WOLFDEN
Resources Inc.

July 6, 2006

NIRB File No. 06EN048

Mr. Kevin Buck
Manager of Environmental Screenings
Nunavut Impact Review Board (NIRB)
PO. Box 1360
Cambridge Bay
Nunavut X0B 0C0

Nunavut Water Board
MAR 02 2007
Public Registry

Dear Mr. Buck,

Re: Wolfden Application – High Lake Relicensing Program

Further to our letter dated July 5, 2006, Wolfden would like to respond to Environment Canada's letter dated June 27, 2006, specifically to address the recommendations contained therein.

Environment Canada (EC)

#2 It is recommended that the proponent avoid all water bodies, as well as ensuring that they don't quarry below the active water table.

It is Wolfden's intention to avoid interference with water bodies in the operation of the pits and quarries on the project. We have on plans to extract aggregate from below the active water table.

#3 All pits, spill basins and fuel caches shall be located above the high water mark of any water body, and in such a manner as to prevent the contents from entering any water body frequented by fish. Therefore, please note that maintaining a buffer of 30m may not always be an adequate preventative measure.

The fuel storage area is located above the high water mark of Sand Lake, and appropriate setbacks from the lakeshore will be incorporated into the final design. The fuel storage area will be constructed within a bermed area capable of containing 110% of the volume of the largest fuel tank. If drum caches are deployed they will be equipped with a portable secondary spill containment system.

#4 EC recommends the use of secondary containment with an impervious liner such as

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E-mail: info@wolfdenresources.com • Web: www.wolfdenresources.com

self-supporting insta-berms, for storage of all barrelled fuel rather than relying on natural depressions to contain spills.

Most of the fuel on site will be stored in tanks, as described in the Relicensing Project Description. Fuel contained in barrels includes several drums of gasoline and aviation fuel, and will be stored within the bermed and lined fuel storage area(s) at Sand Lake and near the proposed Weatherhaven camp near High Lake.

#5 The proponent shall have a Spill Contingency Plan in place prior to establishing any fuel caches.

The Relicensing Program -Spill Contingency Plan was submitted to NIRB along with the Project Description.

#6 Fuel caches shall also be inspected on a regular basis.

Wolfden carries out regular inspections of its fuel caches, and will continue to do so.

#7 A supply of spill kits, shovels, barrels, sorbents, pumps, etc. shall be consistently maintained and readily available on site.

The Spill Contingency Plan identifies the number, location and contents of spill kits that will be onsite, as well as carried on vehicles during the Relicensing Program.

#8 EC recommends the use of drip pans, or other similar preventative measures when refuelling equipment on site.

This will be done. There will also be a liner placed alongside the tank farm at the loading aprons to prevent any spillage from entering the ground or nearby water bodies.

#9 The proponent shall ensure that any fuel or hazardous wastes associated with the proposed projects are properly handled, transported and disposed of at an approved facility.

All hazardous waste will be managed in accordance with regulatory requirements and the Nunavut Department of Environment guidelines. Hazardous waste will be removed from site and disposed of at an approved facility. All shipments of hazardous waste will be tracked using the manifest system in compliance with Nunavut guidelines and the federal Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301).

#10 To ensure compliance with Section 36(3) of the Fisheries Act and Section 35 of the Migratory Bird Regulations all spills of fuel and hazardous materials, regardless of quantity, shall be reported immediately to the NWT 24-hour Spill Line...

This is stated in the Spill Contingency Plan, Section 2.3.

#11 Contact number for Environment Canada

Noted. This is included in the Spill Contingency Plan, Appendix 1.3

 # 12 All non-combustible solid wastes (e.g. potable water bottles) shall be disposed of at an appropriate facility (e.g. Yellowknife, NT, or Inuvik, NT). The proponent is encouraged to make use of recycling facilities for all recyclable materials.

Given the remote location of the camp, there is no practical means of accessing recycling programs that are now available in Yellowknife (e.g. beverage container program). We are not aware of any recycling programs operating in the closest communities in Nunavut at this time. Due to the food residue on beverage containers, it is important to the safe operation of the camp that all food wastes and containers are incinerated properly so that the attraction of wildlife to the camp is minimized.

#13 The proponent should review the incineration options available and provide justification for the selected device to the regulatory authority.

In our letter dated July 5, 2006, we have provided detailed information on the type and specifications of the incinerator that has been purchased by Wolfden for the site. Performance literature from the manufacturer as well as two studies published by Environment Canada confirms that the Eco Waste Solutions technology and the specific unit purchased by Wolfden will meet the relevant CCME and Canada Wide Standards for emissions from waste streams similar to the waste stream generated at the camp.

The comments with respect to the Spill Contingency Plan are noted.

Canadian Wildlife Service (CWS)

#1 Proponent has outlined reasonable mitigation to minimize disturbance to nesting birds.

Noted. Further mitigation measures are put forward for minimizing disturbance to raptors in our letter dated July 5, 2006.

#2 In order to reduce disturbance to nesting birds, CWS recommends that aircraft used in conducting project activities maintain a flight altitude of at least 610 m during horizontal (point to point) flight.

We note that the 610m (2000 ft) is a relatively new recommendation from CWS and suggest that 300m is appropriate for minimizing disturbance to nesting birds. Fixed wing aircraft can maintain the 610 m clearance on flights in to and out of the airstrip. For helicopter operations in the area, a significant amount of extra fuel (also an environmental concern) will be used up climbing to 610m for helicopter flights in the

area. Helicopter operations can be modified as needed to fly around sensitive areas where possible.

#3 CWS recommends that aircraft maintain a vertical distance of 1000m and minimum horizontal distance of 1500m from any observed concentrations of birds.

As there have not been any concentrations of birds noted in the area with the possible exception of the coast, it will be relatively simple to implement this suggestion.

#4 Section 35 of the Migratory Birds Regulations states that no person shall deposit, or permit to be deposited, oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds.

Wolfden understands the above noted regulation and will abide by it.

#5 CWS recommends that camp waste be made inaccessible to wildlife at all times. Incineration of camp waste is a recommended option.

Incineration of all camp waste is the proposed option.

#6 All mitigation measures identified by the proponent, and the additional measures suggested herein, should be strictly adhered to in conduction project activities. EC recommends that all field operations staff be made aware of the proponent's commitments to these mitigation measures and provided with appropriate advice/training on how to implement these measures.

All staff that will be working on the High Lake Relicensing Program activities will be provided with a comprehensive orientation, and appropriate training. Through this process, staff will be made aware of, and trained effectively in, the various measures that will ensure compliance with regulatory approval terms and conditions and environmental commitments made by the company.

#7 The proponent must ensure they remain in compliance with the Migratory Birds Convention Act and Regulations during all phases and in all undertakings related to the project.

Noted. It is Wolfden's full intention to remain in compliance with all applicable laws and regulations.

#8 Species at Risk – various recommendations concerning identification, mitigation and on Species at Risk.

All the species listed, with the exception of the short-eared owl, have been identified as Valued Ecosystem Components in the High Lake EIS (currently being prepared for the proposed High Lake mining project). The four listed species – Peregrine falcon, Grizzly

bear, Wolverine, and short-eared owl are present; however, there have only been two sightings of the short-eared owl, both in the vicinity of Ulu, so these are not of concern for the Relicensing Program. No other listed species are present. As part of the High Lake mining project, extensive research and consultation as been incorporated into developing mitigation and monitoring programs, and all interactions with these species are being documented. The mitigation measures have been designed to minimize contact and disturbance of these species. Though in draft form at present, these measures will be implemented during the Relicensing Program activities.

Sincerely,

For: WOLFDEN RESOURCES INC.

Andrew Mitchell

Andrew Mitchell, P. Geo.
Project Manager

AM/

401-1113 Jade Court • Thunder Bay, ON P7B 6M7 • Tel: 807-346-1668 • Fax: 807-345-0284
E-mail: info@wolfdenresources.com • Web: www.wolfdenresources.com

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Mr. Kevin Buck
Manager of Environmental Screenings
Nunavut Impact Review Board (NIRB)
PO. Box 1360
Cambridge Bay
Nunavut X0B 0C0

Dear Mr. Buck,

Re: Wolfden Application – High Lake Relicensing Program

Thank you for forwarding the comments received from interested parties on the above noted project proposal and related application(s). Wolfden would like to take this opportunity to respond to some of the comments and concerns raised by the parties and hope that this will assist NIRB in recommending appropriate terms and conditions.

The parties that provided comments to NIRB, received on or before June 23, 2006, include:

- Environmental Health Assessment Services, Health Canada, dated June 14 2006
- Environment Division, Indian and Northern Affairs Canada dated June 23, 2006
- Environmental Affairs Programs, Transport Canada dated June 15 2006
- Department of Culture, Language, Elders and Youth, Government of Nunavut, dated June 5 2006
- Department of Environment, Government of Nunavut dated June 15 2006

(Additional comments were received from Environment Canada (June 27th), Transport Canada (June 29th) and the Kitikmeot Inuit Association (June 29th), but are not specifically addressed in this letter).

401-1113 Jade Court • Thunder Bay, ON P7B 6M7 • Tel: 807-346-1668 • Fax: 807-345-0284
E-mail: info@wolfdenresources.com • Web: www.wolfdenresources.com

Government of Canada

1.1 Health Canada

Recommends that the Proponent meet national standards for air quality and avoid incineration of any plastics

Incineration is a proven technology and avoids many of the issues associated with alternative disposal options in remote areas. In particular, incineration provides the following benefits:

- Significant reduction in waste volume (typically >90%)
- Avoidance of wildlife issues;
- Generation of inert residuals suitable for disposal in properly designed landfills.

An Eco Waste Solutions incinerator has been ordered for the site. This is a modern two-stage incinerator, specifically designed for oxidation of municipal waste in remote applications. The performance of similar units has been tested and verified under the Government of Canada's Environmental Technology Verification (ETV) Program. The unit operates with sufficient temperature and residence time in the secondary combustion chamber to minimize the formation of dioxins and furans.

