10.67	467.390	470.020	2.630	91	88	98.41
		2	5.00	1510	0.02	1.170	12.61	470.020	472.890	2.870	90	88	95.34
			5.00	1480	0.02	1.190	12.52	472.890	475.780	2.890	90	88	95.45
			5.00	1430	0.02	1.220	12.35	475.780	478.760	2.980	90	86	97.16
		3	5.00	1500	0.02	1.180	12.58	478.760	481.650	2.890	90	86	95.94
			5.00	1510	0.02	1.170	12.61	481.650	484.530	2.880	90	85	95.94
			5.00	1490	0.02	1.180	12.55	484.530	487.400	2.870	90	85	95.12
		4	5.00	1480	0.02	1.190	12.52	487.400	490.270	2.870	90	85	94.88
			5.00	1480	0.02	1.190	12.52	490.270	493.170	2.900	90	85	95.87
			5.00	1480	0.02	1.190	12.52	493.170	496.040	2.870	90	85	94.88
5		5.00	1488	0.02	1.180	12.54	496.040	498.980	2.940	90	85	97.34	
		5.00	1481	0.02	1.340	13.28	498.980	502.100	3.120	91	86	87.13	
		5.00	1497	0.01	0.980	11.33	502.100	504.880	2.780	91	86	102.16	
6		5.00	1466	0.02	1.350	13.23	504.880	508.000	3.120	92	86	96.67	
		5.00	1501	0.02	1.820	14.76	508.000	511.390	3.390	91	86	96.02	
		5.00	1503	0.02	1.250	12.98	511.390	514.470	3.080	93	86	99.02	
7		5.00	1388	0.02	1.870	14.98	514.470	518.100	3.630	93	86	95.44	
		5.00	1398	0.02	1.710	14.36	518.100	521.660	3.560	94	87	97.81	
		5.00	1415	0.02	1.540	13.76	521.660	525.040	3.380	94	87	97.80	
8		5.00	1415	0.03	2.080	15.98	525.040	528.840	3.800	94	87	94.76	
		5.00	1321	0.02	1.300	11.99	528.840	531.980	3.140	94	87	98.95	
		5.00	1460	0.02	1.660	14.60	531.980	535.490	3.510	95	88	97.85	
9		5.00	1330	0.03	2.020	15.03	535.490	539.170	3.680	95	88	93.00	
		5.00	1323	0.03	2.030	15.00	539.170	543.020	3.850	95	88	97.11	
		5.00	1333	0.02	1.450	12.78	543.020	546.390	3.370	96	88	100.13	
10		5.00	1309	0.02	1.560	13.02	546.390	549.760	3.370	96	90	96.74	
		5.00	1253	0.02	1.610	12.82	549.760	553.170	3.410	96	90	96.34	
		5.00	1328	0.03	2.110	15.32	553.170	557.040	3.870	96	90	95.61	
11		5.00	1338	0.02	1.540	13.12	557.040	560.530	3.490	99	91	100.58	
		5.00	1410	0.03	2.020	15.66	560.530	564.310	3.780	97	91	95.31	
		5.00	1330	0.02	1.790	14.10	564.310	568.010	3.700	99	92	98.90	
12		5.00	1300	0.02	1.900	14.29	568.010	571.750	3.740	99	92	96.98	
		5.00	1268	0.02	1.690	13.21	571.750	575.340	3.590	100	93	98.69	
		5.00	1292	0.02	1.670	13.30	575.340	578.850	3.510	99	93	97.24	
AVE.			1443.01		1.49	13.85				95.03	88.01	96.83	

TRAIL RD LANDFILL SITE, INCINERATOR TESTING PARTICULATE RUN DATE: APR. 25/00 TIME: 10:29 - 16:38

LIST OF CONSTANTS

Pitot tube factor	0.789	cv		
Meter calibration factor	0.994	y		
Nozzle diameter	0.750	in	19.05	mm
Barometric pressure	29.74	in Hg	755.40	mm Hg
Stack area	56.745	ft ²	5.272	m ²
Static press.	-0.16	in H ₂ O	-4.06	mm H ₂ O

STACK GAS CHARACTERISTICS

Average velocity		13.65	ft/sec	4.16	m/sec
Average temperature		1443.01	Deg F	783.90	Deg C
Volumetric flowrate		12096.8	ft ³ /min	342.6	m ³ /min
Molecular weight		28.70	Me		
Flue gas composition					
		dry	wet		
O ₂	29.53	13.85	12.85	%	
CO ₂		6.10	5.66	%	
SO ₂		0.00	0.00	%	
N ₂		80.05	74.29	%	
H ₂ O			7.19	%	

SAMPLING DATA

Total volume sampled	227.904	ft ³	6.454	m ³
Total sampling time	360.00	min		
Isokineticity (ave.)	98.83	%		
Front-half catch (probe)	0.00000	gm		
Front-half catch (filter)	0.00000	gm		
Back-half catch (imp.)	0.00000	gm		
Water catch in impingers	367.79	gm		

EMISSION DATA

			VALUES CORRECTED TO			
			50%EA	11%O ₂	12%CO ₂	3%O ₂
Particulate concentration	0.000	mg/m ³	0.0	0.0	0.0	0.0
Particulate emission rate	0.000	kg/hr				
	0.000	kg/day				
Gaseous concentration	0.00E+00	mg/m ³	0.000	0.000	0.000	
Gaseous emission rate	0.00E+00	gm/hr				
	0.000	kg/day				
Excess Air (percent)	190.2	%				
AIR INFILTRATION (%)		%				
FUEL FACTOR	1.16	Fo				

* Gas Volumes are reported on dry basis at 25 Deg C and 101.3 kPa

TRAIL RD LANDFILL SITE, INCINERATOR TESTING

SVOC RUN # 1

DATE: APR. 18/00 TIME: 10:45 - 14:51

PORT	TRAVERSE POINT (NO.)	SAMPLING TIME (min)	STACK	VELOCITY	ORIFICE	STACK	INITIAL	FINAL	METER	INLET METER TEMP. (oF)	OUTLET METER TEMP. (oF)	ISOKIN- ETICITY %
			GAS TEMP. (oF)	PRESSURE (DPI) (in H2O)	PRESSURE (DHI) (in H2O)	GAS VELOCITY (ft/sec)	METER VOLUME (ft3)	METER VOLUME (ft3)	VOLUME SAMPLED (ft3)			
WEST	1	5.00	1435	0.02	1.080	11.96	888.888	891.680	2.792	68	66	99.25
		5.00	1470	0.01	0.910	11.24	891.680	894.250	2.570	74	68	98.26
	2	5.00	1580	0.02	0.990	12.41	894.250	896.950	2.700	78	70	98.26
		5.00	1560	0.02	1.000	12.35	896.950	899.700	2.750	80	71	99.31
	3	5.00	1610	0.02	1.180	13.69	899.700	902.540	2.840	84	71	94.47
		5.00	1600	0.02	1.120	13.27	902.540	905.420	2.880	86	73	97.96
	4	5.00	1610	0.02	1.190	13.69	905.420	908.320	2.900	89	76	95.58
		5.00	1600	0.02	1.200	13.66	908.320	911.260	2.940	90	77	96.49
	5	5.00	1630	0.02	1.200	13.76	911.260	914.170	2.910	92	79	95.84
		5.00	1620	0.02	1.330	14.47	914.170	917.230	3.060	93	80	95.24
	6	5.00	1620	0.02	1.200	13.72	917.230	920.210	2.980	95	82	97.38
		5.00	1631	0.02	1.330	14.51	920.210	923.280	3.070	95	83	95.37
	7	5.00	1584	0.02	1.220	13.61	923.280	926.410	3.130	96	84	101.12
		5.00	1594	0.02	1.550	15.42	926.410	929.750	3.340	97	85	95.59
	8	5.00	1558	0.02	1.380	14.25	929.750	932.890	3.140	98	86	95.31
		5.00	1553	0.02	1.530	14.93	932.890	936.200	3.310	98	87	95.63
	9	5.00	1642	0.02	1.470	15.25	936.200	939.580	3.380	98	88	99.68
		5.00	1551	0.02	1.600	15.25	939.580	942.820	3.240	99	88	91.35
	10	5.00	1594	0.03	1.780	16.39	942.820	946.380	3.560	100	89	95.26
		5.00	1599	0.03	1.980	17.33	946.380	950.150	3.770	101	90	95.53
	11	5.00	1628	0.03	1.880	17.15	950.150	953.860	3.710	102	90	96.24
		5.00	1610	0.03	1.770	16.46	953.860	957.470	3.610	102	91	96.64
	12	5.00	1612	0.03	2.040	17.68	957.470	961.300	3.830	103	92	95.39
		5.00	1599	0.03	2.190	18.21	961.300	965.280	3.980	104	92	95.63
NORTH	1	5.00	1396	0.01	1.010	11.02	965.280	968.570	3.290	98	91	118.15
		5.00	1348	0.01	1.010	10.87	968.570	971.330	2.760	98	92	97.74
	2	5.00	1298	0.02	1.280	11.90	971.330	974.370	3.040	99	92	95.66
		5.00	1521	0.02	1.140	12.63	974.370	977.300	2.930	100	93	97.67
	3	5.00	1506	0.02	1.290	13.34	977.300	980.380	3.080	101	93	96.36
		5.00	1501	0.03	2.000	16.62	980.380	984.070	3.690	101	93	92.82
	4	5.00	1538	0.02	1.410	14.18	984.070	987.340	3.270	103	94	97.82
		5.00	1590	0.02	1.450	14.72	987.340	990.610	3.270	104	94	96.43
	5	5.00	1616	0.02	1.430	14.81	990.610	993.870	3.260	104	95	96.65
		5.00	1581	0.03	1.950	16.96	993.870	997.590	3.720	104	95	94.82
	6	5.00	1638	0.03	2.300	18.94	997.590	1001.630	4.040	104	95	94.83
		5.00	1616	0.03	1.910	17.10	1001.630	1005.430	3.800	105	96	97.50
	7	5.00	1636	0.03	1.830	16.87	1005.430	1009.170	3.740	105	96	98.18
		5.00	1561	0.02	1.052	12.35	1009.170	1012.010	2.840	104	95	98.20
	8	5.00	1591	0.02	1.383	14.37	1012.010	1015.200	3.190	103	95	96.40
		5.00	1555	0.02	1.550	14.93	1015.200	1018.590	3.390	102	95	96.94
	9	5.00	1530	0.02	1.210	13.05	1018.590	1021.640	3.050	102	95	98.52
		5.00	1579	0.02	1.320	13.96	1021.640	1024.750	3.110	101	94	96.38
	10	5.00	1560	0.02	1.610	15.29	1024.750	1028.150	3.400	100	93	95.56
		5.00	1588	0.02	1.520	15.06	1028.150	1031.510	3.360	100	93	97.21
	11	5.00	1599	0.02	1.240	13.66	1031.510	1034.560	3.050	101	93	97.66
		5.00	1538	0.02	1.340	13.81	1034.560	1037.700	3.140	100	93	96.46
	12	5.00	1527	0.02	1.210	13.04	1037.700	1040.730	3.030	99	92	98.33
		5.00	1579	0.02	1.250	13.59	1040.730	1043.780	3.050	99	92	97.45
AVE.			1564.2		1.433	14.45				97.06	87.65	97.09

TRAIL RD LANDFILL SITE, INCINERATOR TESTING

SVOC RUN # 1

DATE: APR. 18/00 TIME: 10:45 - 14:51

LIST OF CONSTANTS

Pitot tube factor	0.789	cv		
Meter calibration factor	0.994	y		
Nozzle diameter	0.750	in	19.05	mm
Barometric pressure	29.83	in Hg	757.68	mm Hg
Stack area	58.745	ft2	5.272	m2
Static press.	-0.18	in H2O	-4.06	mm H2O

STACK GAS CHARACTERISTICS

Average velocity		14.45	ft/sec	4.40	m/sec
Average temperature		1584.17	Deg F	851.20	Deg C
Volumetric flowrate		11921.6	ft3/min	337.8	m3/min
Molecular weight	Md	29.68	Me		
Flue gas composition		dry	wet		
O2		12.15	11.13	%	
CO2		7.45	8.83	%	
SO2		0.00	0.00	%	
N2		80.40	73.68	%	
H2O			8.36	%	

SAMPLING DATA

Total volume sampled		149.778	ft3	4.242	m3
Total sampling time		240.00	min		
Isokineticity (ave.)		97.09	%		
Front-half catch (probe)		0.00000	gm		
Front-half catch (filter)		0.00000	gm		
Back-half catch (imp.)		0.00000	gm		
Water catch in impingers		284.74	gm		

