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Jericho Project Final EIS
Supplemental Report

Submitted to:

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Toronto, Ontario

Submitted by:

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1.0 INTRODUCTION

This report constitutes an addendum to the Jericho Project Final EIS issued to Tahera Corporation by AMEC Earth & Environmental Limited. Issues addressed refer to government correspondence dated April and May 2003 and a Tahera workshop held in Edmonton, Alberta, the week of June 16, 2003. Issues addressed in this supplemental report are also listed in Table 1-1. Responses are contained in this report in the order listed in Table 1-1. Issues are treated in the order presented in EIS responses, except KIA/.NTI where highly and moderately significant issues are treated first, followed by low significance items.

A directive was issued by NIRB 18 August 2003 that contained a number of issues not previously raised by government and additional requirements for supplemental information for the Jericho Project. These issues are discussed at the end of this supplemental report where they are completely new and in the appropriate sections elsewhere where they supplement previous government requests for additional information, cited above.

Table 1-1: Jericho Final EIS Supplemental Responses List

Agency	Issue No.	Report Section	Issue
KIA/NTI	39	2.1.1	Characterization of sewage effluent
KIA/NTI	40	2.1.2	Human health guides + NO_3 Included in #38
KIA/NTI	53	2.1.3	The need for lake oxygenation
KIA/NTI	14	2.1.4	Lack of Moisture and Silt Content of Coarse PK
KIA/NTI	22	2.1.5	Trigger for lichen metal levels
KIA/NTI	32	2.1.6	Modify Baseline Appendix Figure 3.2
KIA/NTI	43	2.1.7	Modify aquatic monitoring program
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KIA/NTI	45	2.1.9	Expand sediment quality assessment
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KIA/NTI	60	2.1.11	EKATI™ and Diavik Water Licence conditions
KIA/NTI	97	2,1,12	Metal bioaccumulation in wildlife using the PKCA
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KIA/NTI	99	2.1.14	Temporary storage of hazardous wastes
KIA/NTI	100	2.1.15	Adequate spill containment berm areas
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KIA/NTI	117	2.1.17	Adequacy of re-vegetation plans
DIAND	2.3	2.2.1	Aquatic effects of mine discharges
DIAND	2.4.1	2.2.2	Access road options
DIAND	2.4.2	2.2.3	Ice lenses in borrow areas
DIAND	2.4.3	2.2.4	Fuel/hazardous materials storage
DIAND	2.5	2.2.5	Expanded CEA
DIAND	2.6	2.2.6	Green cover/revegetation
DSD	2.2	2.3.1	Hazardous materials storage; NH_3NO_3 pad
DSD	2.3	2.3.2	Spill contingency planning
DSD	2.5	2.3.3	Management of process/industrial wastes
DSD	2.6	2.3.4	Management of domestic wastes
DSD	2.7	2.3.5	Waste oil burning
DSD	3	2.3.6	Project description

Agency	Issue No.	Report Section	Issue
DSD	4.1	2.3.7	General
DSD	4.2	2.3.8	Flocculants
DSD	4.3	2.3.9	Air quality
DSD	4.4	2.3.10	Soil, groundwater and permafrost
DSD	4.7	2.3.11	Revegetation
DSD	4.10	2.3.12	Cumulative effects assessment
DSD	5.1	2.3.13	Abandonment and site restoration
DSD	5.2	2.3.14	Soil handling plan
DSD	5.3	2.3.15	Mine water management plan
DSD	5.4	2.3.16	Revegetation plan
DSD	5.5	2.3.17	Reclamation plan
DSD	6	2.3.18	Level of Confidence and Certainty
DSD	7.4	2.3.19	Abandonment
Env. Canada	28	2.4.1	air quality monitoring
Env. Canada	29	2.4.2	Low sulphur diesel
Env. Canada	31	2.4.3	Phone number correction
Env. Canada	32	2.4.4	Disposal of liquids and contaminated soils
Env. Canada	33	2.4.5	Disposal of contaminated sorbents
Env. Canada	34	2.4.6	Treatment of routine spills
Env. Canada	35	2.4.7	Storage of ammonium nitrate
Env. Canada	36	2.4.8	Cumulative effects assessment
NIRB	1	2.5.1	Traditional Knowledge
NIRB	2	2.5.2	EIA Issues
NIRB	3	2.5.3	Vegetation
NIRB	4	2.5.4	Management Plans
NIRB	5	2.5.5	Monitoring