These compounds are not present in municipal solid waste in appreciable amounts but can be generated during combustion (de-novo synthesis) if not controlled properly. The Eco Waste Solutions incinerator employs a secondary combustion chamber operating at high temperatures (1000 degrees Celsius) and with sufficient residence time (2 seconds) to minimize concentrations of dioxins and furans in the flue gas. Ash remaining in the incinerator will be flown out to an appropriate waste disposal facility.

Performance literature obtained from the manufacturer as well as two studies published by Environment Canada are attached for reference. These reports confirm that the Eco Waste Solutions technology and the specific unit purchased by Wolfden will be capable of meeting relevant CCME and Canada Wide Standards for emissions from waste streams similar to the waste stream generated at the camp.

We note that the report entitled *Characterization of Emissions from an Animal Waste Crematorium, Eco Waste CleanAire* provides demonstration test data from the actual unit purchased by Wolfden for use at High Lake.

It will not be practical to avoid incineration of plastic materials in the waste stream altogether at a remote site such as High Lake. Plastic garbage bags are used to collect waste from the kitchen and dormitory areas and there are simply no practical alternatives to contain and transport garbage from the kitchen and camp to the incinerator. Containment of this type of waste is essential to minimize potential attraction of bears

and other wildlife into the camp area.

The majority of plastic items in the waste stream at the camp would be light weight food and beverage containers. Due to the food residue on such items, it is crucial to the safe operation of the camp that all food wastes are handled and incinerated properly such that the attraction of wildlife to the camp is minimized. Given the remote location of the camp, there is no practical means to access recycling programs for plastic goods and the cost of transporting these items off site by air is prohibitive.

We are not aware of any recycling programs in the closest communities at this time. The proposed incinerator is designed to combust mixed municipal solid waste (including plastics) and will provide the most effective and efficient means of dealing with this waste component. It should be noted that plastic has a high energy content and will increase the BTU value of the waste stream. This will further minimize the need to consume clean fuel to maintain design operating temperatures in the combustion chambers of the incinerator.

As noted, similar incinerator designs by Eco Waste Solutions have been tested and demonstrate the potential to meet the stringent Canada-Wide Standard emission criteria for dioxins and furans without the application of additional pollution control devices. The proposed incinerator is equipped with an automated control system that will maintain design operating conditions during processing without operator intervention. It will be operated by dedicated, trained staff and routine maintenance will be scheduled to minimize potential disruption of service.

In summary, the proposed incinerator will not be a significant source of dioxin and furans when operated as designed and no human health risk assessment is considered necessary.

Effects of noise on workers (e.g., sleep disturbance)

Wolfden is sensitive to the issue of noise and will endeavour to establish living quarters for staff that meet appropriate noise standards. The planned new Weatherhaven camp is a modern, spacious and comfortable living complex, which represents a significant improvement over the current assembly of canvas walled tents and small, wood framed buildings that comprise the existing exploration camp. This new camp will provide quiet and comfortable living accommodations for the workers at the site.

In addition, Wolfden has always and will continue to adhere to Nunavut Workers Compensation Board workplace standards for working hours and crew rotations into and out of the site. It is anticipated that the workforce employed at the site will be accustomed to the circumstances found at a remote work site such as High Lake. With the construction of new camp facilities, the staff and contractors working at the site will be adequately accommodated and cared for, including given the appropriate environment for rest while off-shift. As with many remote camps, company policies will be developed to

ensure adequate peace and quiet for off-shift workers in the camp (housing all night shift workers in one wing of the camp, notices reminding occupants not to slam doors, etc.).

1.2 Indian and Northern Affairs Canada

Additional Information on Acid Rock Drainage Potential

INAC requested further information regarding the acid rock drainage (ARD) characteristics associated with the proposed works, and possible effects on the surrounding environment. Further to this request, the following information on the ARD characteristics of the quarries and rock cut areas along the access road is provided.

The rock found within Aggregate Source No. 1, the quarry south of the airstrip, is shown on geological maps to be of mafic volcanic and sedimentary rock types. Recent inspection of the area confirms the mapping interpretation. Evidence of calcite veining, carbonate alteration and the visual identification of only trace to absent sulphide mineralization in the rocks suggest that the quarried material will likely be net acid consuming rock. A number of grab samples have been recovered from the site and are currently being analyzed to confirm their potential for ARD.

The majority of the access road rock cut areas and the quarry at Aggregate Source No. 4 are situated within the granodiorite complex that occurs to the west of the ore bodies. Samples from the drill core have been subjected to geochemical analysis as part of the ARD assessment of the potential, future High Lake mine waste rock zones. This rock type has been found to be a net acid consuming rock, with little or no sulphide mineralization. The quarry and road areas were inspected in the summer of 2005 and most recently in June 2006. Field observations confirm the continuity of the geology in these areas. Samples were obtained from the proposed quarry areas and have been submitted for chemical analysis to confirm field observations and previous findings.

Surveying and staking of the road alignment this summer will verify the preliminary road design. In conjunction with the survey, a geological assessment of the rock outcrops along the road route and the rock cut areas will be completed, and followed up with laboratory analyses. If areas of concern for ARD are noted in the fieldwork, final adjustments will be made to the road alignment to avoid ARD prone rock to the greatest practical extent. If ARD prone rock excavation cannot be avoided, the excavated material will be placed to the side of the road and covered with sand and gravel to promote permafrost ingress into the rock, thereby limiting the ARD/Metal Leaching (ARD/ML) impact.

The areas proposed as aggregate sources allow for sufficient space to permit the orderly extraction of aggregate as well as crushing and stockpiling. There is sufficient space in each identified aggregate source to allow for the selective drilling and blasting of bedrock such that areas of obvious sulphide mineralization can be avoided. Areas marked out for blasting will be inspected prior to drilling by Wolfden geological staff, and blasting will

only be allowed in areas visually free of significant sulphide mineralization.

During construction Wolfden geological staff will monitor excavations and rock samples will be obtained from the production blasts at a rate of one sample per 20,000 cubic metres of rock. The samples will be subject to Acid Base Account tests as well as total metals analyses. If rock with an ARD potential is found in this testing, it will be set aside and covered with gravel to promote permafrost ingress and will not be used in the construction of the roads and/or airstrip fill.

The quarry and rock cut areas are located at some distance from High Lake and other water bodies. Drainage will be controlled during construction and operation by grading and ditching and sediment control measures (e.g. silt fences, settling sumps) will be implemented, if required, to limit sediment release from the quarry and rock excavation sites.

In summary, ARD/ML will be managed through the implementation of an ARD/ML management plant that includes the assessment of ARD properties of the rocks prior to excavation and avoidance of ARD prone rock areas. ARD potential will be controlled and monitored throughout construction by sampling of outcrops prior to blasting and by sampling of production rock from blasts. Sediment control measures, which may include the installation of geotextile sediment curtains, or sumps as indicated by field conditions, will be implemented where needed to avoid releases of suspended solids into nearby surface water bodies.

1.3 Transport Canada

Proponent to contact Navigable Waters Protection Program (NWPP) to assess navigability of each water body crossing along the all-season road.

A letter was sent to NWPP on May 30 2006 requesting a determination of the navigability of the watercourses that will be crossed in conjunction with the proposed all-season access road. No response has yet been received.

Applications to be sent to NWPP to determine their interest in water intakes

Wolfden will enquire as to NWPP's potential interest in the two water intakes required to supply freshwater for camp use.

2. Government of Nunavut

2.1 Department of Culture, Language, Elders and Youth (CLEY)

Recommend approval of Land Use Application NIRB 6EN048 on the condition that

the Proponent's activities avoid archaeological sites listed in Attachment 1.

The proposed barge landing and temporary storage area at Grays Bay contains three sites for which specific archaeological mitigation plans have been proposed and submitted as part of the Nunavut Archaeologist permit application for 2006. This work has recently been approved under Permit # 2006-009A and will be completed this summer (July 2006). In addition, site inventory surveys for the area of the airstrip and access road will be carried out, now that the geographic coordinates are known and the area limits are defined. The winter trail between Grays Bay and High Lake and Ulu will also be surveyed this summer. For any sites found to be within the development areas, avoidance possibilities will be considered in consultation with the planning engineers this summer.

Every effort will be made to follow the terms and conditions proposed by CLEY with the exception of #8 that stipulates that all sites listed in Attachment 1 shall be avoided. It may not be possible to comply with Condition #8 in all cases. For small, simple sites that cannot be avoided, a general mitigation plan would be implemented, as follows:

- Detailed mapping of all features using a survey instrument
- Closely spaced transects to identify any surface artefacts, mapping of the artefacts in place, followed by collection
- Subsurface testing and excavation as necessary to ensure that a representative sample of all possible information has been recovered.

For larger, more complex sites, a detailed mitigation plan would be prepared and submitted to the Chief Archaeologist of Nunavut. Along the proposed winter trail route, complex sites are considered unlikely except possibly at the James River crossing. Every effort will be made to avoid sites along the road route(s), and in most sections, there is sufficient opportunity to do that.

2.2 Department of Environment (DOE)

Recommends that all hazardous material be removed from site upon completion of activities.

All hazardous waste will be managed in accordance with regulatory requirements and the Nunavut Department of Environment guidelines. Hazardous waste will be removed from the site, and any requiring treatment or disposal will be packaged in accordance with TDG regulations and shipped using registered carriers to approved facilities. All shipments of hazardous waste will be tracked using the manifest system in compliance with Nunavut guidelines and the federal Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301).

Soil remediation guidelines for soils exceeding 2500ppm total petroleum hydrocarbon.

Hydrocarbon contaminated soil accrued during the project will be transferred to a segregated area within the lined landfill for bioremediation treatment. The soil will be regularly turned and nutrients added to promote remediation. The soils will be sampled to determine when hydrocarbon contamination has been reduced to meet the soil remediation guidelines, and subsequently stockpiled for use in reclamation projects.

At closure, if the hydrocarbon contaminated in the soil within the landfill exceeds the soil remediation guidelines, the soil will be placed in drums and removed off site for proper disposal.