EMISSION DATA

		VALUES CORRECTED TO			
		50%EA	11%O2	12%CO2	3%O2
Particulate concentration	0.000	mg/m3	0.0	0.0	0.0
Particulate emission rate	0.000	kg/hr			
	0.000	kg/day			
Gaseous concentration	0.00E+00	mg/m3	0.000	0.000	0.000
Gaseous emission rate	0.00E+00	gm/hr			
	0.000	kg/day			
Excess Air (percent)	133.9	%			
AIR INFILTRATION (%)		%			
FUEL FACTOR	1.17	Fo			

* Gas Volumes are reported on dry basis at 25 Deg C and 101.3 kPa

TRAIL RD LANDFILL SITE, INCINERATOR TESTING

SVOC RUN # 2

DATE: APR. 19/00 TIME: 10:18 - 14:25

PORT	TRAVERSE POINT (NO.)	SAMPLING TIME (min)	STACK GAS TEMP. (oF)	VELOCITY PRESSURE (DP) (in H2O)	ORIFICE PRESSURE (DH) (in H2O)	STACK GAS VELOCITY (ft/sec)	INITIAL METER VOLUME (ft3)	FINAL METER VOLUME (ft3)	METER VOLUME SAMPLED (ft3)	INLET METER TEMP. (oF)	OUTLET METER TEMP. (oF)	ISOKIN- ETICITY %
NORTH	1	5.00	1480	0.02	1.185	12.48	44.375	47.500	3.125	76	74	106.77
		5.00	1465	0.02	1.110	12.08	47.500	50.380	2.880	79	75	100.66
	2	5.00	1500	0.02	1.090	12.19	50.380	53.180	2.820	84	76	99.59
		5.00	1500	0.01	1.020	11.78	53.180	56.220	3.040	88	77	110.80
	3	5.00	1510	0.02	1.310	13.39	56.220	58.890	2.670	88	78	85.88
		5.00	1510	0.02	1.310	13.39	58.890	61.990	3.100	91	79	99.33
	4	5.00	1550	0.02	1.220	13.14	61.990	64.840	2.850	93	81	94.54
		5.00	1550	0.02	1.370	13.90	64.840	67.900	3.060	94	82	95.88
	5	5.00	1580	0.02	1.710	15.73	67.900	71.390	3.490	97	83	97.75
		5.00	1590	0.02	1.710	15.77	71.390	74.720	3.330	99	85	93.16
	6	5.00	1620	0.03	1.970	17.16	74.720	78.370	3.650	100	87	95.02
		5.00	1630	0.03	2.030	17.51	78.370	82.150	3.780	102	88	96.68
WEST	7	5.00	1590	0.02	1.360	14.03	82.150	85.390	3.240	102	90	101.05
		5.00	1580	0.02	1.370	14.00	85.390	88.540	3.150	102	91	97.92
	8	5.00	1570	0.01	0.940	11.55	88.540	91.420	2.880	102	91	107.85
		5.00	1580	0.02	1.080	12.44	91.420	94.130	2.710	101	91	94.82
	9	5.00	1592	0.02	1.080	12.48	94.130	96.930	2.800	101	92	98.17
		5.00	1556	0.01	1.020	11.95	96.930	99.740	2.810	100	92	101.16
	10	5.00	1552	0.02	1.170	12.76	99.740	102.620	2.880	101	92	98.84
		5.00	1574	0.01	1.020	12.00	102.620	105.410	2.790	101	93	100.71
	11	5.00	1582	0.02	1.160	12.85	105.410	108.280	2.870	101	93	97.13
		5.00	1569	0.02	1.170	12.81	108.280	111.160	2.880	101	93	97.16
	12	5.00	1572	0.01	1.020	11.99	111.160	113.980	2.820	102	93	101.65
		5.00	1575	0.01	1.020	12.00	113.980	116.771	2.791	102	94	100.59
	1	5.00	1584	0.01	1.010	12.03	116.771	119.890	3.119	97	93	113.26
		5.00	1593	0.02	1.080	12.48	119.890	122.700	2.810	98	92	98.81
	2	5.00	1627	0.02	1.280	13.78	122.700	125.670	2.970	99	93	96.00
		5.00	1554	0.01	1.030	11.94	125.670	128.480	2.810	100	93	101.02
	3	5.00	1600	0.01	1.000	12.08	128.480	131.250	2.770	99	93	100.80
		5.00	1654	0.02	1.050	12.66	131.250	134.040	2.790	99	93	99.37
	4	5.00	1664	0.02	1.180	13.51	134.040	136.900	2.860	99	93	95.94
		5.00	1655	0.02	1.190	13.48	136.900	139.780	2.880	98	92	96.58
	5	5.00	1620	0.02	1.210	13.37	139.780	142.720	2.940	98	92	97.78
		5.00	1640	0.02	1.410	14.57	142.720	145.820	3.100	98	92	95.56
	6	5.00	1668	0.02	1.320	14.30	145.820	148.900	3.080	98	91	98.12
		5.00	1660	0.02	1.320	14.27	148.900	152.010	3.110	97	91	98.98
	7	5.00	1595	0.02	1.360	14.05	152.010	155.130	3.120	98	91	97.69
		5.00	1600	0.02	1.280	13.69	155.130	158.200	3.070	98	90	98.95
	8	5.00	1600	0.02	1.430	14.43	158.200	161.380	3.180	97	90	97.38
		5.00	1600	0.02	1.360	14.07	161.380	164.530	3.150	97	90	98.92
	9	5.00	1580	0.02	1.440	14.36	164.530	167.760	3.230	97	90	98.41
		5.00	1593	0.02	1.220	13.28	167.760	170.820	3.060	97	90	101.39
	10	5.00	1590	0.02	1.360	14.03	170.820	173.930	3.110	97	90	97.43
		5.00	1573	0.02	1.370	13.98	173.930	177.060	3.130	97	89	97.74
	11	5.00	1582	0.02	1.290	13.63	177.060	180.130	3.070	97	89	98.69
		5.00	1574	0.02	1.440	14.34	180.130	183.290	3.160	97	89	96.22
	12	5.00	1583	0.02	1.360	14.01	183.290	186.450	3.160	98	89	98.83
		5.00	1588	0.02	1.360	14.03	186.450	189.607	3.157	98	89	98.86
AVE.			1582.0		1.267	13.45				96.94	88.63	98.83

TRAIL RD LANDFILL SITE, INCINERATOR TESTING

SVOC RUN # 2

DATE: APR. 19/00 TIME: 10:18 - 14:25

LIST OF CONSTANTS

Pitot tube factor	0.769	cv		
Meter calibration factor	0.994	y		
Nozzle diameter	0.750	in	19.05	mm
Barometric pressure	29.74	in Hg	755.40	mm Hg
Stack area	58.745	ft2	5.272	m2
Static press.	-0.18	in H2O	-4.06	mm H2O

STACK GAS CHARACTERISTICS

Average velocity		13.45	ft/sec	4.10	m/sec
Average temperature		1581.98	Deg F	881.09	Deg C
Volumetric flowrate		10931.8	ft3/min	308.6	m3/min
Molecular weight	Md	29.85	Me		
Flue gas composition		dry	wet		
	O2	13.15	12.01	%	
	CO2	7.05	8.44	%	
	SO2	0.00	0.00	%	
	N2	79.80	72.88	%	
	H2O		8.67	%	

SAMPLING DATA

Total volume sampled	139.849	ft3	3.961	m3
Total sampling time	240.00	min		
Isokineticity (ave.)	98.83	%		
Front-half catch (probe)	0.00000	gm		
Front-half catch (filter)	0.00000	gm		
Back-half catch (imp.)	0.00000	gm		
Water catch in impingers	276.48	gm		

EMISSION DATA

		VALUES CORRECTED TO			
		50%EA	11%O2	12%CO2	3%O2
Particulate concentration	0.000 mg/m3	0.0	0.0	0.0	0.0
Particulate emission rate	0.000 kg/hr				
	0.000 kg/day				
Gaseous concentration	0.00E+00 mg/m3	0.000	0.000	0.000	
Gaseous emission rate	0.00E+00 gm/hr				
	0.000 kg/day				
Excess Air (percent)	186.1 %				
AIR INFILTRATION (%)	%				
FUEL FACTOR	1.10 Fo				

* Gas Volumes are reported on dry basis at 25 Deg C and 101.3 kPa

TRAIL RD LANDFILL SITE, INCINERATOR TESTING

SVOC RUN # 3

DATE: APR. 20/00 TIME: 9:54 - 14:00

PORT	TRAVERSE POINT (NO.)	SAMPLING TIME (min)	STACK	VELOCITY	ORIFICE	STACK	INITIAL	FINAL	METER	INLET METER TEMP. (oF)	OUTLET	ISOKIN- ETICITY %
			GAS TEMP. (oF)	PRESSURE (DP) (in H2O)	PRESSURE (DH) (in H2O)	GAS VELOCITY (ft/sec)	METER VOLUME (ft3)	METER VOLUME (ft3)	VOLUME SAMPLED (ft3)		METER TEMP. (oF)	
WEST	1	5.00	1588	0.02	1.210	13.27	189.875	192.850	2.975	81	80	101.06
		5.00	1624	0.02	1.110	12.98	192.850	195.640	2.790	83	80	98.34
	2	5.00	1566	0.02	1.210	13.20	195.640	198.550	2.910	86	81	97.77
		5.00	1573	0.02	1.350	13.97	198.550	201.630	3.080	89	82	97.73
	3	5.00	1604	0.02	1.270	13.71	201.630	204.630	3.000	91	83	98.25
		5.00	1636	0.02	1.320	14.19	204.630	207.690	3.060	93	83	98.13
	4	5.00	1646	0.02	1.310	14.22	207.690	210.760	3.070	94	84	98.50
		5.00	1648	0.02	1.380	14.60	210.760	213.990	3.230	95	85	100.89
	5	5.00	1648	0.02	1.380	14.60	213.990	217.020	3.030	96	86	94.48
		5.00	1645	0.02	1.520	15.30	217.020	220.300	3.280	97	86	97.39
	6	5.00	1642	0.02	1.670	15.97	220.300	223.740	3.440	98	87	97.58
		5.00	1616	0.02	1.620	15.54	223.740	227.140	3.400	99	87	97.81
	7	5.00	1633	0.02	1.260	13.80	227.140	230.110	2.970	99	88	96.80
		5.00	1609	0.02	1.270	13.72	230.110	233.130	3.020	99	89	97.78
	8	5.00	1552	0.02	1.380	13.90	233.130	236.260	3.130	99	90	97.21
		5.00	1575	0.02	1.440	14.34	236.260	239.400	3.140	100	90	95.52
	9	5.00	1580	0.02	1.370	14.00	239.400	242.520	3.120	100	91	97.39
		5.00	1574	0.02	1.300	13.61	242.520	245.610	3.090	100	91	98.93
	10	5.00	1674	0.02	1.650	16.09	245.610	249.010	3.400	100	91	96.65
		5.00	1577	0.02	1.590	15.05	249.010	252.410	3.400	101	92	98.43
	11	5.00	1583	0.03	1.870	16.39	252.410	256.070	3.660	102	92	97.59
		5.00	1563	0.02	1.530	14.66	256.070	259.400	3.330	103	93	98.05
	12	5.00	1625	0.02	1.270	13.77	259.400	262.470	3.070	103	93	98.06
		5.00	1633	0.02	1.410	14.55	262.470	265.648	3.178	102	93	97.53
NORTH	1	5.00	1449	0.01	1.080	11.62	265.648	268.570	2.924	97	92	102.87
		5.00	1530	0.02	1.110	12.28	268.570	271.420	2.850	97	93	98.91
	2	5.00	1520	0.01	0.890	10.96	271.420	274.020	2.600	98	92	100.58
		5.00	1537	0.02	1.180	12.71	274.020	276.910	2.890	98	93	97.13
	3	5.00	1564	0.01	1.020	11.97	276.910	279.890	2.780	98	92	100.81
		5.00	1538	0.02	1.330	13.48	279.890	282.810	3.120	99	92	99.01
	4	5.00	1527	0.02	1.700	15.20	282.810	286.310	3.500	99	92	98.08
		5.00	1525	0.02	1.630	14.86	286.310	289.750	3.440	99	92	98.50
	5	5.00	1623	0.03	1.980	17.17	289.750	293.530	3.780	100	92	98.27
		5.00	1655	0.03	2.090	17.91	293.530	291.430	-2.100	101	93	-53.07
	6	5.00	1633	0.03	2.180	18.11	291.430	301.440	10.010	101	92	247.82
		5.00	1652	0.03	2.090	17.90	301.440	305.360	3.920	101	92	99.08
	7	5.00	1638	0.02	1.120	13.03	305.360	308.250	2.890	101	92	99.45
		5.00	1538	0.02	1.330	13.48	308.250	311.390	3.140	101	92	99.47
	8	5.00	1584	0.02	1.300	13.64	311.390	314.500	3.110	100	92	98.73
		5.00	1594	0.02	1.570	15.11	314.500	317.830	3.330	99	92	96.98
	9	5.00	1554	0.02	1.310	13.54	317.830	320.920	3.090	99	91	98.54
		5.00	1597	0.02	1.360	14.06	320.920	324.050	3.130	99	92	98.10
	10	5.00	1568	0.02	1.310	13.59	324.050	327.160	3.110	100	92	99.34
		5.00	1575	0.02	1.300	13.61	327.160	330.240	3.080	99	91	98.72
	11	5.00	1633	0.02	1.340	14.18	330.240	333.340	3.100	99	92	98.01
		5.00	1584	0.02	1.220	13.25	333.340	336.380	3.040	99	91	100.47
	12	5.00	1520	0.02	1.340	13.42	336.380	339.490	3.110	99	92	98.25
		5.00	1562	0.02	1.310	13.57	339.490	342.548	3.058	99	91	97.71
AVE.			1589.9		1.412	14.25				97.79	89.67	98.36