Geochemical stability of bedrock and exposed rock.

Characterization, monitoring and mitigation of potential ARD/ML effects will be carried out prior to and during construction as described under 1.2.

Spill Contingency Plan – additional provisions

All-terrain vehicles such as Foremost Nodwell and Commander or tractor and sleigh units will be used to transport equipment and supplies on the winter trail. The maximum travel speed for these vehicles is 5 km/hr for the Nodwell and 30 km/hr for the Commander. The suggested maximum speed of 30 km/hr loaded and 50 km/hr unloaded would apply to highway tractor/trailer units, which will not be used during the Relicensing Program.

All vehicles will be equipped with reliable radio communications for safety purposes. A helicopter will be available during winter trail operations to enable rapid responses to a spill incident, should one occur that is larger than can be handled using the spill kits on the vehicles.

The spill response equipment to be carried on transport vehicles is listed in Appendices 3.4 and 3.5 of the Spill Contingency Plan, High Lake Relicensing Program. All vehicles contain vehicle spill kits, and will include shovels, polyethylene tarps, and absorbent blankets and squares to contain spilled materials. In the event that a fuel truck overturns, the spill response equipment can be accessed from the larger mobile spill unit in the sea container (to include hatch cone covers, hoses, empty drums, pumps etc on each truck would be impractical).

Emissions discharged from the incinerator.

See comments under 1.1.

Energy conservation; greenhouse gas emissions.

The new Weatherhaven camp facility incorporates many energy conserving features and

is fully weatherproofed and well insulated. Operations will be planned and executed efficiently to minimize the amount of fuel consumed during the project. This is both an environmentally and fiscally responsible practice. Wolfden will endeavour to conserve energy where possible.

Wildlife

Caribou:

The Dolphin and Union herd moves throughout the mainland from late October to early June, and congregate along the coast in April-May prior to migrating across to Victoria Island where they calve and summer. As the winter trail would be established between January and March, it is likely that caribou will be encountered during the transport of equipment from the coast to High Lake during this period. Operating protocols (minimize disturbance to wildlife; give right-of-way to animals occupying or crossing the winter trail) will be employed to minimize the disturbance to wildlife that may be present during this activity. These measures are easily accomplished given the frequency of travel and relatively slow travel speed of the vehicles and equipment planned for the winter trail haul. Other mitigating measures proposed to reduce interference with movement of animals include:

- Establish a communication system to alert personnel of the number and locations of ungulates, so that staff can relay this information to vehicle and equipment operators
- Height of snow banks along road will be kept to minimum (<40 cm) to minimize the barrier effect to ungulate movement
- Restrict vehicle use to designated roads and work areas (recreational use of off-road vehicles is prohibited)

DOE recommends that there is no construction or blasting within 5 km of any "Designated Crossing" (which covers a 30km buffer around the proposed development footprint).

There are no Designated Crossing sites identified within the regional study area, so this should not be an issue.

The Bathurst herd has minimal overlap with the development proposal. For the past ten years (satellite collar and survey data), Bathurst caribou have been observed primarily southeast of Wolfden's Ulu property, and only rarely observed north of Ulu, and only during the immediate pre-calving and calving period (mid-May to late June). Calving has generally occurred well southeast of Ulu, and would not be affected by the proposed construction activities further north at High Lake and Sand Lake, nor by the winter trail that would be used earlier in the winter (January to March). It is not anticipated, therefore, that the proposed activities will overlap with Bathurst caribou movements or

calving.

Low level flights:

Wolfden will restrict low level flying to avoid or minimize disturbance to caribou and muskox. A minimum flying altitude of 300m above ground level for cargo and passenger aircraft outside the immediate project area will be enforced. It is anticipated that any low level flying will mostly be helicopters providing support for exploration drilling or geophysics within the construction corridor. Fixed wing aircraft would fly above this elevation beyond the take off and landing approach zones.

Winter road - effects on harvesting activities:

Harvesting mostly occurs along the coast, with little harvesting effort inland due to the difficult, rocky terrain. While actual harvest numbers of Dolphin and Union caribou are difficult to assess, indications suggest that Kugluktuk hunters tend to focus efforts on the Bluenose East herd, rather than the Dolphin and Union herd. No caribou harvest in the project area has been documented by hunters from Bathurst Inlet and Umingmaktok, or by any hunters inland from the coast. Wolverines are also harvested primarily along the coast (along travel routes), with only three recorded as harvested inland since 1999.

The winter road will be in use for a few weeks during the period January to March. While it is possible that harvesters along the coast may use the trail to access species further inland, it is unlikely that wildlife harvesting inland would increase significantly during this short period of time. The winter trail will not be maintained once the transport of equipment from the coast has been completed.

Raptor Nesting Areas:

The road corridor has been extensively surveyed for raptors for three field seasons. Cliff habitats are limited in the immediate area of the proposed access road. The only raptor sites identified are an occupied (with no nesting confirmed) gyrfalcon territory 1.5 km east of the road, about midway between High Lake and Sand Lake, and a peregrine falcon, raven, rough-legged hawk set of nest sites on a small lake about 600m northwest of the proposed Weatherhaven camp near High Lake. The general precautionary measures suggested by DOE will be followed during the proposed construction activity.

Additional measures proposed by Wolfden include:

Where active raptor nests have been identified within 1.6 km of a development footprint, a nest-specific management plan will be developed to ensure that nesting success is not compromised during development. In general, activity within 500m of active nests should be avoided during the early nesting period. Later in the breeding season, some activity to within 150m may be tolerated with minimal risk to abandonment. The risk of

disturbance to individual nest sites can be influenced by a number of factors including cliff aspect relative to source of disturbance, nest height, etc. A nest specific management plan that addresses proximity, timing and scope of allowed activities, will be developed prior to construction, based on site-specific requirements.

Carnivores:

Camp procedures will be followed to minimize the likelihood that bears will be attracted to the operation. Mr. A. McMullen (Bearwise) has audited Wolfden's camp operations and found the procedures and practices to be largely effective in reducing attractions to wildlife at the camps. Several recommendations have been implemented to improve operations, and a plan is being prepared that will largely focus on camp operating procedures for reducing grizzly bear and wolverine conflicts. The proposed measures will be implemented during the proposed construction activities.

CLOSURE

We trust the above comments and proposed procedures will adequately address the comments of the interested parties relating to Wolfden's Relicensing Project proposal. Furthermore, it is our hope that our Relicensing Project Description, operating procedures and contingency plans demonstrate Wolfden's commitment to safe and environmentally sustainable development in Nunavut.

If you have any questions concerning the above information or any other matter relating to the Relicensing Project or any of Wolfden's operations in Nunavut, please do not hesitate to contact me at your convenience. I may be reached by phone at 807-346-1668 or by e-mail at andrew.mitchell@wolfdenresources.com.

Sincerely

For: WOLFDEN RESOURCES INC.

Andrew Mitchell, P.Geo.
Project Manger

AM/
Encl.

401-1113 Jade Court • Thunder Bay, ON P7B 6M7 • Tel: 807-346-1668 • Fax: 807-345-0284
E-mail: info@wolfdenresources.com • Web: www.wolfdenresources.com

ATTACHMENT 1
ECO WASTE INCINERATOR SPECIFICATIONS

401-1113 Jade Court • Thunder Bay, ON P7B 6M7 • Tel: 807-346-1668 • Fax: 807-345-0284
E-mail: info@wolfdenresources.com • Web: www.wolfdenresources.com

Eco Waste Solutions

Sustainable Waste Management Solution for Remote Camp

Submitted to:

Luc Gravelle
Wardrop Engineering
May 31, 2006

Re:
Wolfden Resources – High Lake Mine
Wardrop Project no.: 05513101
EWS Quotation No: CA-100 (Demo) 310506

Eco Burn Inc. o/a
Eco Waste Solutions
5195 Harvester Road, Unit 6
Burlington, ON, Canada L7L 6E9
Tel: 905-634-7022 Fax: 905-634-0831
Toll Free: 1-866-326-2876
Steve Meldrum
Email: smeldrum@ecosolutions.com
Web: www.ecosolutions.com

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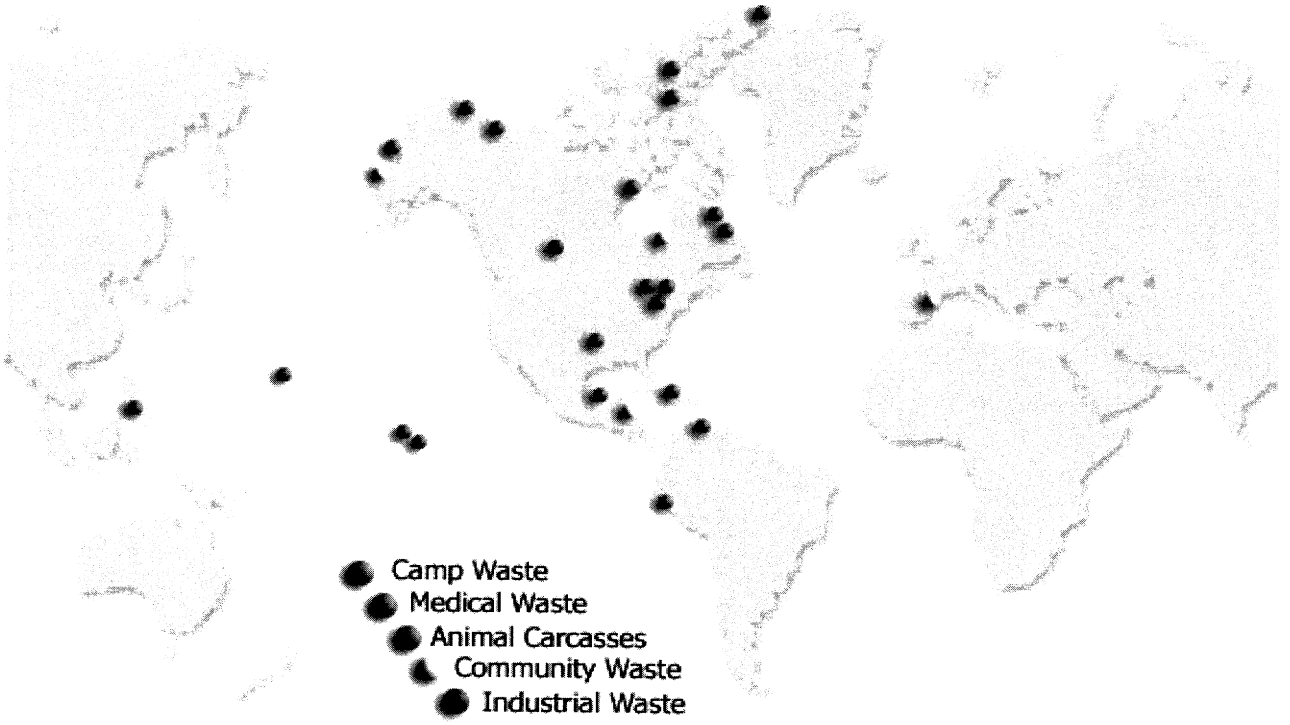
INTRODUCTION

Eco Burn Inc. operating as Eco Waste Solutions (EWS) has developed an innovative, world-leading technology to eliminate hazardous and problematic waste streams on a cost efficient basis through a patented process without generating hazardous emissions.

EWS has deployed Waste Oxidizers in nine countries. **EWS** customers include the United States Department of Health, the U.S. Department of Agriculture, the Canadian Department of Defense, PEMEX (Mexico), the City of Skagway, Alaska, US Air Force on Wake Island, as well as private and municipal customers in Canada, the U.S. and abroad.



EWS provides alternative solutions for the destruction of hazardous and non-hazardous waste for pharmaceutical, hospital, and other high cost waste streams. **EWS'** leading edge and cost-effective waste management solutions provide environmentally safe and effective alternatives to these issues. The **Eco Waste Oxidizer** is especially effective for smaller on-site destruction of waste.

EWS ADVANTAGES

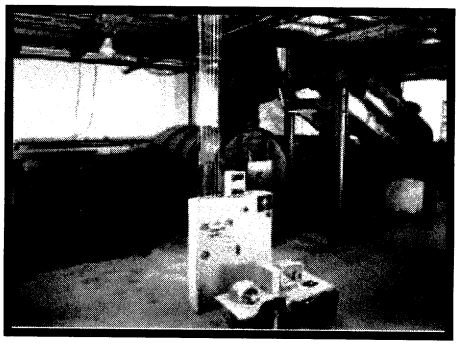
EWS Company Experience

- ISO 9001:2000 Registered
- Worldwide Installations
- Significant R&D Investment
- Proven Track Record
- Service & Quality

EWS Advanced Technology

- Automated Control System
- Minimal Down-Time
- Proven Technology
- Environment Canada Verified
- Patented in US, Canada and Europe
- 90% Waste Reduction by Volume and Weight
- Assured Destruction of Infectious Matter
- Sterilization of Metals and Glass for recycling
- Real-time Trouble Shooting
- On-line Diagnostics Available

Performance Claim Verified by the ETV Program



Burlington, Ontario Demonstration Unit with Wet Scrubber

EWS ADVANTAGES

Minimal Maintenance The **Eco Waste Oxidizer** has few moving parts and uses "off-the-shelf" parts that are generally available throughout the world, making it easy to maintain systems, even in remote locations.

Minimal Labor The **Eco Waste Oxidizer** operates on a "batch" basis and uses a computerized process control system, requiring only a part-time operator. Competitive incinerators that use a continuous feed process typically require full-time operators. The **Eco Waste Oxidizer** does not require highly technical or previously skilled personnel. By contrast, competitive systems often require highly skilled operators who have undergone intensive training.

No Pre-Sorting The **Eco Waste Oxidizer** is highly computerized, which is designed to process several types of solid materials with very low environmental impact. Tires, sewage sludge and municipal waste may be mixed together in a single load. By contrast, competitive systems often require pre-sorting of waste materials.

PLC A patented thermal treatment process drives a **Programmable Logic Control (PLC)** control panel that automates the operation of the system. By automatically ensuring optimal parameters for combustion, the need for constant operator input is eliminated. In fact, the combustion continues through to completion regardless of waste stream characteristics. The control panel is equipped with a modem to allow for downloading software or code updates. In addition, the modem permits on-line and off-site diagnostics and trouble-shooting.

Safety Features Safety features are also incorporated into the **Eco Waste Oxidizer**. For instance, if any of the doors are opened during the operation of the unit, the Control Panel will turn off all burners and blowers. The unit cannot be re-started until all doors are sealed. The Automatic Control System will shut down the system (shut off all burners) if the thermocouple on either the exhaust Stack or if the Primary Chamber reaches 1100°C. All air intake openings into the blower will also be shut down to stop the burning process. The unit will not re-start until the temperature falls below its set point operating parameters. Prior to ignition of the burners, both chambers are automatically evacuated (purged) of all gases. This safeguards against a build up of gases in the chambers. The Oxidizer system will not operate until all doors are sealed closed.

ENVIRONMENTAL PERFORMANCE

Advanced Control

EWS' patented process and programmable logic control system ensures a consistent and clean burn via strict control of temperature, combustion oxygen and burner output. By carefully maintaining the temperature of the Primary Chamber below the melting point of glass and metals, the release of heavy metals into the atmosphere is minimal. Strict control of the Secondary Chamber temperature ensures that noxious emissions from the Primary Chamber are destroyed. Most importantly, control of these combustion parameters minimizes dioxins.

Retention Time

One of the single most important combustion variables in achieving clean emissions is the Secondary Chamber Residence (or Retention) Time. The highly turbulent, high temperature and oxygenated conditions of the Secondary Chamber break down the gases emitted from the Primary Chamber into carbon dioxide, water vapor and trace elements. However, if the residence time is insufficient for complete combustion of organics and combustible particulates, they will be emitted directly into the atmosphere. To ensure complete combustion, the minimum residence time of an **Eco Waste Oxidizer** is 1.7 seconds.

Greenhouse Gas Friendly

An **Eco Waste Oxidizer** emits significantly less air emissions than a landfill. Landfills emit methane gas and other toxic compounds that are harmful to the surroundings. According to Hans Tammemagi in The Waste Crisis - Landfills, Incinerators, And The Search For A Sustainable Future (1999), "incinerating one million tonnes of municipal garbage produces net emissions of 15,000 tonnes of carbon in the form of carbon dioxide, whereas landfilling it with energy recovery produces emissions of greenhouse gases equivalent to 50,000 tonnes of carbon as carbon dioxide."

Proven Performance

EWS has installed systems in Canada, the United States, and abroad. Each of our customers have applied for and received all necessary environmental permits.

Third Party Independent Test Data

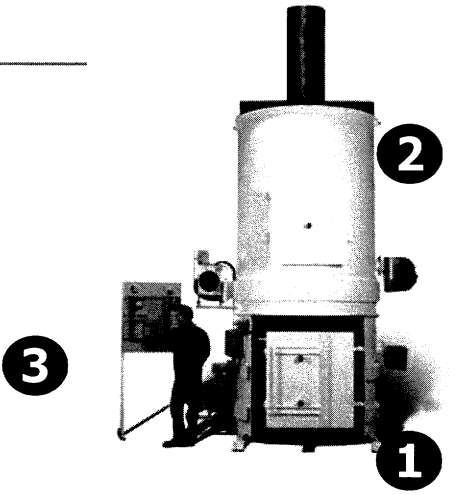
Air emissions stack test and residual ash test data available upon request for your Engineers to review.

Regulatory Compliance

EWS is a leader in providing environmentally responsible waste management equipment. The CleanAire Waste Oxidizer unit produces minimal emissions without an Air Pollution Control device (Scrubber), when processing camp kitchen waste in accordance with factory recommended operating procedures. However, some jurisdictions may require a scrubber to control HCl.

TECHNICAL OFFERING

CA Oxidizer
(CA-600 Shown)



1. Primary Chamber
2. Secondary Chamber
3. Main Control Panel

Explanation of Component Functions

Primary Chamber The Waste Oxidizer System uses a two-stage batch process. Waste is loaded into the Primary Chamber while the machine is off. The machine can be activated once the doors are sealed. The burning begins after the Secondary Chamber is at temperature. In the first stage, waste is converted to gas in the *Primary Chamber* at temperatures of (650°-800°C) in starved air conditions. At this temperature, metals and glass will not fuse and form clinkers (protecting the refractory from damage) and reducing the volatilization of some heavy metals. However, the temperature is sufficiently high to reduce waste volumes by over 90% and destroy any potentially infectious material.

Secondary Chamber Gases from the Primary Chamber enter the high temperature 1000°C, oxygenated and turbulent conditions of the *Secondary Chamber (Afterburner)* for combustion. The complete combustion is achieved after a minimum retention time of two seconds.

Controls Critical process parameters such as temperature, combustion airflow and burner output are computer-controlled to maintain optimal combustion conditions. Our proprietary programmable logic controlled (PLC) system ensures a consistent and clean burn, ensuring compliance with environmental standards.

The complete oxidation cycle, which consists of loading, combustion, cooling, residual removal, and re-loading occurs over 4-7 hours. This allows for several batches that can be repeated in a 24-hour period.