TRAIL RD LANDFILL SITE, INCINERATOR TESTING

SVOC RUN # 3

DATE: APR. 20/00 TIME: 9:54 - 14:00

LIST OF CONSTANTS

Pitot tube factor	0.789	cv		
Meter calibration factor	0.994	y		
Nozzle diameter	0.750	in	19.05	mm
Barometric pressure	29.77	in Hg	756.16	mm Hg
Stack area	56.745	ft2	5.272	m2
Static press.	-0.16	in H2O	-4.06	mm H2O

STACK GAS CHARACTERISTICS

Average velocity		14.25	ft/sec	4.34	m/sec
Average temperature		1589.88	Deg F	865.49	Deg C
Volumetric flowrate		11520.5	ft3/min	326.3	m3/min
Molecular weight	Md	29.85			
Flue gas composition					
		dry	wet		
	O2	13.15	11.98	%	
	CO2	7.05	6.42	%	
	SO2	0.00	0.00	%	
	N2	79.80	72.72	%	
	H2O		8.88	%	

SAMPLING DATA

Total volume sampled		146.963	ft3	4.162	m3
Total sampling time		240.00	min		
Isokineticity (ave.)		98.36	%		
Front-half catch (probe)		0.00000	gm		
Front-half catch (filter)		0.00000	gm		
Back-half catch (imp.)		0.00000	gm		
Water catch in impingers		298.27	gm		

EMISSION DATA

			VALUES CORRECTED TO			
			50%EA	11%O2	12%CO2	3%O2
Particulate concentration	0.000	mg/m3	0.0	0.0	0.0	0.0
Particulate emission rate	0.000	kg/hr				
	0.000	kg/day				
Gaseous concentration	0.00E+00	mg/m3	0.000	0.000	0.000	
Gaseous emission rate	0.00E+00	gm/hr				
	0.000	kg/day				
Excess Air (percent)	166.1	%				
AIR INFILTRATION (%)		%				
FUEL FACTOR	1.10	Fo				

* Gas Volumes are reported on dry basis at 25 Deg C and 101.3 kPa

Gaseous Data From Trail Road Flare

Standards:

CO 9683
NS 1256

O ₂	CO	NO	NO ₂	NO _x	SO ₂	CO ₂	Bal
(%)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(%)	
22.01	902	-	-	-	270	18.01	N ₂
-	210	95.9	-	95.9	-	4.98	N ₂

April 18, 2000

Organic Sampling Run # 1

	Time of Day	O ₂	CO	CO	NO	NO	NO ₂	NO ₂	NO _x	NO _x	SO ₂	SO ₂	CO ₂	CO ₂
		(%)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(%)	(adjust)
Initial Cal (L)	10:42:00	0.1	430		96		0		96		0		5	
Initial Cal (H)	na	na	na		na		na		na		na		na	
Final Cal (L)	na	na	na		na		na		na		na		na	
Final Cal (H)	15:02:00	0.1	425		93		0		93		0		4.9	
Initial Ambient	10:38:00	20.9	0		0		0		0		0		0	
Final Ambient		20.9	0		0		0		0		0		0	
West Port	10:52:00	13.0	410	410	8	8	1	1	9	9	0	0	4.5	4.5
	11:01:00	13.8	412	412	7	7	1	1	8	8	0	0	6.0	6.0
	11:15:00	14.0	1008	1009	6	6	2	2	8	8	0	0	6.5	6.5
	11:26:00	13.7	924	926	8	8	2	2	10	10	0	0	6.5	6.5
	11:39:00	14.3	984	987	6	6	2	2	8	8	0	0	6.5	6.5
	11:50:00	13.3	937	940	8	8	2	2	10	10	0	0	6.3	6.4
	11:53:00	13.5	427	428	3	3	0	0	3	3	0	0	7.0	7.1
	12:01:00	13.2	940	943	8	8	2	2	10	10	0	0	6.5	6.6
	12:05:00	13.9	836	839	7	7	2	2	9	9	0	0	6.7	6.8
	12:17:00	13.2	500	502	9	9	1	1	10	10	0	0	6.9	7.0
	12:36:00	14.3	1371	1378	6	6	3	3	9	9	0	0	7.2	7.3
	12:54:00	12.4	174	175	11	11	0	0	11	11	0	0	8.0	8.1
	13:21:00	12.4	850	856	8	8	1	1	9	9	0	0	6.7	6.8
	13:23:00	13.0	213	215	5	5	0	0	5	5	0	0	na	na
	13:36:00	12.6	74	75	12	12	0	0	12	12	0	0	8.0	8.2
	13:52:00	13.4	560	565	1	1	0	0	1	1	0	0	7.2	7.4
	14:08:00	13.2	590	595	2	2	0	0	2	2	0	0	7.3	7.5
	14:22:00	13.2	748	755	1	1	0	0	1	1	0	0	7.3	7.5
	14:27:00	11.6	24	24	15	15	0	0	15	15	0	0	7.5	7.7
	14:48:00	13.4	358	362	9	9	1	1	10	10	0	0	7.6	7.8
Average		13.3	617	620	7	7	1	1	8	8	0	0	6.9	7.0
Standard Deviation				354		4		1		4		0		1

April 19, 2000

Organic Sampling Run # 2

	Time of Day	O ₂	CO	CO	NO	NO	NO ₂	NO ₂	NO _x	NO _x	SO ₂	SO ₂	CO ₂	CO ₂
		(%)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(%)	(adjust)
Initial Cal (L)	10:10:00	0.1	210		96		0		96		0		na	
Initial Cal (H)	na	na	na		na		na		na		na		na	
Final Cal (L)	na	na	209		na		na		na		na		na	
Final Cal (H)	15:02:00	0.1	na		93		0		93		0		na	
Initial Ambient	10:18:00	20.9	0		0		0		0		0		na	
Final Ambient	14:24:00	20.9	0		0		0		0		0		na	
North Port	10:22:00	11.4	4	4	12	12	0	0	12	12	0	0	8.5	8.5
	10:34:00	11.4	0	0	12	12	0	0	12	12	0	0	8.9	8.9
	10:51:00	11.2	2	2	12	12	0	0	12	12	0	0	9.2	9.2
	11:10:00	11.4	1	1	12	12	0	0	12	12	0	0	9.4	9.4
	11:30:00	11.0	0	0	12	12	0	0	12	12	0	0	9.3	9.3
	11:52:00	11.2	1	1	12	12	0	0	12	12	0	0	9.1	9.1
	12:14:00	11.4	0	0	11	11	0	0	11	11	0	0	na	na
	12:30:00	13.3	593	594	6	6	2	2	8	8	0	0	6.4	6.4
	12:46:00	13.7	986	989	5	5	3	3	8	8	0	0	7.3	7.3
	12:57:00	14.0	1208	1211	4	4	4	4	8	8	0	0	6.3	6.3
	13:11:00	14.1	1190	1194	6	6	4	4	10	10	0	0	6.3	6.3
	13:28:00	14.2	1312	1316	4	4	4	4	8	8	0	0	6.6	6.6
	13:48:00	13.2	111	111	3	3	0	0	3	3	0	0	7.3	7.3
	13:49:00	13.5	841	844	6	6	3	3	9	9	0	0	na	na
	13:56:00	13.4	837	840	6	6	3	3	9	9	0	0	7.0	7.0
	14:05:00	13.2	90	90	4	4	2	2	6	6	0	0	na	na
	14:06:00	13.6	856	859	6	6	3	3	9	9	0	0	na	na
	14:11:00	13.2	41	41	4	4	0	0	4	4	0	0	na	na
	14:13:00	14	1036	1040	5	5	5	5	10	10	0	0	6.8	6.8
West Port	10:22:00	11.4	4	4	12	12	0	0	12	12	0	0	8.5	8.5
	10:34:00	11.4	0	0	12	12	0	0	12	12	0	0	8.9	8.9
	10:51:00	11.2	2	2	12	12	0	0	12	12	0	0	9.2	9.2
	11:10:00	11.4	1	1	12	12	0	0	12	12	0	0	9.4	9.4
	11:30:00	11.0	0	0	12	12	0	0	12	12	0	0	9.3	9.3
	11:52:00	11.2	1	1	12	12	0	0	12	12	0	0	9.1	9.1
	12:14:00	11.4	0	0	11	11	0	0	11	11	0	0	na	na
	12:30:00	13.3	593	594	6	6	2	2	8	8	0	0	6.4	6.4
	12:46:00	13.7	986	989	5	5	3	3	8	8	0	0	7.3	7.3
	12:57:00	14.0	1208	1211	4	4	4	4	8	8	0	0	6.3	6.3
	13:11:00	14.1	1190	1194	6	6	4	4	10	10	0	0	6.3	6.3
	13:28:00	14.2	1312	1316	4	4	4	4	8	8	0	0	6.6	6.6
	13:48:00	13.2	111	111	3	3	0	0	3	3	0	0	7.3	7.3
	13:49:00	13.5	841	844	6	6	3	3	9	9	0	0	na	na
	13:56:00	13.4	837	840	6	6	3	3	9	9	0	0	7.0	7.0
	14:05:00	13.2	90	90	4	4	2	2	6	6	0	0	na	na
	14:06:00	13.6	856	859	6	6	3	3	9	9	0	0	na	na
	14:11:00	13.2	41	41	4	4	0	0	4	4	0	0	na	na
	14:13:00	14	1036	1040	5	5	5	5	10	10	0	0	6.8	6.8
Average		12.8	479	481	7	8	2	2	9	9	0	0	7.7	7.7
Standard Deviation				504		3		2		3		0		1

April 20, 2000

Organic Sampling Run #3

	Time of Day	O ₂	CO	CO	NO	NO	NO ₂	NO ₂	NO ₂	NO ₂	SO ₂	SO ₂	CO ₂	CO ₂
		(%)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(%)	(adjust)
Initial Cal.(L)	9:36:00	0.1	207		95		0		95		0		5	
Initial Cal.(H)	9:45:00	23.6	902		na		0		na		0		na	
Final Cal.(L)	13:30:00	0.0	207		94		0		94		0		na	
Final Cal.(H)	13:34:00	23.6	923		na		0		na		0		4.9	
Ambient	10:38:00	21.0	0		0		0		0		0		0	
W.P. T.C. Pt 1	9:59:00	11.5	18		10		0		10		0		9.3	
N.P. H.L.	10:02:00	14.6	506		7		1		8		0		5.2	
W.P. T.C. Pt 2	10:07:00	11.6	41		9		0		9		0		8.9	
N.P. H.L.	10:13:00	15.2	871		5		2		7		0		5.2	
W.P. T.C. Pt 3	10:18:00	11.2	17		9		0		9		0		9.4	
N.P. H.L.	10:23:00	15.2	500		6		1		7		0		5.3	
W.P. T.C. Pt 4	10:29:00	11.1	13		9		0		9		0		9.3	
N.P. H.L.	10:34:00	14.6	631		6		1		7		0		5.7	
W.P. T.C. Pt 5	10:37:00	11.6	51		8		0		8		0		9.2	
N.P. H.L.	10:45:00	14.6	533		6		1		7		0		6.0	
W.P. T.C. Pt 6	10:50:00	11.8	114		6		0		6		0		8.9	
N.P. H.L.	10:54:00	15.0	500		6		1		7		0		5.3	
W.P. T.C. Pt 7	10:58:00	12.7	150		5		0		5		0		7.8	
N.P. H.L.	11:02:00	15.1	748		5		2		7		0		5.3	
W.P. T.C. Pt 8	11:06:00	13.0	563		3		0		3		0		8.0	
N.P. H.L.	11:11:00	15.7	684		5		2		7		0		5.0	
W.P. T.C. Pt 9	11:18:00	12.3	151		5		0		5		0		8.3	
N.P. H.L.	11:24:00	15.2	554		7		1		8		0		4.7	
W.P. T.C. Pt 9	11:28:00	13.0	565		3		0		3		0		7.8	
N.P. H.L.	11:34:00	13.0	500		3		0		3		0		7.9	
T.C. N.P. Pt 1	12:00:00	13.5	890		3		0		3		0		7.7	
N.P. H.L.	12:05:00	14.3	541		6		1		7		0		6.2	
T.C. N.P. Pt 2	12:10:00	13.2	724		10		0		10		0		7.6	
N.P. H.L.	12:17:00	14.7	331		9		1		10		0		6.2	
T.C. N.P. Pt 3	12:19:00	13.1	685		3		0		3		0		7.8	
N.P. H.L.	12:23:00	14.4	526		7		1		8		0		6.0	
T.C. N.P. Pt 4	12:30:00	12.1	326		3		0		3		0		8.5	
N.P. H.L.	12:33:00	14.1	504		7		1		8		0		6.1	
T.C. N.P. Pt 5	12:39:00	11.3	140		6		0		6		0		8.4	
N.P. H.L.	12:47:00	14.2	8		9		0		9		0		5.7	
T.C. N.P. Pt 6	12:51:00	11.0	65		7		0		7		0		9.4	
N.P. H.L.	12:57:00	14.1	39		8		0		8		0		6.3	
T.C. N.P. Pt 7	13:02:00	13.1	704		2		0		2		0		7.5	
N.P. H.L.	13:09:00	13.9	17		8		0		8		0		5.7	
T.C. N.P. Pt 8	13:13:00	13.2	664		2		0		2		0		7.8	
Average		13.4	396		6		0		7		0		7.1	
Standard Deviation					278				1		2		0	

April 25, 2000

Particulate Sampling Combined Run 1-3

	Time of Day	O ₂	CO	CO	NO	NO	NO ₂	NO ₂	NO ₂	NO ₂	SO ₂	SO ₂	CO ₂	CO ₂
		(%)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(ppm)	(adjust)	(%)	(adjust)
Initial Cal.(L)	10:14:00	0.1	206		na		0		na		274		11.6	
Initial Cal.(H)	10:18:00	23.9	903.0		96.0		na		96.0		na		12.6	
Final Cal.(L)	na	na	na		na		na		na		na		na	
Final Cal.(H)	na	na	na		na		0		na		na		na	
Ambient	10:25:00	20.9	2		0		0		0		2		na	
N.P. Pt. 1	10:27:00	14.6	1087		2		0		2		0		4.8	
Pt. 2	10:44:00	14.9	1291		2		0		2		0		5.8	
Pt. 3	10:58:00	14.2	1123		3		0		3		0		6.5	
Pt. 4	11:13:00	13.9	1043		4		0		4		0		7.3	
Pt. 6	11:44:00	12.0	262		9		0		9		0		8.8	
Pt. 7	12:06:00	14.4	1579		4		0		4		0		6.3	
Pt. 8	12:24:00	14.0	1416		4		0		4		0		6.6	
Pt. 8	12:54:00	14.0	1368		4		0		4		0		6.7	
W.P. Pt. 1	13:35:00	13.5	571		6		0		6		0		7.2	
Pt. 4	14:19:00	13.2	659		5		0		5		0		7.4	
Pt. 8	15:25:00	14.5	1621		2		0		2		0		6.1	
Average		13.9	1093						4		0		6.7	
Standard Deviation											0			

*Note: No final calibration available to correct for drift

APPENDIX II

- **Ion Chromatography Report**
- **Dioxin, Furan, HCB and PAH Analytical Report**
- **SVOC Proofing Analysis**
- **VOC Analysis**
- **SVOC Analysis**

MEMORANDUM - NOTE DE SERVICE

TO/A:
Ian D. Rigden
Source Testing Unit, ERMD

Date: April 27th, 2000

From/De:
Maria Piechowski
Inorganic Section, AAQD

Subject/Objet: **Particulate Emission Samples a Landfill Gas Flare.**

Please find attached Fluoride and Chloride results for 2 water samples. The analyses were performed using Ion Chromatography DX-300/AS11 System.

CLIENT:	Source Testing Unit - ERMD
PROJECT:	Highland Energy <i>TRAIL ROAD</i>
SAMPLES:	Particulate Emission Samples a Landfill Gas Flare
METHOD:	DX-300/AS11
Numbers of samples:	2
Analyst:	M. Piechowski
Approved:	Dr. E. Dabek

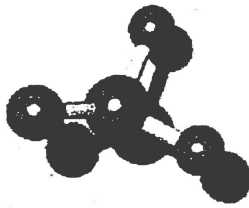
Received:	26-Apr-00
Analyzed:	26-Apr-00
Reported:	27-Apr-00

Sample	Concentration, [µg/mL]		<i>Volume mL</i>
	Fluoride	Chloride	
0004090/Back half	0.244	4.57	710
0004091/BLANK	0.013	0.01	350
DL [µg/mL]	0.002	0.01	
QL [µg/mL]	0.007	0.04	

Please do not hesitate to contact me further, if required

Maria Piechowski

cc: Dr. Ewa Dabek
Richard Turle, Division Chief



*Analysis & Air Quality Division
ETC, Environment Canada
3439 River Road, Ottawa, Ontario K1A 0H3
Tel.: (613) 990-8564 / Fax: (613) 990-8568
poole.gary@etc.ec.gc.ca*

June 12, 2000

Ian Rigden
ERMD, ETC

Re: Results for Trail Road Landfill

Ian:

Attached please find the OCS results for blank XAD, XAD-raw gas, 3 trains and the blank train. Also included are the results of a method blank which was used as an internal QA/QC sample.

If you require further information, please let me know.

Sincerely,

Gary Poole
Supervisor, Organic Laboratories

cc D. Cianciarelli, C. Chiu, R. Turle, M. Tardif

HCB/OCS ANALYTICAL REPORT

08/06/2000

CLIENT: IAN RIGDEN

File: HPO08060078.rtf

PROJECT: TRAIL Rd SVOC

SAMPLE MATRIX LANDFILL EMISSIONS

BATCH #:	UTL-150	UTL-150	UTL-150	UTL-150
SAMPLE ID:	AAQ00-O-00061	AAQ00-O-00062	AAQ00-O-00063	AAQ00-O-00064
FIELD ID:	ORG-01-OC-TS1 TO TS6	XAD-BLANK	ORG-02-OC-TS1 TO TS6	ORG-03-OC-TS1 TO TS6
SAMPLING DATE:	18/04/00	14/04/00	19/04/00	20/04/00
SAMPLE TYPE:	COMBINED TRAIN	XAD BLANK	COMBINED TRAIN	COMBINED TRAIN
SAMPLE SIZE:	1	1	1	1
SAMPLE SIZE UNITS	N/A	N/A	N/A	N/A
RESULT UNITS:	ug	ug	ug	ug

HCB	0.005	0.003	0.004	0.005
OCS	< 0.002	< 0.002	< 0.002	< 0.002
Recovery %				
13C6-HCB	73	63	77	85

Note: A < sign indicates the value is below the detection limit reported

Analysed by: DA Reviewed by: RL Approved by: _____

HCB/OCS ANALYTICAL REPORT

08/06/2000

CLIENT: IAN RIGDEN

File: HPO08060078.rtf

PROJECT: TRAIL Rd SVOC

SAMPLE MATRIX LANDFILL EMISSIONS

BATCH #:	UTL-150	UTL-150	UTL-150
SAMPLE ID:	AAQ00-O-00065	AAQ00-O-00066	AAQ00-O-00067
FIELD ID:	ORG-02-RAW-TS4	ORG-04-OB-TS2 TO TS6	B27/04/00
SAMPLING DATE:	19/04/00	19/04/00	27/04/00
SAMPLE TYPE:	XAD INLET GAS	COMBINED TRAIN	METHOD BLANK
SAMPLE SIZE:	1	1	1
SAMPLE SIZE UNITS	N/A	N/A	N/A
RESULT UNITS:	ug	ug	ug

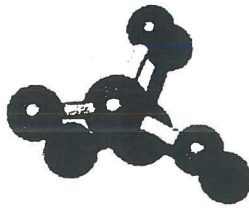
HCB	< 0.002	0.005	0.002
OCS	< 0.002	< 0.002	< 0.002

Recovery %

13C6-HCB	71	69	61
----------	----	----	----

Note: A < sign indicates the value is below the detection limit reported

Analysed by: DA Reviewed by: 22 Approved by: _____



*Analysis & Air Quality Division
ETC, Environment Canada
3439 River Road, Ottawa, Ontario K1A 0H3
Tel.: (613) 990-8564 / Fax: (613) 990-8568
poole.garyv@etc.ec.gc.ca*

June 8, 2000

Ian Rigden
ERMD, ETC

Re: Results for Trail Road Landfill

Ian:

Attached please find the PCDD/PCDF, PAH and HCB results for blank XAD, XAD-raw gas, 3 trains and the blank train. Also included are the results of a method blank which was used as an internal QA/QC sample. The OCS results should be available shortly. Please note that there was low recovery for the lighter PAH surrogates from the XAD blank, Train 2, Train 4 (blank train) and the method blank.

If you require further information, please let me know.

Sincerely,

Gary Poole
Supervisor, Organic Laboratories

cc D. Ciarciarelli, C. Chiu, R. Turle, M. Tardif

DIOXIN/FURAN ANALYTICAL REPORT

31/05/2000

CLIENT: IAN RIGDEN	PROJECT: TRAIL Rd SVOC	GC/MS: 60M DB5/VG70S 10000
MATRIX: LANDFILL EMISSIONS	SAMPLE SIZE: 1 (N/A)	BATCH #: UTL-150
SAMPLE ID: AAQ00-O-00061	SAMPLING DATE: 18-Apr-00	ANALYSIS DAT 15/05/2000
FIELD ID: ORG-01-OC-TS1 TO TS6	SAMPLE TYPE: COMBINED TRAIN	FILE: DFN31050013.rtf

Congener	Pg	Maximum TEQ	Homologue	Pg	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	183	4	2
12378-P5CDD	N.D.	N.C.	Total P5CDD	22	6	1
123478-H6CDD	N.D.	N.C.	Total H6CDD	4	3	1
123678-H6CDD	N.D.	N.C.	Total H7CDD	12	4	2
123789-H6CDD*	N.D.	N.C.	OCDD	20	8	1
1234678-H7CDD	8	0.08	Total PCDD	241		
OCDD	20	0.02				
2378-TCDF*	40	4.04	Total TCDF	257	2	16
12378-P5CDF	6	0.32	Total P5CDF	85	4	10
23478-P5CDF*	8	4.20	Total H6CDF	36	3	5
123478-H6CDF*	10	1.00	Total H7CDF	13	5	1
123678-H6CDF	5	0.48	OCDF	N.D.	8	0
234678-H6CDF	3	0.32				
123789-H6CDF	N.D.	N.C.	Total PCDF	391		
1234678-H7CDF	13	0.13				
1234789-H7CDF	N.D.	N.C.				
OCDF	N.D.	N.C.				
Total TEQ		10.59				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	88
13C12-TCDF	1	92
13C12-P5CDD	1	86
13C12-P5CDF	1	88
13C12-H6CDD	1	87
13C12-H6CDF	1	85
13C12-H7CDD	1	89
13C12-H7CDF	1	80
13C12-OCDD	2	60

Note: (1) Results are corrected for surrogate recovery.

(2) DL = detection limit (pg / analyte peak); NP=number of analyte peaks.

(3) * represents maximum possible amount as this isomer could coelute with other isomer(s).

(4) N.D. = Not Detected.

(5) Numbers in brackets represent values not detected due to incorrect ratio.

(6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.

(7) N.C. = Not Calculable.

DIOXIN/FURAN ANALYTICAL REPORT

31/05/2000

CLIENT: IAN RIGDEN	PROJECT: TRAIL Rd SVOC	GC/MS: 60M DB5/VG70S 10000
MATRIX: LANDFILL EMISSIONS	SAMPLE SIZE: 1 (N/A)	BATCH #: UTL-150
SAMPLE ID: AAQ00-O-00063	SAMPLING DATE: 19-Apr-00	ANALYSIS DAT 15/05/2000
FIELD ID: ORG-02-OC-TS1 TO TS6	SAMPLE TYPE: COMBINED TRAIN	FILE: DFN31050011.rtf

Congener	pg	Maximum TEQ	Homologue	pg	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	142	4	2
12378-P5CDD	N.D.	N.C.	Total P5CDD	28	8	2
123478-H6CDD	N.D.	N.C.	Total H6CDD	10	4	2
123678-H6CDD	N.D.	N.C.	Total H7CDD	20	6	2
123789-H6CDD*	N.D.	N.C.	OCDD	37	8	1
1234678-H7CDD	13	0.13	Total PCDD	237		
OCDD	37	0.04				
2378-TCDF*	21	2.12	Total TCDF	101	2	14
12378-P5CDF	3	0.14	Total P5CDF	30	3	6
23478-P5CDF*	5	2.40	Total H6CDF	6	3	2
123478-H6CDF*	4	0.40	Total H7CDF	6	4	1
123678-H6CDF	N.D.	N.C.	OCDF	6	6	1
234678-H6CDF	N.D.	N.C.				
123789-H6CDF	N.D.	N.C.	Total PCDF	149		
1234678-H7CDF	6	0.06				
1234789-H7CDF	N.D.	N.C.				
OCDF	6	0.01				
Total TEQ		5.30				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	83
13C12-TCDF	1	88
13C12-P5CDD	1	75
13C12-P5CDF	1	82
13C12-H6CDD	1	83
13C12-H6CDF	1	86
13C12-H7CDD	1	76
13C12-H7CDF	1	73
13C12-OCDD	2	48

Note: (1) Results are corrected for surrogate recovery.