CA Waste Oxidizer Specifications

General	• Two-stage, Controlled-Air, batch process • Factory assembled as packaged unit and knocked down for transport (easy flange together assembly), pre-wired
Primary Waste Chamber	• Batch Capacity: 160-200 lbs • Cycle time: Burn 3-4 hours, Cool 1-2 hours • Operating temperature 650-750°C
Secondary Combustion Chamber (Afterburner)	• Operates at 1000°C with a retention time of 2 seconds • Includes combustion air blower and burner separate from primary chamber • Includes inspection/access door with site-glass/view port
Front Load Design	• Large front door on chamber allows for manual loading • Convenient ash removal access through same door • Door clamps and gaskets ensure good seal • Sight glass/view port on door • Safety interlocked to shut machine off if opened during burn
Oxidizer Casing	• 6 mm mild steel with rust-inhibiting, heat-resistant paint
Refractory Lining	• Combination of: hardened ceramic module and cast refractory all minimum 152 mm thick on walls and floor
Exhaust Stacks	• Mild steel, painted, with refractory lining 76 mm thick • Four (4) Sections of 1.52 m each, flange together • Includes damper section, spark arrestor and test ports
Diesel Burners	• General: Forced draft, pressure-mechanical atomizing, with built-in blower to supply combustion air, oil pump driven by blower motor, complete with integral relief valve and filter, pressure gauge, high voltage ignition transformer. • Control: electronic combustion control relay with scanner to control combustion and to supervise flame. Control to shut off fuel within 5 s upon flame failure or upon signal of a safety interlock and to ensure, when restarted, in sequence, ignition and supervision of burner operation. Main burner (afterburner) is fully modulating. UL/FM approved
Blowers	• Two supplied as part of Oxidizer – 1 in each Primary Chamber (for cooling) and 1 in Afterburner for Oxidation • All TEFC, VFD controlled
Controls	PLC programmable controller controlling the following functions: • Air/fuel modulation for temperature and process control • Primary-secondary burner interlock • Override protection • Shutdown and burndown cycle Control Panel includes: • Full read out at PLC of operating parameters • Single point electrical connection • Key lock power on, pushbutton start • Emergency stop switch • Full indicator and status lamps • Telephone modem for remote monitoring/ trouble-shooting of system operation (PC workstation option strongly recommended for customers wishing to use this feature)

Waste Oxidizer Model CA-100 - Operating Philosophy

The CleanAire Waste Oxidizer (or "Incinerator") will be located in a climate-controlled enclosure (modified shipping container).

The CleanAire Waste Oxidizer will be equipped with a large front door that allows for convenient manual loading and ash removal. There is no need for pre-sorting of the waste if source separation is practiced to keep inappropriate materials out of the waste feed. These inappropriate materials include but are not limited to hazardous materials such as batteries.

The system operates in a batch style. First the Primary Chambers are loaded to capacity (when cold). The doors are sealed shut and the Secondary Chamber (afterburner) is fired. The system is interlocked so that the waste is not allowed to combust until the afterburner is at operating temperature. The process is automated and does not require operator input during operation. The burn cycle is approximately 3-5 hours in length followed by a 1-2 hour cool down period. The necessary throughput may be achieved within two batches. However, if batch times are longer, due to higher volume, energy content or moisture content, a third batch may be started at the end of the work day with ash cleanout to occur at the start of the next day before loading the first batch.

In between waste processing the machine can be used to store the waste until a full load is acquired. However, the machine can be operated with smaller loads, if required. The design capacity and assumptions can be found on page 13 of this document (see Design Criteria).

It is not necessary for the Operator to monitor the process, once it has started. The process, including burn cycle and cooldown phases, will operate automatically. All key operating parameters will be controlled to factory pre-set settings using the PLC.

However, the system has the capability to be monitored remotely via the internal modem. This capability is best utilized with the optional PC Operator Workstation package. The PC is outfitted with Eco Waste Solution's proprietary Operator Interface software. The software has an easy to understand graphic user interface. The software displays the status of all of critical components, alarms malfunctions and allows for logging of system data. Another PC can view the screens remotely, on-site or by Eco Waste for factory support. A reliable telephone line connection is required for the remote monitoring.

Design Specification Criteria

Solid Waste Description

Domestic Waste from a 70-man camp with a waste generation **assumption of 4lbs of waste per person per day**. Therefore the **daily waste generation rate is 280 lbs per day**, during the construction period.

In addition, to the domestic waste there will be wood, paper, cardboard, oil & air filters, light plastics and cooking oil. The amount of these wastes are undetermined. These wastes will be mixed with the domestic wastes for processing.

Assumption: Solid waste characterization (a mix of the following)

The following waste types are assumed to comprise the "kitchen waste":

Waste Type 1: Rubbish, a mixture of combustible waste; paper, cardboard cartons, clean wood scrap, foliage and combustible floor sweepings from domestic, commercial and industrial activities. Contains up to 20% by weight of restaurant or cafeteria waste including food wastes. The waste has 25% moisture, 16% incombustible solids and a heating value of 6,500 Btu/lb when fired.

Waste type 3: Garbage, consisting of animal and vegetable wastes from restaurants, cafeterias, hotels, hospitals, markets and similar institutions. This type of waste contains up to 70% moisture, up to 5% incombustible solids, and has a heating value of 1000 BTU/lb when fired.

Kitchen waste is expected to have waste types 1 and 3 in a 40:60 ratio. As a result, the density is assumed to be in the 10 – 15 lbs per cubic ft. range.

In addition to the characterization of the waste to determine product selection and throughput these waste properties are also used to predict the stack gas quality. Consideration of the input waste material's composition is the most important factor in controlling air emission contaminants.

Waste engine oil will also need to be processed. This will be used as a fuel source for the waste oil burner that will act as an auxilliary burner in the Secondary Chamber. This burner will consume waste oil and reduce the consumption of virgin fuel used for processing the solid waste.

Performance Criteria Conditions

- The owner / operator is responsible for preventative measures to eliminate heavy metals from the waste stream fed into the incinerator (including adequate elimination and tracking procedures)
- The owner / operator is responsible to maintain the input waste mix in accordance with the Solid Waste Description as defined in the system specification requirements
- The owner / operator will ensure that each chamber is not charged with any load weighing greater than 160-200 lbs or 75-80% of the chamber's internal capacity by volume per burn cycle (as indicated by the lowest aspect of the burner port in the Primary Chamber). The chamber volumes are calculated to provide enough space for the total weight at the assumed density in the area below the burner port.
- The owner / operator is responsible for operating the unit according to the manufacturer's instructions in order to minimize excess air and particulate emissions, and unburned soot / ash.
- The owner / operator is responsible for ensuring the safe operation of the unit, according to procedures outlined in the owner's manual and including good housekeeping practices such as ash cleanout prior to re-loading the unit.
- The unit must be maintained according to the Eco Waste Maintenance Schedule.
- Modification of the unit in any way voids all warranties and obligations by Eco Waste Solutions.

If these conditions are not met, Eco Waste Solutions cannot assure the performance of the unit as designed.

If Performance Testing is required the procedure is to be mutually agreed upon between Eco Waste Solutions and owner / operator and performance testing to be performed within 90 days of start-up or 120 days after shipment, whichever occurs first.

Equipment Warranty

To the original Purchaser that the products and parts manufactured by the Corporation and supplied hereunder (the "Equipment") shall be free from defective workmanship and material for a period of 6 months from start-up or 12 months after delivery to the Purchaser. Eco Waste Solutions' warranty is limited to Eco Waste Solutions Inc. supplying the Purchaser with parts F.O.B. Purchaser site, replacement of any product or parts which shall be proved to the Corporation to be defective, provided that the Purchaser gives notice in writing within three (3) days after defect discovery.

To provide all labour related to Eco Waste Solutions manufactured / warranted parts for 6 months from start-up or 12 months after delivery to the Purchaser. In the case where Eco Waste Solutions has purchased components from other vendors or suppliers, warranty will be limited to providing, render reasonable assistance to Purchaser when requested, in order to enable Purchaser to enforce such warranties and guarantees by third party manufacturers suppliers.

Equipment Warranty (continued)

Equipment Covered

Equipment supplied under a purchase order to Eco Waste Solutions including:

- Primary Chamber
- Secondary Chamber
- Stack Sections
- Controls – Manual, Electronic and Electric

Extent of Coverage

All costs related to the repair or replacement of system components where failure is due to defect in material, workmanship or design is covered by Eco Waste Solutions for one year from the date of installation and start-up.

Replacement due to abuse, misuse, and/or lack of maintenance or carelessness is not covered. Wear from normal use, or alternative disposal costs are not covered.

There is no warranty on the following parts (consumables):

Thermocouples	Electrodes and wires	U.V. Sensors
Thermocouple Elements	Gaskets and Seals	Fuses
Thermocouple Protecting Tubes	Auto Pilots	Light Bulbs
Filters	Nozzles	Spark Screen
Glass Assemblies	Floor grate (if used)	
Refractory Surface Cracks		

Warranty Provisions and Exceptions

Eco Waste Solutions does not guarantee or warrant, either expressly or implied, the materials and workmanship of supplies, materials, equipment or machinery manufactured by third parties and furnished and installed by Eco Waste Solutions in the performance of the Work, to the extent such supplies, materials, and equipment or machinery is itself an end product with its own customary warranty. Eco Waste Solutions shall endeavour to obtain from all such vendors and suppliers and assign to Purchaser the customary warranties and guarantees of such vendors and suppliers with respect thereto. Eco Waste Solutions shall, at the sole expense to Purchaser, render reasonable assistance to Purchaser when requested in order to enable Purchaser to enforce such warranties and guarantees by third party manufacturers' suppliers.

Equipment Warranty (continued)

Eco Waste Solutions will not be liable for any consequential damages, loss or expense arising from any change in or alteration to equipment of its manufacturer such changes or alterations having been made by any persons other than personnel of Eco Waste Solutions or its agents, in which event such agents must have written permission of Eco Waste Solutions prior to making such changes or alterations.

Eco Waste Solutions shall in no event, be liable for consequential damages as a result of any breach of this agreement by or for any other reason. This warranty shall not apply to products or parts not manufactured by Eco Waste Solutions or to equipment parts which shall be subject negligence, accident or improper control, improper operation, maintenance, storage, or damage or circumstances beyond the control of Eco Waste Solutions or to other than normal use or service. Regarding parts of the equipment purchased by Eco Waste Solutions, no warranty is made other than that offered by the original equipment manufacturer.