(2) DL = detection limit (pg / analyte peak); NP=number of analyte peaks.

(3) * represents maximum possible amount as this isomer could coelute with other isomer(s).

(4) N.D. = Not Detected.

(5) Numbers in brackets represent values not detected due to incorrect ratio.

(6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.

(7) N.C. = Not Calculable.

31/05/2000

CLIENT: IAN RIGDEN PROJECT: TRAIL Rd SVOC GC/MS: 60M DB5/VG70S 10000
 MATRIX: LANDFILL EMISSIONS SAMPLE SIZE: 1 (N/A) BATCH #: UTL-150
 SAMPLE ID: AAQ00-O-00064 SAMPLING DATE: 20-Apr-00 ANALYSIS DAT 15/05/2000
 FIELD ID: ORG-03-OC-TS1 TO TS6 SAMPLE TYPE: COMBINED TRAIN FILE: DFN31050010.rtf

Congener	pg	Maximum TEQ	Homologue	pg	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	12	3	2
12378-P5CDD	N.D.	N.C.	Total P5CDD	5	4	1
123478-H6CDD	N.D.	N.C.	Total H6CDD	8	5	1
123678-H6CDD	N.D.	N.C.	Total H7CDD	36	5	2
123789-H6CDD*	N.D.	N.C.	OCDD	71	8	1
1234678-H7CDD	19	0.19	Total PCDD	132		
OCDD	71	0.07				
2378-TCDF*	23	2.28	Total TCDF	124	2	15
12378-P5CDF	[4]	[0.18]	Total P5CDF	26	4	3
23478-P5CDF*	[6]	[2.80]	Total H6CDF	N.D.	3	0
123478-H6CDF*	N.D.	N.C.	Total H7CDF	N.D.	4	0
123678-H6CDF	N.D.	N.C.	OCDF	N.D.	6	0
234678-H6CDF	N.D.	N.C.				
123789-H6CDF	N.D.	N.C.	Total PCDF	150		
1234678-H7CDF	N.D.	N.C.				
1234789-H7CDF	N.D.	N.C.				
OCDF	N.D.	N.C.				
Total TEQ		2.54				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	75
13C12-TCDF	1	82
13C12-P5CDD	1	75
13C12-P5CDF	1	77
13C12-H6CDD	1	73
13C12-H6CDF	1	73
13C12-H7CDD	1	77
13C12-H7CDF	1	68
13C12-OCDD	2	53

Note: (1) Results are corrected for surrogate recovery.

(2) DL = detection limit (pg / analyte peak); NP=number of analyte peaks.

(3) * represents maximum possible amount as this isomer could coelute with other isomer(s).

(4) N.D. = Not Detected.

(5) Numbers in brackets represent values not detected due to incorrect ratio.

(6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.

(7) N.C. = Not Calculable.

DIOXIN/FURAN ANALYTICAL REPORT

31/05/2000

CLIENT: IAN RIGDEN PROJECT: TRAIL Rd SVOC GC/MS: 60M DB5/VG70S 10000
 MATRIX: LANDFILL EMISSIONS SAMPLE SIZE: 1 (N/A) BATCH #: UTL-150
 SAMPLE ID: AAQ00-O-00066 SAMPLING DATE: 19-Apr-00 ANALYSIS DAT 15/05/2000
 FIELD ID: ORG-04-OB-TS2 TO TS6 SAMPLE TYPE: COMBINED TRAIN FILE: DFN31050008.rtf

Congener	PG	Maximum TEQ	Homologue	PG	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	N.D.	4	0
12378-P5CDD	N.D.	N.C.	Total P5CDD	N.D.	5	0
123478-H6CDD	N.D.	N.C.	Total H6CDD	N.D.	4	0
123678-H6CDD	N.D.	N.C.	Total H7CDD	N.D.	4	0
123789-H6CDD*	N.D.	N.C.	OCDD	6	6	1
1234678-H7CDD	N.D.	N.C.	Total PCDD	6		
OCDD	6	0.01				
2378-TCDF*	N.D.	N.C.	Total TCDF	N.D.	2	0
12378-P5CDF	N.D.	N.C.	Total P5CDF	N.D.	2	0
23478-P5CDF*	N.D.	N.C.	Total H6CDF	N.D.	3	0
123478-H6CDF*	N.D.	N.C.	Total H7CDF	N.D.	3	0
123678-H6CDF	N.D.	N.C.	OCDF	N.D.	4	0
234678-H6CDF	N.D.	N.C.				
123789-H6CDF	N.D.	N.C.	Total PCDF	0		
1234678-H7CDF	N.D.	N.C.				
1234789-H7CDF	N.D.	N.C.				
OCDF	N.D.	N.C.				
Total TEQ		0.01				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	74
13C12-TCDF	1	77
13C12-P5CDD	1	79
13C12-P5CDF	1	84
13C12-H6CDD	1	80
13C12-H6CDF	1	77
13C12-H7CDD	1	95
13C12-H7CDF	1	79
13C12-OCDD	2	72

Note: (1) Results are corrected for surrogate recovery.

(2) DL = detection limit (PG / analyte peak); NP=number of analyte peaks.

(3) * represents maximum possible amount as this isomer could coelute with other isomer(s).

(4) N.D. = Not Detected.

(5) Numbers in brackets represent values not detected due to incorrect ratio.

(6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.

(7) N.C. = Not Calculable.

DIOXIN/FURAN ANALYTICAL REPORT

31/05/2000

CLIENT: IAN RIGDEN	PROJECT: TRAIL Rd SVOC	GC/MS: 60M DB5/VG70S 10000
MATRIX: LANDFILL EMISSIONS	SAMPLE SIZE: 1 (N/A)	BATCH #: UTL-150
SAMPLE ID: AAQ00-O-00065	SAMPLING DATE: 19-Apr-00	ANALYSIS DAT 15/05/2000
FIELD ID: ORG-02-RAW-TS4	SAMPLE TYPE: XAD INLET GAS	FILE: DFN31050009.rtf

Congener	pg	Maximum TEQ	Homologue	pg	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	N.D.	4	0
12378-P5CDD	N.D.	N.C.	Total P5CDD	N.D.	4	0
123478-H6CDD	N.D.	N.C.	Total H6CDD	N.D.	6	0
123678-H6CDD	N.D.	N.C.	Total H7CDD	N.D.	6	0
123789-H6CDD*	N.D.	N.C.	OCDD	6	6	1
1234678-H7CDD	N.D.	N.C.	Total PCDD	6		
OCDD	6	0.01				
2378-TCDF*	2	0.24	Total TCDF	2	2	1
12378-P5CDF	N.D.	N.C.	Total P5CDF	N.D.	4	0
23478-P5CDF*	N.D.	N.C.	Total H6CDF	N.D.	4	0
123478-H6CDF*	N.D.	N.C.	Total H7CDF	N.D.	4	0
123678-H6CDF	N.D.	N.C.	OCDF	N.D.	8	0
234678-H6CDF	N.D.	N.C.				
123789-H6CDF	N.D.	N.C.	Total PCDF	2		
1234678-H7CDF	N.D.	N.C.				
1234789-H7CDF	N.D.	N.C.				
OCDF	N.D.	N.C.				
Total TEQ		0.25				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	77
13C12-TCDF	1	80
13C12-P5CDD	1	78
13C12-P5CDF	1	81
13C12-H6CDD	1	77
13C12-H6CDF	1	79
13C12-H7CDD	1	65
13C12-H7CDF	1	62
13C12-OCDD	2	41

Note: (1) Results are corrected for surrogate recovery.

(2) DL = detection limit (pg / analyte peak); NP=number of analyte peaks.

(3) * represents maximum possible amount as this isomer could coelute with other isomer(s).

(4) N.D. = Not Detected.

(5) Numbers in brackets represent values not detected due to incorrect ratio.

(6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.

(7) N.C. = Not Calculable.

DIOXIN/FURAN ANALYTICAL REPORT

31/05/2000

CLIENT: IAN RIGDEN	PROJECT: TRAIL Rd SVOC	GC/MS: 60M DB5/VG70S 10000
MATRIX: LANDFILL EMISSIONS	SAMPLE SIZE: 1 (N/A)	BATCH #: UTL-150
SAMPLE ID: AAQ00-O-00062	SAMPLING DATE: 14-Apr-00	ANALYSIS DAT 15/05/2000
FIELD ID: XAD-BLANK	SAMPLE TYPE: XAD BLANK	FILE: DFN31050012.rtf

Congener	Pg	Maximum TEQ	Homologue	Pg	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	N.D.	4	0
12378-P5CDD	N.D.	N.C.	Total P5CDD	N.D.	6	0
123478-H6CDD	N.D.	N.C.	Total H6CDD	N.D.	6	0
123678-H6CDD	N.D.	N.C.	Total H7CDD	N.D.	6	0
123789-H6CDD*	N.D.	N.C.	OCDD	6	6	1
1234678-H7CDD	N.D.	N.C.	Total PCDD	6		
OCDD	6	0.01				
2378-TCDF*	N.D.	N.C.	Total TCDF	N.D.	4	0
12378-P5CDF	N.D.	N.C.	Total P5CDF	N.D.	4	0
23478-P5CDF*	N.D.	N.C.	Total H6CDF	N.D.	6	0
123478-H6CDF*	N.D.	N.C.	Total H7CDF	N.D.	6	0
123678-H6CDF	N.D.	N.C.	OCDF	N.D.	8	0
234678-H6CDF	N.D.	N.C.	Total PCDF	0		
123789-H6CDF	N.D.	N.C.				
1234678-H7CDF	N.D.	N.C.				
1234789-H7CDF	N.D.	N.C.				
OCDF	N.D.	N.C.				
Total TEQ		0.01				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	52
13C12-TCDF	1	55
13C12-P5CDD	1	52
13C12-P5CDF	1	54
13C12-H6CDD	1	54
13C12-H6CDF	1	52
13C12-H7CDD	1	64
13C12-H7CDF	1	55
13C12-OCDD	2	47

- Note: (1) Results are corrected for surrogate recovery.
 (2) DL = detection limit (pg / analyte peak); NP=number of analyte peaks.
 (3) * represents maximum possible amount as this isomer could coelute with other isomer(s).
 (4) N.D. = Not Detected.
 (5) Numbers in brackets represent values not detected due to incorrect ratio.
 (6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.
 (7) N.C. = Not Calculable.

31/05/2000

CLIENT:

PROJECT: TRAIL Rd. SVOC
 MATRIX: METHOD BLANK
 SAMPLE ID: AAQ00-O-00067
 FIELD ID: B27/04/00

SAMPLE SIZE: 1 (N/A)
 TSP (ug/m3): 0
 SAMPLING DATE: 27-Apr-00
 SAMPLE TYPE: METHOD BLANK

GC/MS: 60M DB5/VG70S 10000
 BATCH #: UTL-150
 ANALYSIS DAT 15/05/2000
 FILE: DFN31050020.rtf

Congener	pg	Maximum TEQ	Homologue	pg	DL	NP
2378-TCDD	N.D.	N.C.	Total TCDD	N.D.	4	0
12378-P5CDD	N.D.	N.C.	Total P5CDD	N.D.	8	0
123478-H6CDD	N.D.	N.C.	Total H6CDD	N.D.	8	0
123678-H6CDD	N.D.	N.C.	Total H7CDD	N.D.	6	0
123789-H6CDD*	N.D.	N.C.	OCDD	7	6	1
1234678-H7CDD	N.D.	N.C.	Total PCDD	7		
OCDD	7	0.01				
2378-TCDF*	N.D.	N.C.	Total TCDF	N.D.	4	0
12378-P5CDF	N.D.	N.C.	Total P5CDF	N.D.	5	0
23478-P5CDF*	N.D.	N.C.	Total H6CDF	N.D.	5	0
123478-H6CDF*	N.D.	N.C.	Total H7CDF	N.D.	5	0
123678-H6CDF	N.D.	N.C.	OCDF	N.D.	6	0
234678-H6CDF	N.D.	N.C.				
123789-H6CDF	N.D.	N.C.	Total PCDF	0		
1234678-H7CDF	N.D.	N.C.				
1234789-H7CDF	N.D.	N.C.				
OCDF	N.D.	N.C.				
Total TEQ		0.01				

Surrogate	Amount Added, ng	Recovery %
13C12-TCDD	1	57
13C12-TCDF	1	60
13C12-P5CDD	1	61
13C12-P5CDF	1	61
13C12-H6CDD	1	65
13C12-H6CDF	1	63
13C12-H7CDD	1	81
13C12-H7CDF	1	87
13C12-OCDD	2	63

Note: (1) Results are corrected for surrogate recovery.

(2) DL = detection limit (pg / analyte peak); NP=number of analyte peaks.

(3) * represents maximum possible amount as this isomer could coelute with other isomer(s).

(4) N.D. = Not Detected.

(5) Numbers in brackets represent values not detected due to incorrect ratio.

(6) TEQ = Toxic Equivalents as 2, 3,7,8 - TCDD using International Toxic Equivalency Factors.

(7) N.C. = Not Calculable.

Batch # :	UTL-150	UTL-150	UTL-150
Sample id :	AAQ00-O-00065	AAQ00-O-00066	AAQ00-O-00067
Field id :	ORG-02-RAW-TS4	ORG-04-OB-TS2 TO TS6	B27/04/00
Sampling date :	19/04/00	19/04/00	27/04/00
Sample type :	XAD INLET GAS	COMBINED TRAIN	METHOD BLANK
Sample size :	1	1	1
Sample size units :	N/A	N/A	N/A
PAH result units :	ug	ug	ug

AL	0.099	0.001	< 0.001
AE	2.051	0.002	< 0.001
FL	1.146	0.005	< 0.001
MFL	0.161	0.002	< 0.001
PHE	0.308	0.011	< 0.001
AN	0.016	< 0.001	< 0.001
FLT	0.016	0.006	0.001
PY	0.009	0.004	0.001
B(a)FL	< 0.001	< 0.001	< 0.001
B(b)FL	< 0.001	< 0.001	< 0.001
MPY	0.001	0.001	< 0.001
B(ghi)F	< 0.005	< 0.005	< 0.005
B(a)A	< 0.005	< 0.005	< 0.005
Tri	< 0.005	< 0.005	< 0.005
Chrysene	< 0.005	< 0.005	< 0.005
C&T			
MB(a)A	< 0.005	< 0.005	< 0.005
B(b)FLT	< 0.010	< 0.010	< 0.010
B(k)FLT	< 0.010	< 0.010	< 0.010
B(b)F & B(k)F			
B(e)P	< 0.010	< 0.010	< 0.010
B(a)P	< 0.010	< 0.010	< 0.010
PER	< 0.010	< 0.010	< 0.010
MCH	< 0.020	< 0.020	< 0.020
IP	< 0.010	< 0.010	< 0.010
D(ah)A	< 0.010	< 0.010	< 0.010
B(b)C	< 0.010	< 0.010	< 0.010
B(ghi)P	< 0.010	< 0.010	< 0.010
ANT	< 0.020	< 0.020	< 0.020

Total PAH	3.807	0.032	0.002
-----------	-------	-------	-------

Recovery %

d10-AE %	53	21	14
d10-AN %	73	32	18
d10-PY	74	42	34
d12-B(a)A %	90	62	40
d12-B(a)P %	83	51	22
d14-D(ah)A	79	65	44
d12-B(ghi)P %	80	69	51

Note: A < sign indicates the value is below the detection limit reported

Analysed by: AJ

Reviewed by: LL

Approved by: [Signature]

Batch # :	UTL-150	UTL-150	UTL-150	UTL-150
Sample id :	AAQ00-O-00061	AAQ00-O-00062	AAQ00-O-00063	AAQ00-O-00064
Field id :	ORG-01-OC-TS1 TO TS6	XAD-BLANK	ORG-02-OC-TS1 TO TS6	ORG-03-OC-TS1 TO TS6
Sampling date :	18/04/00	14/04/00	19/04/00	20/04/00
Sample type :	COMBINED TRAIN	XAD BLANK	COMBINED TRAIN	COMBINED TRAIN
Sample size :	1	1	1	1
Sample size units :	N/A	N/A	N/A	N/A
PAH result units :	ug	ug	ug	ug

AL	0.008	< 0.001	0.006	0.028
AE	0.005	< 0.001	0.003	0.013
FL	0.013	< 0.001	0.018	0.050
MFL	0.010	< 0.001	0.018	0.081
PHE	0.161	0.002	0.222	0.969
AN	0.006	< 0.001	0.007	0.041
FLT	0.067	0.001	0.126	0.451
PY	0.069	0.001	0.125	0.570
B(a)FL	0.015	< 0.001	0.046	0.213
B(b)FL	0.004	< 0.001	0.011	0.048
MPY	0.015	< 0.001	0.029	0.186
B(ghi)F	0.009	< 0.005	0.017	0.070
B(a)A	0.006	< 0.005	0.015	0.065
Tri	0.023	< 0.005	0.043	0.148
Chrysene	0.029	< 0.005	0.057	0.198
C&T				
MB(a)A	< 0.005	< 0.005	< 0.005	< 0.005
B(b)FLT	0.011	< 0.010	0.052	0.079
B(k)FLT	< 0.010	< 0.010	0.011	0.015
B(b)F & B(k)F				
B(e)P	0.016	< 0.010	0.039	0.140
B(a)P	< 0.010	< 0.010	0.005	0.013
PER	< 0.010	< 0.010	< 0.010	< 0.010
MCH	< 0.020	< 0.020	< 0.020	< 0.020
IP	< 0.010	< 0.010	< 0.010	0.013
D(ah)A	< 0.010	< 0.010	< 0.010	< 0.010
B(b)C	< 0.010	< 0.010	< 0.010	< 0.010
B(ghi)P	< 0.010	< 0.010	< 0.010	0.056
ANT	< 0.020	< 0.020	< 0.020	< 0.020

Total PAH	0.467	0.004	0.850	3.447
-----------	-------	-------	-------	-------

Recovery %				
d10-AE %	30	15	21	36
d10-AN %	42	20	35	52
d10-PY	50	34	48	63
d12-B(a)A %	67	59	70	82
d12-B(a)P %	58	43	66	78
d14-D(ah)A	65	59	74	76
d12-B(ghi)P %	69	69	74	75

Note: A < sign indicates the value is below the detection limit reported

Analysed by: AJ Reviewed by: JK Approved by: [Signature]

Batch # :	UTL-150	UTL-150	UTL-150
Sample id :	AAQ00-O-00065	AAQ00-O-00066	AAQ00-O-00067
Field id :	ORG-02-RAW-TS4	ORG-04-OB-TS2 TO TS6	B27/04/00
Sampling date :	19/04/00	19/04/00	27/04/00
Sample type :	XAD INLET GAS	COMBINED TRAIN	METHOD BLANK
Sample size :	1	1	1
Sample size units :	N/A	N/A	N/A
PAH result units :	ug	ug	ug

AL	0.099	0.001	< 0.001
AE	2.051	0.002	< 0.001
FL	1.146	0.005	< 0.001
MFL	0.161	0.002	< 0.001
PHE	0.308	0.011	< 0.001
AN	0.016	< 0.001	< 0.001
FLT	0.016	0.006	0.001
PY	0.009	0.004	0.001
B(a)FL	< 0.001	< 0.001	< 0.001
B(b)FL	< 0.001	< 0.001	< 0.001
MPY	0.001	0.001	< 0.001
B(ghi)F	< 0.005	< 0.005	< 0.005
B(a)A	< 0.005	< 0.005	< 0.005
Tri	< 0.005	< 0.005	< 0.005
Chrysene	< 0.005	< 0.005	< 0.005
C&T			
MB(a)A	< 0.005	< 0.005	< 0.005
B(b)FLT	< 0.010	< 0.010	< 0.010
B(k)FLT	< 0.010	< 0.010	< 0.010
B(b)F & B(k)F			
B(e)P	< 0.010	< 0.010	< 0.010
B(a)P	< 0.010	< 0.010	< 0.010
PER	< 0.010	< 0.010	< 0.010
MCH	< 0.020	< 0.020	< 0.020
IP	< 0.010	< 0.010	< 0.010
D(ah)A	< 0.010	< 0.010	< 0.010
B(b)C	< 0.010	< 0.010	< 0.010
B(ghi)P	< 0.010	< 0.010	< 0.010
ANT	< 0.020	< 0.020	< 0.020
Total PAH	3.807	0.032	0.002

Recovery %

d10-AE %	53	21	14
d10-AN %	73	32	18
d10-PY	74	42	34
d12-B(a)A %	90	62	40
d12-B(a)P %	83	51	22
d14-D(ah)A	79	65	44
d12-B(ghi)P %	80	69	51

Note: A < sign indicates the value is below the detection limit reported

Analysed by: AJ

Reviewed by: RL

Approved by: [Signature]

HCB ANALYTICAL REPORT

17/05/2000

CLIENT: IAN RIGDEN

File: HCB17050005.rtf

PROJECT: TRAIL Rd SVOC

SAMPLE MATRIX LANDFILL EMISSIONS

BATCH #:	UTL-150	UTL-150	UTL-150	UTL-150
SAMPLE ID:	AAQ00-O-00061	AAQ00-O-00062	AAQ00-O-00063	AAQ00-O-00064
FIELD ID:	ORG-01-OC-TS1 TO TS6	XAD-BLANK	ORG-02-OC-TS1 TO TS6	ORG-03-OC-TS1 TO TS6
SAMPLING DATE:	18/04/00	14/04/00	19/04/00	20/04/00
SAMPLE TYPE:	COMBINED TRAIN	XAD BLANK	COMBINED TRAIN	COMBINED TRAIN
SAMPLE SIZE:	1	1	1	1
SAMPLE SIZE UNITS	N/A	N/A	N/A	N/A
RESULT UNITS:	ug	ug	ug	ug

HCB	0.005	0.003	0.004	0.005
-----	-------	-------	-------	-------

Recovery %

13C6-HCB	73	63	77	85
----------	----	----	----	----

Note: A < sign indicates the value is below the detection limit reported

Analysed by: L.S Reviewed by: DH Approved by: [Signature]

HCb ANALYTICAL REPORT

17/05/2000

CLIENT: IAN RIGDEN

File: HCB17050005.rtf

PROJECT: TRAIL Rd SVOC

SAMPLE MATRIX LANDFILL EMISSIONS

BATCH #:	UTL-150	UTL-150	UTL-150
SAMPLE ID:	AAQ00-O-00065	AAQ00-O-00066	AAQ00-O-00067
FIELD ID:	ORG-02-RAW-TS4	ORG-04-OB-TS2 TO TS6	B27/04/00
SAMPLING DATE:	19/04/00	19/04/00	27/04/00
SAMPLE TYPE:	XAD INLET GAS	COMBINED TRAIN	METHOD BLANK
SAMPLE SIZE:	1	1	1
SAMPLE SIZE UNITS	N/A	N/A	N/A
RESULT UNITS:	ug	ug	ug

HCb	< 0.002	0.005	0.002
Recovery %			
13C6-HCB	71	69	61

Note: A < sign indicates the value is below the detection limit reported

Analysed by: LS Reviewed by: DH Approved by: [Signature]

Inlet Canisters (04/18/00 - 04/20/00)