THE ABOVE ARE ECO WASTE SOLUTIONS'S SOLE WARRANTIES, AND THE REMEDIES SET FORTH ABOVE CONSTITUTE PURCHASER'S EXCLUSIVE REMEDIES IN THE EVENT SUCH WARRANTIES ARE BREACHED. WITH RESPECT TO THE CONSTRUCTION AND MECHANICAL FUNCTION OF THE PRODUCTS, ECO WASTE SOLUTIONS MAKES NO OTHER WARRANTIES OF ANY KIND WHATEVER, AND THESE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES OR GUARANTEES, WRITTEN OR ORAL, STATUTORY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Payment Terms

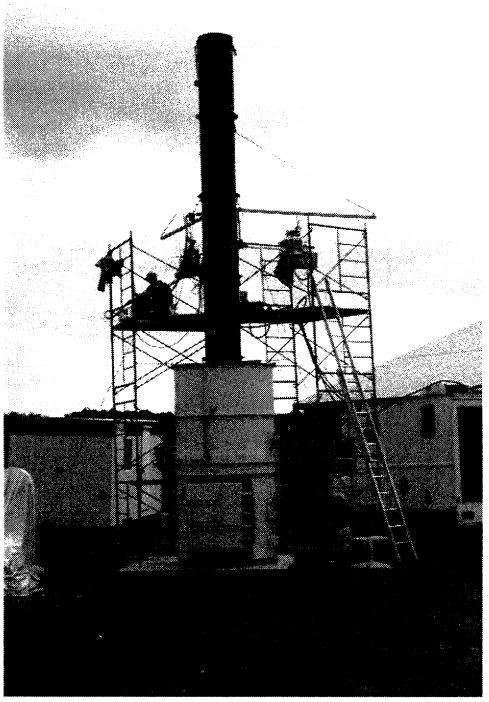
All orders are accepted when accompanied by a purchase order with deposit. Expected delivery time is 8-10 weeks after PO. Delivery date of July 28th in Hay River can be met if PO received by Eco Waste Solutions by June 5th, 2006.

Eco Waste Solutions manufactures equipment on a custom order basis. Therefore, the Schedule of Payments is as follows:

- 35% with purchase order
- 30% within 30 days of order
- 35% prior to shipping

ATTACHMENT 2
CHARACTERIZATION OF EMISSIONS FROM AN ANIMAL WASTE CREMATORIUM, ECO WASTE CLEANAIRE

401-1113 Jade Court • Thunder Bay, ON P7B 6M7 • Tel: 807-346-1668 • Fax: 807-345-0284
E-mail: info@wolfdenresources.com • Web: www.wolfdenresources.com



Characterization of Emissions from an Animal Crematorium EcoWaste CleanAire

Dominic Cianciarelli
Christopher House

Report ERMD 2003-03
March 2004
Emissions Research and Measurement Division
Environmental Technology Advancement Directorate

Environment Canada Environnement Canada

Environmental Technology Centre
Centre de Technologie Environnementale

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Environment Canada
Emissions Research and Measurement Division
Environmental Technology Advancement Directorate
Environmental Technology Centre
Ottawa, Ontario
K1A 0H3

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ACKNOWLEDGEMENTS

The Emissions Research and Measurement Division would like to express their appreciation to Dr. Bill Van Heyst of the University of Guelph and the operating staff of the Arkell Research Station, Ping Wu of the Ontario Ministry of Agriculture and Farms and Ali Alikaj of Eco Waste Solutions. Special thanks are extended to the Analysis and Ambient Air Quality Division at the Environmental Technology Centre for performing the analyses for dioxins, furans, co-planar polychlorinated biphenyls, chlorobenzenes, pentachlorophenol, polycyclic aromatic hydrocarbons and volatile organic compounds. Philip Analytical Services Inc. of Burlington, Ontario performed the metals analysis.

1. INTRODUCTION

Currently, cremation is not an approved disposal method for dead animals under the Dead Animals Disposal Act (DADA) in Ontario. However, on-farm dead animal cremation units (DACU) are currently being used in Ontario. Approximately 250 units are being used for on-site disposal of poultry and other species not mentioned in DADA. Cremation has the potential to be an acceptable method of carcass disposal under the new Nutrient Management Act and the new Food Safety Quality Act. Thus, the environmental impact of DACUs needs to be fully characterized and demonstrate that they can meet the current MOE limits and Canada-Wide Standards.

Specific concerns regarding deadstock cremation include air emissions of toxic substances from numerous small-scale DACUs, potential concentration of chemicals in the ash and the fate of pathogens, spores and prions from cremation.

The Ontario Ministry of Agriculture and Food, the Ontario Ministry of the Environment, the University of Guelph, the Ontario Region and the Emissions Research & Measurement Division entered into a cooperative program to address the issues listed above. The program was carried out at the Arkell Research Station of the University of Guelph. Two feeds, poultry and swine were selected for evaluation. Commercially available animal cremators were selected for evaluation. This report details the characterization of the Eco Waste Solutions CleanAire cremator manufactured in Burlington, Ontario. The CleanAire cremator system involves a two stage process. During the first stage, cremation occurs at temperatures above 649°C in the primary chamber. Smoke and gases then travel into the secondary (afterburner) chamber, where the combustion is completed. This unit is rated at 250 kilograms capacity.

This report details the releases to air of selected compounds from the dead animal cremator. Target pollutants included particulate, acid gases, metals including mercury, dioxins and furans (PCDDs/PCDFs), co-planar polychlorinated biphenyls (co-planar PCBs), chlorobenzenes (CBs), pentachlorophenol (PCP), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and flue gases (O_2, CO_2, CO, SO_2 and NO_x).

2. SAMPLING SITE AND LOCATION

Sampling was conducted on the exhaust stack of the cremator. The sampling location is illustrated in Figure 1. Sampling was conducted from two four-inch ports located about 19 feet above grade. The stack sampling location met the upstream and downstream flow disturbance criteria.

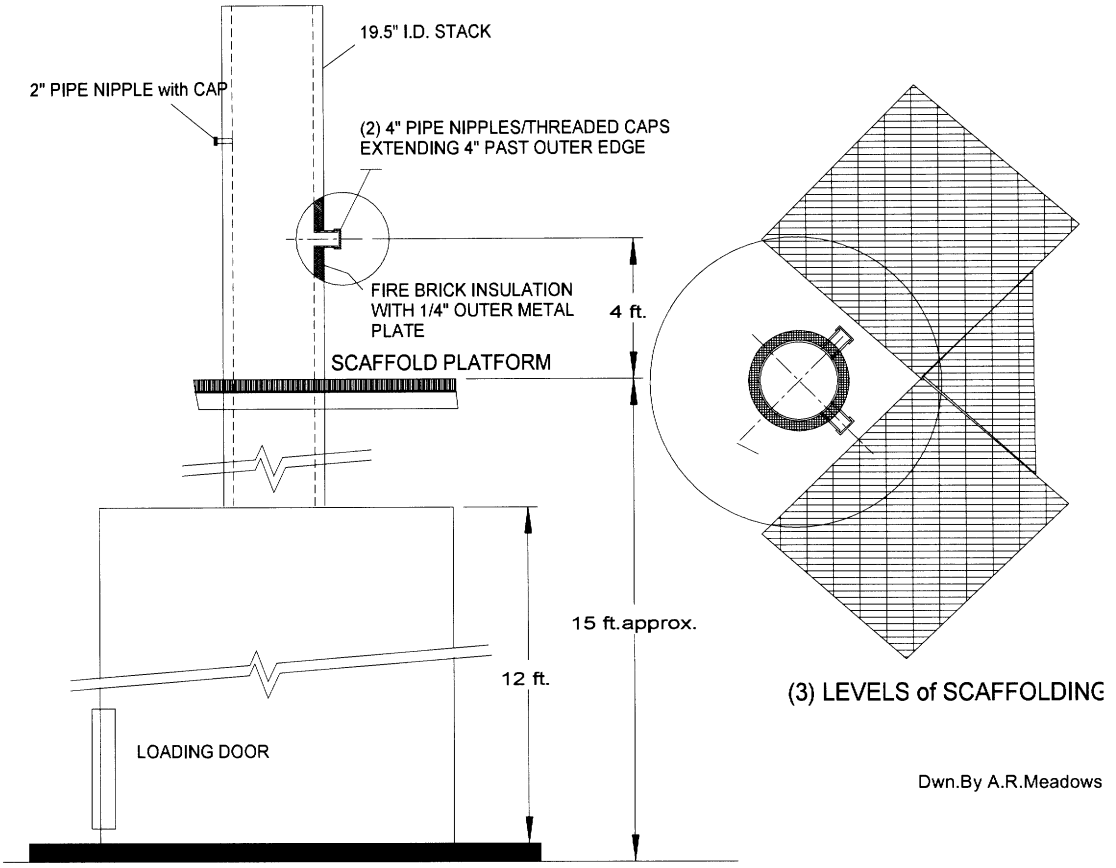


Figure 1 Sampling Location – Eco Waste Cremation Unit

3. SAMPLING METHODS

3.1 General

The Method 5 train formed the basis of the manual methods used to collect particulate, acid gases, metals and semi-volatile organics (SVOCs) during the sampling phase. The train consisted of a 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 and micromanometer. 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 mobile 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 from two traverses at isokinetic sampling rates for each of the particulate/acid gases/metals and SVOC sampling trains with readings recorded every five minutes. Sampling duration for the SVOC and particulate/acid gases/metals runs was 240 and 120 minutes respectively.

3.2 Particulate, Acid Gases and Metals Train Description

EPA Method 29, "Determination of Metal Emissions from Stationary Sources", was used to determine particulate and metal emissions. Particulate emissions were collected in the probe and on the heated filter. The condensation and collection of the gaseous fraction was accomplished using seven impingers connected in series. The first impinger, normally empty in Method 29, was filled with 100 mL water for acid gas determination followed by two impingers containing 100 mL of an acidic solution of hydrogen peroxide (5% HNO_3/10% H_2O_2), followed by another empty impinger, followed by two impingers containing 100 mL each of an acidic solution of potassium permanganate (4% $KMnO_4$/10% H_2SO_4) and finally followed by a silica gel impinger. A schematic of the sampling train is shown in Figure 2.