Species	Tue Apr 18 00		Wed Apr 19 00		Thu Apr 20 00		Average
	EPS 162	EPS 224	EPS 017	EPS 018	SMG 033	SMG 034	
	MS795.D	MS796.D	MS797.D	MS798.D	MS799.D	MS800.D	
	Concentration (µg/m³)						
Propane	6502.00	6961.60	6471.40	5819.13	7182.80	7386.00	6720.40
Freon 22 (Chlorodifluoromethane)	23896.60	26760.80	25376.70	25661.38	31372.00	30756.80	27304.00
Freon 12 (Dichlorodifluoromethane)	3811.60	4057.90	3949.90	4095.63	4521.50	4590.60	4171.10
Propyne	4999.00	5219.30	5061.00	5085.88	5289.70	5571.20	5204.30
Chloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Isobutane	97.10	111.90	90.10	94.00	92.50	88.00	95.50
Freon 114 (1,2-Dichlorotetrafluoroethane)	21598.10	22991.80	22799.20	23400.50	25329.20	26225.10	23723.90
Vinylchloride (Chloroethene)	635.80	660.90	627.70	636.13	675.60	701.40	656.20
1-Butene/Isobutene	3215.90	3337.50	3316.70	3355.63	3694.90	3853.10	3462.20
1,3-butadiene	2361.50	2456.60	2239.30	2326.50	2581.00	2621.60	2431.00
Butane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Butene	2698.10	2827.00	2753.50	2811.25	3091.50	3238.00	2903.20
2,2-Dimethylpropane	175.10	194.20	200.20	207.63	243.30	255.80	212.70
Bromomethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-Butyne	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-2-Butene	218.20	242.00	234.40	246.00	262.30	272.00	245.80
Chloroethane	803.00	822.30	808.80	820.63	894.90	916.10	844.20
2-Methylbutane	1275.50	1325.00	1223.10	1269.38	1448.70	1437.90	1329.90
Freon 11 (Trichlorofluoromethane)	447.10	579.00	552.10	414.13	450.80	471.90	485.80
1-Pentene	1325.20	1404.20	1241.40	1281.38	1360.30	1364.30	1329.40
2-Methyl-1-Butene	408.90	462.50	425.80	438.75	454.90	488.40	446.50
Pentane	1221.90	1316.80	1311.70	1295.00	1443.60	1503.10	1348.60
Isoprene	79.10	83.00	32.30	72.50	45.70	42.00	59.10
Formamide	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-Pentene	73.00	82.10	89.80	84.88	107.50	117.80	92.50
1,1-Dichloroethene	28.30	30.00	31.10	31.38	36.90	36.70	32.40
c-2-Pentene	146.20	145.30	154.50	161.38	183.10	184.20	162.40
Dichloromethane	979.40	1073.80	1039.50	1064.63	1149.10	1158.10	1077.40
2-Methyl-2-Butene	933.90	1001.10	949.70	975.88	1101.70	1123.80	1014.30
Freon 113 (1,1,2-Trichlorotrifluoroethane)	126.50	131.90	125.90	127.25	123.90	130.60	127.60
2,2-Dimethylbutane	281.80	311.30	304.70	314.13	338.20	388.30	323.00
Cyclopentene	13.80	14.10	14.30	15.38	16.10	17.00	15.10
1,1,2-Dichloroethene	128.70	136.00	151.40	153.63	149.90	168.20	147.90
4-Methyl-1-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-Methyl-1-Pentene	31.30	33.00	36.50	41.25	31.60	41.60	35.80
Cyclopentane	0.00	55.30	59.40	66.75	71.80	83.10	56.00
1,1-Dichloroethane	607.20	660.70	800.90	807.88	741.70	900.00	753.00
2,3-Dimethylbutane	274.20	312.60	587.20	607.50	621.00	659.00	510.20
4-Methyl-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylpentane	964.10	1048.90	2231.20	2254.50	2417.90	2523.70	1906.70
c-4-Methyl-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-Methylpentane	952.00	1078.10	2251.30	2281.25	2497.40	2555.60	1935.90
1-Hexene/2-Methyl-1-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,2-Dichloroethene	2173.70	4303.90	4218.50	4156.25	4457.20	4715.80	4004.20
Hexane	3977.50	4166.00	4099.20	4204.88	4449.10	4651.80	4258.00
Chloroform	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Hexene	69.30	72.10	73.50	71.25	80.10	87.60	75.60
2-Methyl-1-Butene	50.10	50.70	45.10	48.63	51.60	56.50	50.40
2-Methyl-2-Pentene	55.90	55.00	55.70	55.88	61.00	68.50	58.60
c-2-Hexene	66.10	71.40	65.80	66.63	64.80	67.30	67.00
c-3-Methyl-2-Pentene	69.60	72.40	67.10	66.75	75.80	73.00	70.70
2,2-Dimethylpentane	217.30	220.30	220.80	226.50	238.30	243.00	227.70
Methylcyclopentane	2052.50	2105.00	2143.40	2151.50	2296.10	2417.50	2194.30

Species	Tue Apr 18 00		Wed Apr 19 00		Thu Apr 20 00		Average
	EPS 162	EPS 224	EPS 017	EPS 018	SMG 033	SMG 034	
	MS795.D	MS796.D	MS797.D	MS798.D	MS799.D	MS800.D	
	Concentration (µg/m³)						
1,2-Dichloroethane	36.90	35.80	38.90	39.88	37.20	41.50	38.36
2,4-Dimethylpentane	396.50	408.80	401.40	409.38	447.40	462.90	421.06
2,2,3-Trimethylbutane	0.00	0.00	0.00	59.50	0.00	53.70	
1,1,1-Trichloroethane	333.00	345.20	332.50	335.38	368.80	383.10	349.60
1-Methylcyclopentene	69.20	71.10	66.70	76.13	81.70	84.30	74.88
Benzene	1035.20	1059.50	1047.50	1062.25	1147.20	1184.90	1089.43
Carbontetrachloride	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyclohexane	2473.90	2611.30	2565.10	2578.50	2757.70	2879.50	2644.33
2-Methylhexane	2774.20	2813.90	2801.40	2702.50	3030.70	3100.90	2870.60
2,3-Dimethylpentane	1151.10	1186.90	1157.20	1152.13	1280.60	1315.00	1207.15
Cyclohexene	59.40	59.80	59.00	60.13	62.70	63.10	60.68
3-Methylhexane	3749.90	3839.60	3761.30	3796.75	4087.00	4231.50	3911.00
Dibromomethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromodichloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-Heptene	1700.80	1773.30	1699.00	1643.13	1650.21	1875.20	1723.61
Trichloroethene	1515.00	1519.80	1454.00	1449.38	1513.00	1558.50	1501.61
2,2,4-Trimethylpentane	3077.40	3096.50	3104.70	3083.50	3382.70	3497.00	3206.97
c-3-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heptane	4438.90	4652.70	4564.10	4601.88	5053.10	5166.70	4746.23
t-3-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t-2-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-2-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-Dimethylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-1,3-Dichloropropene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methylcyclohexane	4255.30	4308.10	4249.60	4265.38	4600.60	4774.10	4408.85
2,5-Dimethylhexane	749.20	764.80	755.70	772.25	823.70	840.60	781.38
2,4-Dimethylhexane	995.70	1008.30	1011.60	985.63	1097.20	1120.50	1011.23
t-1,3-Dichloropropene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,2-Trichloroethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromotrichloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-Trimethylpentane	1566.80	1610.10	1585.70	1606.13	1776.50	1829.80	1662.50
Toluene	24528.40	24918.20	24321.70	24596.38	26438.70	27679.80	25413.86
2-Methylheptane	2689.10	2711.00	2653.10	2715.50	2958.70	3007.90	2789.22
4-Methylheptane	962.00	995.20	965.90	957.75	1039.70	1126.20	1007.79
1-Methylcyclohexene	73.30	81.10	85.10	78.50	96.10	103.80	86.32
3-Methylheptane	2915.80	2975.10	2946.00	2957.50	3243.30	3353.50	3065.20
Dibromochloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-1,3-Dimethylcyclohexane	1578.90	1645.40	1593.00	1598.88	1755.00	1817.40	1664.76
t-1,4-Dimethylcyclohexane	681.00	709.80	733.40	697.50	771.80	828.80	737.05
2,2,5-Trimethylhexane	850.90	878.20	863.70	865.00	942.70	981.30	896.97
EDB (1,2-Dibromoethane)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-Octene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Octane	3592.70	3689.40	3666.70	3714.13	4063.90	4250.30	3829.52
t-1,2-Dimethylcyclohexane	1351.90	1373.70	1367.20	1353.13	1467.10	1504.20	1402.87
t-2-Octene	916.80	836.00	848.50	0.00	908.50	955.30	744.18
Tetrachloroethene	3456.90	3330.20	3217.80	3185.88	3317.30	3636.40	3357.41
c-1,4/t-1,3-Dimethylcyclohexane	830.80	865.50	861.00	844.25	907.90	976.80	881.04
c-2-Octene	726.40	750.90	734.60	747.38	823.30	857.30	773.31
c-1,2-Dimethylcyclohexane	240.20	248.80	239.80	240.13	262.00	268.00	249.82
Chlorobenzene	345.10	300.00	292.50	291.13	303.90	334.90	311.25
Ethylbenzene	7542.40	7630.00	7683.50	7820.88	8444.70	8837.80	7911.29
m/p-Xylene	15489.50	15820.00	15690.00	16119.63	17267.10	18285.50	16445.29
Bromoform	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-Dichlorobutane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Styrene	237.10	220.00	47.90	158.63	66.60	49.30	129.92

Species	Tue Apr 18 00		Wed Apr 19 00		Thu Apr 20 00		Average
	EPS 162	EPS 224	EPS 017	EPS 018	SMG 033	SMG 034	
	MS795.D	MS796.D	MS797.D	MS798.D	MS799.D	MS800.D	
	Concentration (µg/m³)						
1,1,2,2-Tetrachloroethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p-Xylene	4236.70	4400.00	4372.20	4472.88	4782.00	5053.80	4552.93
m-Xylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nonane	7421.00	7800.00	7763.80	8026.63	8630.40	9135.90	8129.62
iso-Propylbenzene	329.40	350.60	346.10	347.25	373.00	405.10	358.58
3,6-Dimethyloctane	5125.80	5643.00	5643.40	5801.63	6150.20	5581.03	5657.51
n-Propylbenzene	552.80	600.70	597.90	607.75	649.50	714.30	620.49
3-Ethyltoluene	1485.50	1635.20	1622.90	1642.13	1744.40	1918.90	1674.84
4-Ethyltoluene	518.40	554.70	541.70	559.13	590.30	666.20	571.74
1,3,5-Trimethylbenzene	921.10	1027.00	1023.70	1042.25	1099.90	1222.90	1056.14
2-Ethyltoluene	579.00	637.40	629.30	649.88	668.10	745.90	651.60
1-Decene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
tert-Butylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-Trimethylbenzene	2418.50	2749.20	2754.70	2864.38	2950.00	3352.30	2848.18
Decane	8523.30	9813.40	10085.90	10498.13	10712.70	12270.50	10317.32
Benzylchloride	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-Dichlorobenzene	29.20	0.00	0.00	0.00	736.80	0.00	127.67
1,4-Dichlorobenzene	538.40	621.30	610.90	631.25	661.50	756.90	636.71
iso-Butylbenzene	75.00	79.50	83.80	87.63	94.70	104.90	87.59
sec-Butylbenzene	121.80	132.10	135.20	139.38	143.90	162.60	139.16
1,2,3-Trimethylbenzene	1089.20	1251.60	1208.10	1250.13	1329.40	1464.50	1265.49
p-Cymene	5704.90	6608.00	6492.00	6860.50	7030.00	7826.40	6753.63
1,2-Dichlorobenzene	57.20	42.10	40.10	41.38	38.50	42.50	43.63
Indane	95.50	106.30	105.90	109.50	112.60	131.90	110.28
1,3-Diethylbenzene	104.00	122.00	120.10	127.63	126.90	146.90	124.59
1,4-Diethylbenzene	406.30	483.00	483.70	512.13	501.20	613.30	499.94
n-Butylbenzene	115.80	129.20	129.20	38.00	135.70	159.50	117.90
m-Diethylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Undecane	3091.00	3782.60	3893.20	4189.38	3795.50	4958.80	3951.75
1,2,4-Trichlorobenzene	80.80	23.70	14.10	13.25	0.00	13.70	24.26
Naphthalene	116.50	119.10	108.60	119.00	86.70	122.50	112.07
Dodecane	258.10	486.00	479.40	565.25	353.20	579.80	453.63
Hexachlorobutadiene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hexylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary of VOC Data

Family of Compounds	Total Concentration ($\mu\text{g}/\text{m}^3$)						Average
Total VOCs	233425	249387	247285	250186	273570	285720	256595
BTEX	52832	53828	53115	54072	58080	61042	55495
Freons	10020	10649	10317	10359	11062	11466	10645
Halogenated Species*	14542	16813	16566	16591	18281	18726	16920

* excluding Freons

Trail Rd Landfill
Outlet Canisters (04/18/00 - 04/20/00)

Species	Tue Apr 18 00	Wed Apr 19 00	Thu Apr 20 00				Average
	SMG 029	SMG 030	SMG 031	SMG 032	SMG 035	SMG 036	
	TA026.D	TA020.D	TA022.D	TA023.D	TA024.D	TA025.D	
	Concentration (µg/m³)						
Propene	8.28	3.32	0.20	9.56	2.34	5.04	
Propane	8.82	1.84	0.28	1.78	0.88	2.18	2.65
Freon 22 (Chlorodifluoromethane)	0.04	0.02	0.04	0.04	0.06	0.06	0.04
Freon 12 (Dichlorodifluoromethane)							
Propyne	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloromethane	0.50	0.44	0.22	11.80	0.00	0.42	2.25
Isobutane	0.18	0.12	0.16	0.26	0.00	0.10	0.14
Freon 114 (1,2-Dichlorotetrafluoroethane)	2.14	2.14	0.06	2.72	2.14	0.26	1.58
Vinylchloride (Chloroethene)	0.34	0.26	0.00	0.28	0.00	0.00	0.15
1-Butene/Isobutene	0.60	8.66	0.74	2.02	3.46	2.16	2.94
1,3-butadiene	0.02	5.30	0.06	0.04	0.00	0.00	0.90
Butane	0.00	5.22	0.16	0.20	0.00	0.00	0.93
t-2-Butene	0.00	8.52	0.04	0.06	0.00	0.00	1.44
2,2-Dimethylpropane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromomethane	0.12	0.00	0.14	0.40	0.24	0.20	0.18
1-Butyne	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-2-Butene	0.00	0.00	0.04	0.06	0.06	0.04	0.03
Chloroethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylbutane	0.06	0.00	0.24	0.16	0.24	0.18	0.15
Freon 11 (Trichlorofluoromethane)	0.10	0.00	0.10	0.10	0.12	0.06	0.08
1-Pentene	0.10	0.00	0.40	0.28	0.30	0.30	0.23
2-Methyl-1-Butene	0.00	0.00	0.14	0.00	0.12	0.00	0.04
Pentane	0.00	0.00	0.12	0.00	0.20	0.00	0.05
Isoprene	0.00	0.00	0.10	0.10	0.14	0.10	0.07
Ethylbromide	0.00	0.00	0.04	0.04	0.04	0.00	
t-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethene	0.20	0.00	0.00	0.10	0.00	0.00	0.05
c-2-Pentene	0.00	0.00	0.04	0.02	0.00	0.00	0.01
Dichloromethane	0.62	0.00	0.14	0.18	0.36	0.26	0.26
2-Methyl-2-Butene	0.00	0.00	0.00	0.00	0.10	0.00	0.02
Freon 113 (1,1,2-Trichlorotrifluoroethane)	0.12	0.00	0.08	0.10	0.08	0.08	0.08
2,2-Dimethylbutane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyclopentene	0.00	0.00	0.02	0.04	0.02	0.02	0.02
t-1,2-Dichloroethene	0.26	0.00	0.00	0.06	0.00	0.00	0.05
4-Methyl-1-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-Methyl-1-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyclopentane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-Dimethylbutane	0.00	0.00	0.00	0.00	0.00	0.22	0.04
t-4-Methyl-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.04	0.01
2-Methylpentane	0.00	0.00	0.00	0.00	0.00	0.94	0.16
c-4-Methyl-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-Methylpentane	0.00	0.00	0.00	0.00	0.00	1.26	0.21
1-Hexene/2-Methyl-1-Pentene	0.00	0.00	0.20	0.14	0.24	0.18	0.13
c-1,2-Dichloroethene	0.28	0.00	0.00	0.08	0.00	0.00	0.06
Hexane	0.40	0.00	0.36	0.20	0.54	2.84	0.72
Chloroform	0.00	0.02	0.02	0.02	0.02	0.02	0.02
t-2-Hexene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Ethyl-1-Butene	0.00	0.00	0.00	0.00	0.00	0.00	
t-3-Methyl-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	
c-2-Hexene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-3-Methyl-2-Pentene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-Dimethylpentane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methylcyclopentane	0.00	0.00	0.00	0.00	0.00	0.64	0.11

Species	THU Apr 18 00	THU Apr 18 00	THU Apr 18 00	THU Apr 18 00	THU Apr 18 00	THU Apr 18 00	Average
	SMG 029	SMG 030	SMG 031	SMG 032	SMG 035	SMG 036	
	TA028.D	TA020.D	TA022.D	TA023.D	TA024.D	TA025.D	
	Concentration (µg/m ³)						
1,2-Dichloroethane	0.00	0.00	0.00	0.00	0.00	0.64	0.11
2,4-Dimethylpentane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-Trimethylbutane	0.02	0.04	0.04	0.02	0.00	0.00	0.02
1,1,1-Trichloroethane	0.02	0.04	0.04	0.02	0.00	0.00	0.02
1-Methylcyclopentene	0.00	0.00	0.02	0.00	0.02	0.00	0.01
Benzene	5.08	2.18	1.24	2.28	1.34	1.14	2.21
Carbontetrachloride	0.02	0.04	0.04	0.02	0.02	0.02	0.02
Cyclohexane	0.00	0.00	0.00	0.00	0.00	0.78	0.13
2-Methylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-Dimethylpentane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyclohexene	0.00	0.00	0.06	0.06	0.06	0.04	0.04
3-Methylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dibromomethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromodichloromethane	0.00	0.04	0.00	0.00	0.00	0.00	0.01
1-Heptene	0.00	0.38	0.14	0.14	0.16	0.00	0.14
Trichloroethene	0.34	0.14	0.04	0.14	0.04	0.04	0.12
2,2,4-Trimethylpentane	0.00	0.00	0.08	0.00	0.00	0.00	0.01
c-3-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heptane	0.00	0.00	0.16	0.00	0.20	0.00	0.06
t-3-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t-2-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-2-Heptene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-Dimethylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-1,3-Dichloropropene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methylcyclohexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-Dimethylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dimethylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t-1,3-Dichloropropene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,2-Trichloroethane	0.00	0.04	0.00	0.00	0.00	0.00	0.01
Bromotrichloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-Trimethylpentane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Toluene	116.12	107.04	296.78	437.42	170.16	401.30	254.80
2-Methylheptane	0.00	0.00	0.14	0.00	0.00	0.00	0.02
4-Methylheptane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-Methylcyclohexene	0.02	0.06	0.04	0.04	0.04	0.04	0.04
3-Methylheptane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dibromochloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-1,3-Dimethylcyclohexane	0.06	0.00	0.20	0.22	0.00	0.12	0.10
t-1,4-Dimethylcyclohexane	0.04	0.00	0.06	0.06	0.00	0.04	0.03
2,2,5-Trimethylhexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EDB (1,2-Dibromoethane)	0.00	0.10	0.04	0.00	0.00	0.00	0.02
1-Octene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Octane	0.00	0.18	0.28	0.00	0.16	0.14	0.13
t-1,2-Dimethylcyclohexane	0.00	9.12	0.00	0.00	0.00	0.00	1.52
t-2-Octene	0.00	0.00	0.12	0.00	0.00	0.00	0.02
Tetrachloroethene	2.24	0.54	0.06	0.76	0.08	0.02	0.62
c-1,4/t-1,3-Dimethylcyclohexane	0.00	0.00	0.08	0.10	0.00	0.06	0.04
c-2-Octene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-1,2-Dimethylcyclohexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chlorobenzene	0.18	0.16	0.08	0.12	0.08	0.06	0.11
o-Xylene	0.12	0.22	0.46	0.38	0.16	0.22	0.26
m-p-Xylene	0.14	0.44	1.06	0.50	0.34	0.28	0.46
Bromoform	0.00	0.14	0.04	0.02	0.00	0.00	0.03
1,4-Dichlorobutane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Styrene	0.02	0.16	0.06	0.08	0.06	0.06	0.07

Species	Tue Apr 18 00		Wed Apr 19 00		Thu Apr 20 00		Average
	SMG 029	SMG 030	SMG 031	SMG 032	SMG 035	SMG 036	
	TA026.D	TA020.D	TA022.D	TA023.D	TA024.D	TA025.D	
Concentration (µg/m ³)							
1,1,2,2-Tetrachloroethane	0.00	0.28	0.06	0.00	0.00	0.00	0.06
o-Xylene	0.00	0.52	0.20	0.00	0.00	0.22	0.16
1-Nonene	0.06	0.22	0.46	0.22	0.12	0.12	0.20
Nonane	0.00	0.24	0.26	0.18	0.22	0.18	0.18
iso-Propylbenzene	0.00	0.12	0.08	0.08	0.02	0.04	0.06
3,6-Dimethyloctane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n-Propylbenzene	0.00	0.18	0.12	0.00	0.08	0.00	0.06
3-Ethyltoluene	0.04	0.22	0.30	0.08	0.16	0.06	0.14
4-Ethyltoluene	0.02	0.32	0.18	0.04	0.10	0.02	0.11
1,3,5-Trimethylbenzene	0.02	0.16	0.16	0.04	0.06	0.04	0.08
2-Ethyltoluene	0.02	0.18	0.12	0.04	0.06	0.02	0.07
1-Decene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
tert-Butylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-Trimethylbenzene	0.08	0.52	0.68	0.22	0.32	0.12	0.32
Decane	0.00	0.28	0.40	0.00	0.52	0.22	0.24
Benzylchloride	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-Dichlorobenzene	0.02	0.42	0.12	0.04	0.02	0.02	0.11
1,4-Dichlorobenzene	0.40	0.36	0.32	0.32	0.18	0.06	0.27
iso-Butylbenzene	0.00	0.18	0.06	0.00	0.02	0.00	0.04
sec-Butylbenzene	0.00	0.20	0.06	0.00	0.02	0.00	0.05
1,2,3-Trimethylbenzene	0.04	0.26	0.16	0.00	0.00	0.12	0.10
p-Cymene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-Dichlorobenzene	0.04	0.44	0.12	0.06	0.02	0.02	0.12
Indane	0.02	0.26	0.12	0.04	0.04	0.02	0.08
1,3-Diethylbenzene	0.00	0.00	0.08	0.00	0.00	0.00	0.01
1,4-Diethylbenzene	0.04	0.56	0.26	0.16	0.00	0.08	0.18
n-Butylbenzene	0.00	0.28	0.12	0.00	0.00	0.00	0.05
1,2-Diethylbenzene	0.02	0.24	0.08	0.04	0.00	0.02	0.07
Undecane	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-Trichlorobenzene	0.08	1.28	0.38	0.30	0.16	0.10	0.38
Naphthalene	0.20	1.12	0.50	0.66	0.76	0.32	0.59
Dodecane	0.18	0.98	1.26	3.12	1.24	0.38	1.19
Hexachlorobutadiene	0.16	1.06	0.56	0.40	0.26	0.24	0.45
Hexylbenzene	0.20	1.22	0.28	0.60	0.50	0.36	0.53

Summary of VOC Data

Family of Compounds	Concentration (µg/m ³)						Average
Total VOCs	149	169	313	480	190	425	288
BTEX	121	110	300	441	172	403	258
Freons	2	2	0	3	2	0	2
Halogenated Species*	6	12	3	16	2	2	7

* excluding Freons

SUMMARY OF SVOC ANALYTICAL PROCEDURE

Upon receipt in the laboratory the samples are inspected to ensure integrity and proper labelling. The samples are then entered into the laboratory information management system (LIMS) where they are assigned a laboratory code. The code is then entered onto each container which are then stored in a fridge at 4°C until sample processing proceeds.

Typically the train samples are divided into the front-half (probe rinse, filter, and front-half filter holder rinse) and back-half sections (back-half filter holder rinse, XAD, condensate trap, glycol impinger and back-half glassware rinses). The solvent fractions are dried by passage through sodium sulphate and reduced in volume by rotary evaporation. The solids (filter and XAD) are air dried prior to a 20 hour soxhlet extraction using toluene. Prior to extraction, each sample is spiked with a solution containing a known amount of Carbon-13 labelled dioxin/furans and hexachlorobenzene as well as deuterated PAH. These are used to assess losses incurred during the extraction and sample cleanup procedures. Analytical results for dioxin/furan and hexachlorobenzene are corrected for the recovery of these surrogates.

After extraction, the solvent extracts of the solids are reduced in volume and combined with the train rinses prior to cleanup. The samples are split into two equal fractions. One is used for PAH cleanup and analysis while the other is used for dioxin/furan and hexachlorobenzene cleanup and analysis.

The PAH cleanup involves passing the sample extract through an activated silica column. Co-extracted compounds which may cause interference during analysis are eluted out of the column while the PAH are retained on the column. A more polar solvent is then applied to the column to elute the PAHs. The cleaned up sample extract is concentrated to 500 uL and an internal standard is added to monitor instrumental performance and is used to correct for any variations in injection and sample volume. The sample is analyzed using low resolution mass spectroscopy. Calibration standards containing a various known amounts of the analytes are injected into the instrument before, during and after the samples are injected. These standards are used to determine the concentrations of the analytes in the sample. The accuracy of the standards are periodically assessed using standard reference materials.

The dioxin/furan and hexachlorobenzene cleanup is more rigorous since the concentration of the dioxin/furans are much lower than other compounds which may be present in the extract. These co-extractants could interfere with the final analysis. Initially the sample extract is passed through a multibed silica column containing layers of acid, base, and silver nitrate. Some of the co-extractants are retained on the column, and others may be reduced or oxidized. Sulphur containing compounds are removed by the silver nitrate. The extract is then passed through an alumina column to separate out the dioxin/furans from other compounds such as PCBs and hexachlorobenzene. The fraction containing hexachlorobenzene is reduced to 500 uL and an internal standard is added to monitor instrumental performance and is used to correct for any variations in injection and sample volume. The sample is analyzed using low resolution mass spectroscopy. The fraction containing dioxin/furans is reduced to 20 uL and an internal standard is added to monitor instrumental performance and is used to correct for any variations in injection and sample volume. The sample is analyzed using high resolution mass spectroscopy.

As a part of quality assurance and quality control, a method blank, containing none of the analytes, is usually processed along with the samples to assess cross contamination. A control sample containing a known amount of analytes may also be processed along with the samples to check extraction, cleanup and analytical efficiency. The division participates in interlaboratory studies the results of which are used to compare results from several different laboratories for various analytes from a variety of matrices. The division is accredited by CAEAL for the analysis of PAH and dioxin/furan.