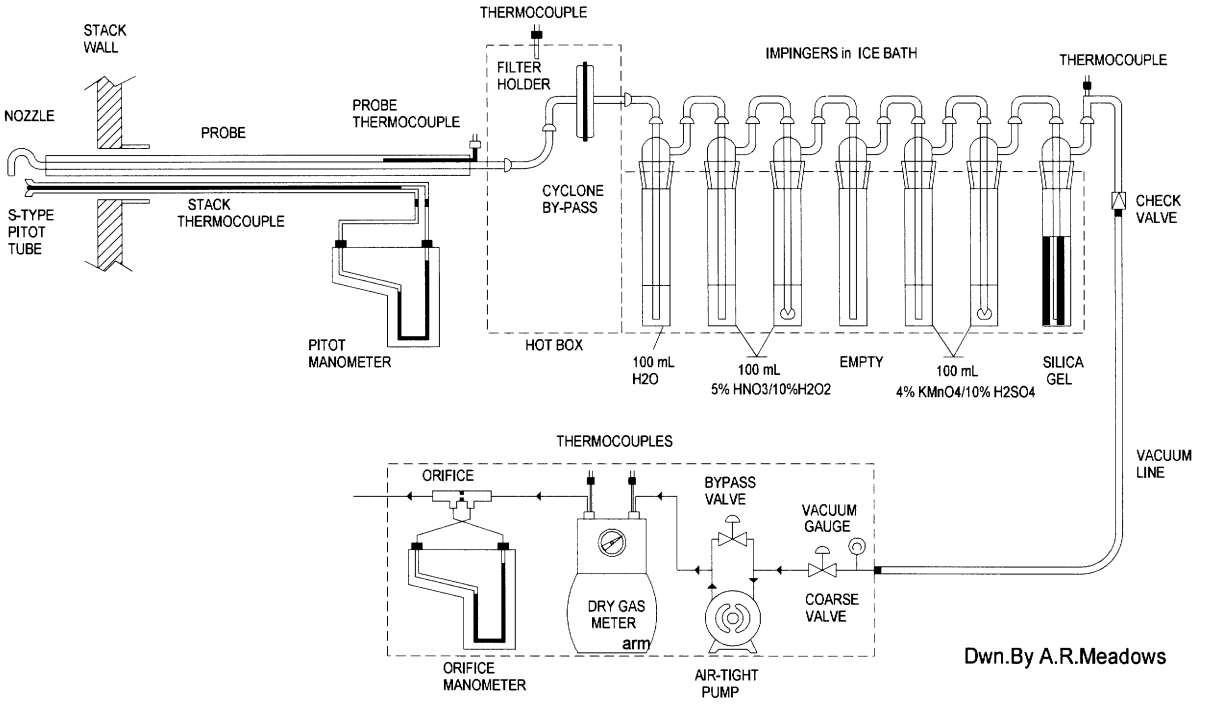


Figure 2 Particulate/Acid Gases/Metals Sampling Train

The glassware was pre-cleaned following the meticulous procedure detailed in the method. Eight samples from each test were obtained from the recovery procedure and submitted for analysis. These samples include the particulate filter, an aliquot of the first impinger water, rinses of the front- and back-half glassware with various portions of acetone, nitric acid, acidified potassium permanganate and hydrochloric acid that are detailed in the method. As

well, aliquots of the reagents used in the sampling train and in the recovery procedure were submitted for blank analysis.

Glass bottles with Teflon-lined caps were used for storage of acidified $KMnO_4$ containing samples and blanks. No metal components were used in the sampling train. Quartz nozzles and liners were used to avoid contamination and handle the high temperatures at the outlet.

3.3 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, co-planar PCBs, CBs, PCP and PAHs from the stack. A schematic of the sampling train is shown in Figure 3.

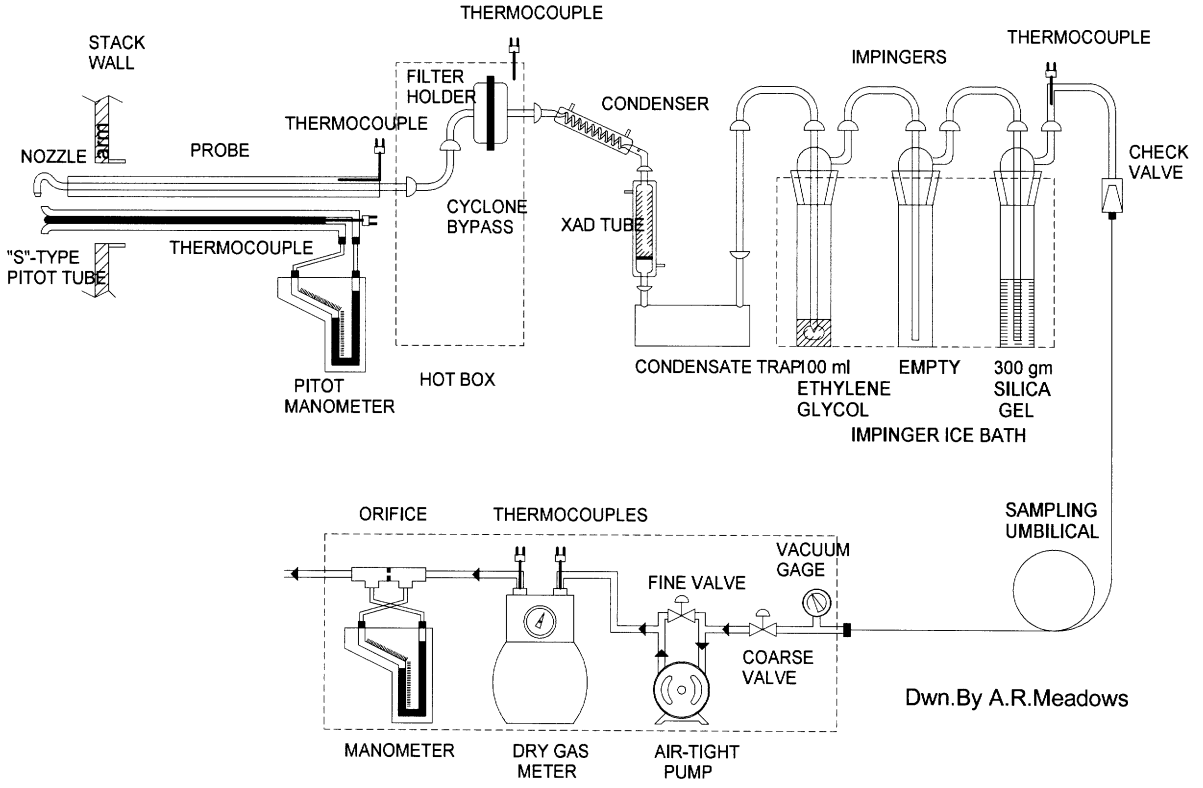


Figure 3 Semi-volatile Organic Compounds Sampling Train

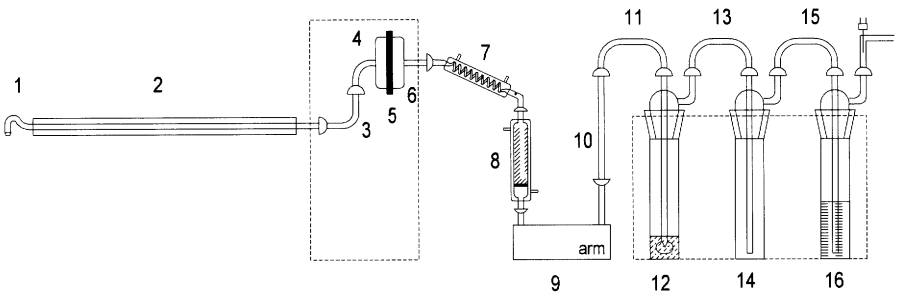
This method is the most widely accepted for the measurement of organic compounds with boiling points above 100°C. Gaseous organics were trapped in a single adsorbent tube containing about 40 grams of Amberlite XAD-2 resin. As the temperature of the resin must be kept below 20°C for optimal collection 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 aluminum foil during sampling and storage to prevent photodegradation of the trapped organics. All glassware joints were wrapped with Teflon tape as vacuum greases are not permitted for organic sampling. Quartz nozzles and liners were used in the sampling train.

3.3.1 Glassware Cleaning and Proofing

Prior to the test program, all train glassware, probe brushes, glass wool and aluminum foil were cleaned following the rigorous procedure in the Reference Method. 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. Eight 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.

3.3.2 Sample Recovery

Following the completion of each run, the organic train was recovered in the ERMD mobile laboratory. During the transportation between the sampling site and the lab, all openings were sealed with pre-cleaned glass plugs or caps or aluminum 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. The loaded filter was carefully removed from the holder, sealed in pre-cleaned foil and stored in a pre-cleaned glass petri dish. Amberlite tubes were capped and re-wrapped in aluminum 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.



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 filter 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, wrap all the caps with tape and label all bottles/containers.
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 vessel provides a stable sample collection and storage media for many organic compounds.

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 Inconel probe, a moisture trap, a Teflon-coated pump, a mechanical flow controller and a canister (Figure 5).

Two canisters were collected for each SVOC run corresponding to the first and second halves of the traverses. Sampling duration for the VOC samples was variable, ranging from 60 to 63 minutes. The sample was collected into the evacuated canister to a final pressure of 16 to 22 psig. Following sample collection, the canister valve was closed and the canisters were transported to the AAQD laboratory for analysis.

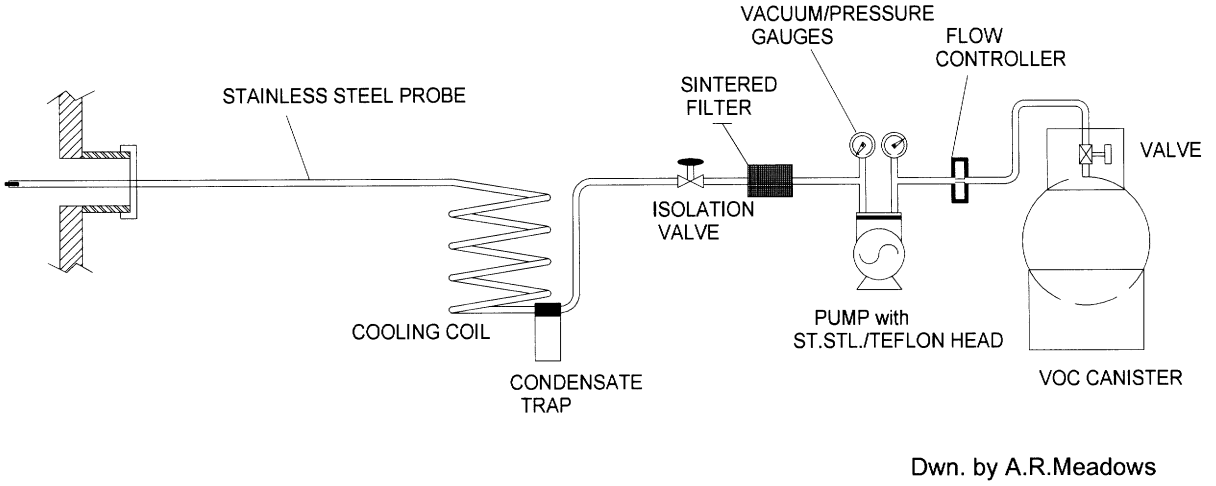


Figure 5 Volatile Organic Compounds Sampling Train

3.5 Flue Gases

An integrated gaseous sample method was employed to collect a representative sample from the stack. This was accomplished by drawing sample gas through a 12-inch Inconel probe located directly in the exhaust stream. Following particulate removal in a heated filter and conditioning (drying and cooling) of the sample gas, the sample gas was drawn through a stainless steel/Teflon head pump into a high volume aluminized Tedlar sample bag. Sampling rate and duration were 1.0 Lpm and 30 minutes respectively. An integrated bag sample was collected every half-hour during the sampling. A schematic of the system is shown in Figure 6.

Each integrated sample was then analyzed using both an ECOM Model KD (electrochemical analysis of O_2, CO, SO_2 and NO and NO_2) and a Nova Model 306 BD (infrared analysis of CO_2), to determine target species concentration. Each instrument was individually calibrated twice a day using two ranges of certified gas standards. Initial calibration was carried out prior to the commencement of sampling, once all equipment had reached operating conditions, while final calibration was performed at the end of sampling.

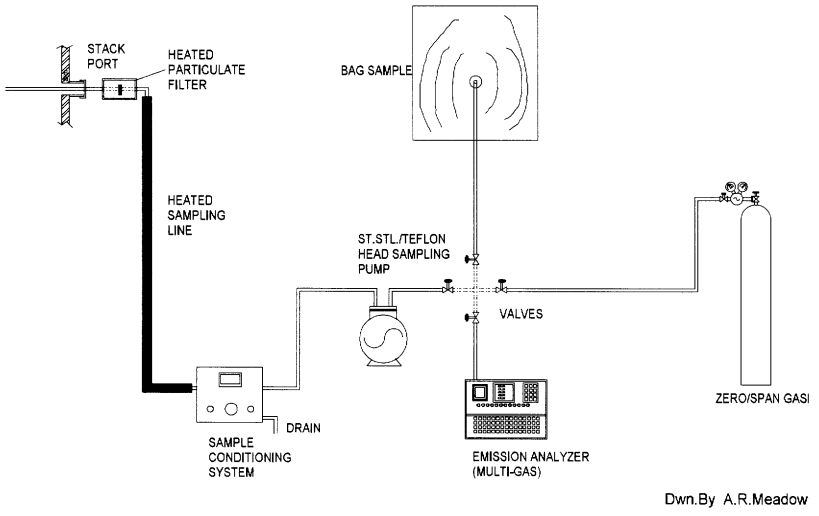


Figure 6 Flue Gas Monitoring System

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

The dry gas and orifice meters were calibrated using a spirometer. Pitot tubes were calibrated at the ERMD 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 caliper. In addition to the above, the sampling consoles and inclined gauges were checked for leaks and the operation of all probe and box heaters was verified. Zero and span calibrations, drift and ten-point linearity checks were completed on the flue gas analyzers.

5. ANALYTICAL METHODS

5.1 Particulate, Acid Gases and Metals

Particulate was determined gravimetrically following desiccation of the front-half acetone rinse and loaded filter. The samples were acid digested, and appropriate fractions were analyzed for mercury by cold vapour atomic absorption spectroscopy (CVAAS) and the remainder of the metals was analyzed by inductively coupled argon plasma emission spectroscopy (ICAP). The front- and back-half components were combined for the metals analysis. Acid gases were determined from the impinger solutions using ion chromatography.

5.2 Semi-volatile Organic Compounds

Upon receipt in the laboratory, the samples are inspected to ensure integrity and proper labeling. 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 cyclohexane/toluene (8:2 v/v). Prior to extraction, each sample is spiked with a solution containing a known amount of carbon-13

labelled dioxin/furans, dioxin-like PCBs and chlorobenzenes as well as deuterated PAH. These are used to assess losses incurred during the extraction and sample cleanup procedures. Analytical results for dioxin/furan, dioxin-like PCBs and chlorobenzenes/octachlorostyrene are corrected for the recovery of these surrogates. PAH results are not corrected for surrogate recovery.

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 fraction is used for PAH and chlorobenzene/octachlorostyrene cleanup and analysis while the other is used for dioxin/furan and dioxin-like PCB cleanup and analysis.

The PAH and chlorobenzene/octachlorostyrene cleanup involves passing the sample extract through a deactivated silica column which contains 5% water (w/w). Chlorobenzenes and octachlorostyrene are eluted out of the column using hexane while the PAHs are retained on the column. A more polar solvent is then applied to the column to elute the PAHs. The cleaned sample extracts are concentrated to 500 µL and an internal standard is added to monitor instrumental performance and is used to correct for any variations in injection and sample volume. The samples are analyzed using low resolution mass spectroscopy. Calibration standards containing 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 is periodically assessed using standard reference materials.

The dioxin/furan and dioxin-like PCB cleanup is more rigorous since the concentrations of these analytes are much lower than other compounds that may be present in the extract. These co-extractants could interfere with the final analysis. Initially the sample extract is passed through a multi-bed 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 chlorobenzenes/octachlorostyrene. The fraction containing dioxin/furans is reduced to 20 µL and an internal standard is added to monitor instrumental performance and to correct for any variations in injection and sample volume. The sample is analyzed using high resolution mass spectroscopy. Following analysis for dioxin/furans, the analyzed fraction is combined with the previously eluted fractions from the alumina column and the volume of the combined extracts is reduced to 100 µL. The combined fraction is then injected on an HPLC COSMOSIL PYE column. A PYE is a reversed phase silica-based column which can separate the ortho-, mono-ortho, and non-ortho-chlorinated chlorinated biphenyls on the basis of the degree of planarity and chlorination using pentane as the eluent. The dioxin-like PCB fraction is collected and reduced to a final volume of 20 µL by the addition of an internal standard. The extract is analyzed using low resolution mass spectroscopy.

As a part of quality assurance and quality control, a method blank is usually processed along with the samples to assess cross contamination. A control sample, usually a standard reference material containing a known amount of analytes, may also be processed along with the samples to check extraction, cleanup and analytical efficiency. The division also participates in inter-laboratory studies. The results of these studies are used to compare the results obtained in-house

with the results obtained from several different laboratories. These studies involve various analytes from a variety of matrices. The division is accredited by CAEAL for the analysis of PAHs and dioxin/furan.

5.3 Volatile Organic Compounds

The stack samples in canisters were analyzed using thermal desorption technique with a high-resolution gas chromatograph and quadrupole mass-selective detector (GC-MSD) as described in EPA Methods TO-15 and TO-17. A Dynatherm Analytical Instruments ACEM Model 900 thermal desorption system was used for sample preconcentration. Sorbent tubes packed with 20/35 mesh Tenax-TA, 60/80 mesh Carboxen 1000 and 60/80 mesh Carbosieve SIII were used for sample concentration. An Agilent 5890 series II gas chromatograph and an Agilent 5972 MSD were used for species identification and quantification. Volatile organic compounds were separated on a 60 meter, 0.32 mm I.D. fused silica capillary column with a 1.0 μm film thickness of J&W DB-1 bonded liquid phase.

Gas from the canister was drawn through the LiOH packed tube and concentrated onto a sorbent. Sample volumes were measured with a mass flow controller at a fixed flow rate, 100 mL/min. Normally, 500 mL of stack sample was passed through a LiOH tube to remove acid and CO_2 from stack gas and then concentrated on sorbent tube. Ten mL of internal standard was loaded onto the sorbent tube at the same time. The sorbent tube was purged with 500 mL of UHP air to flush out CO_2 from the sorbent tube. The sorbent tube was loaded onto ACEM Model 900 thermal desorption system. An internal flow of helium purges the tube of residual water vapour and air prior to transfer of the collected analytes to a capillary packed trap for refocusing, then into a GC-MS equipped with wide-bore capillary column and mass spectrometer.

Optimum results were obtained by temperature programming the GC column. Column temperature was initially held for 3 min at –60°C, then raised to 250°C at a rate of 8°C min^{-1}. The GC-MSD was operated in the selected ion monitoring mode (SIM). Identification of target analytes by SIM is based on a combination of chromatographic retention time and relative abundance of selected monitored ions. Two or three characteristic ions were monitored for each of approximately 145 hydrocarbon compounds found in urban air samples. Since the MSD acquires data for only target ions, this detection technique is considered highly specific and sensitive.

An instrument calibration standard was made from gas standards prepared in the laboratory of Environment Canada from three multi-component liquid mixtures and gas mixture cylinders purchased from Scott Environmental Technology Inc. Quantification was based on five-point linear regression calibration curves.