2.0 KIA/NTI ISSUES

2.1.1. Issue 39: Internal Loading of Carat Lake

KIA/NTI Conclusions and Recommendations

Tahera needs to revise its statements and predictions with regards to conservative water quality variables. As the water management system for the proposed Jericho project represents a partially closed loop, concentrations of conservative parameters area likely to increase over the life of the mine. Tahera must address the issue of internal loading.

AMEC's Response

The issue is addressed by Greisman (Greisman and Dunbar 2003) where it is concluded that

> *The effect of recirculation in increasing the concentration of the effluent is dependent upon the number of circuits a water parcel makes through the lake – process – polishing pond circuit. Conceptually, additional solutes would be added to the process water on each circuit through the system. A time scale of recirculation is needed to evaluate the effect.*
>
> *The modelling demonstrates that months pass before water discharged to Lake C3 is detected in Carat Lake. Another time scale is available form the flow-through time of the system. The volume of Carat Lake is approximately 30 million cubic metres. The average flow for the year modelled is approximately 1500 cubic metres per hour. The ratio of these values yields a flow-through time of approximately 800 days. Both time scales suggest that, at most, only one or two "flow-throughs", or circuits, are completed by a water parcel in a given year. Using this time scale and the numerically simulated dilutions, one would expect an increase in effluent concentration of less than one percent. The importance of recirculation on increasing effluent concentration will, of course, increase if the intake is placed very close to the effluent discharge. In terms of the foregoing discussion, this placement decreases the flow-through time, permitting more circuits through the process.*

Characterization of Sewage Effluent

KIA/NTI Conclusions and Recommendations

A complete characterization of the waste water treatment plant effluent is required; the interaction of PK and phosphorus requires characterization.

AMEC's Response

The second part of KIA/NTI's request is addressed by SRK, based on a University of Alberta study of EKATI's™ PKC and waste waster treatment plant discharge.

Additional information was obtained from a supplier of rotating biological contactor (RBC) waste water treatment plants. The manufacturer quotes the following for a typical 100-man camp unit similar in configuration (but smaller) than that installed at Diavik:

BOD_5	<10 mg/L
TSS	<10 mg/L
NO_3	<10 mg/L
Total N	<20 mg/L
P	<1.0 mg/L
Faecal coliform	<2.2 MPN
UV disinfection	

Specifications for this type of plant are well in excess of NWT sewage treatment plant guidelines.

See also response to DSD Issue 2.5, below.

2.1.2. ISSUE 40 Water Toxicity

Potential Toxic Effects of Altered Water Quality: Human Health Guides for Water Quality Effects

KIA's Conclusions and Recommendations

Tahera has not given adequate consideration to the human health effects of altered water quality as a result of project activities. As well, the potential effect of increased nitrogenous compounds has not been adequately considered.

Health Canada guidelines are provided in the appendices, but not discussed within the context of the EIA or EIS. Predicted Jericho PK effluent quality exceeds Health Canada guidelines for total dissolved solids (TDS) and chloride. However, major ions are not addressed as a potential concern anywhere within the primary text.

Tahera needs to consider and apply Health Canada guidelines in a more thorough manner throughout the EIS. This would involve a consideration of the environmental and health impact of changes in major ion concentrations within the aquatic environment. Since at least a portion of the effluent water will be re-circulated as drinking water (via use of Carat Lake as a drinking water source), human health effects need to be considered in much more detail.

AMEC's Response

Aquatic toxicity is discussed by AMEC (2003a). Human health is the subject of this response.

Drinking water guidelines are provided for Canada by Health Canada. Based on discharge predictions (SRK supplemental report 2003) and water quality impact assessment supplement (AMEC 2003b) at extreme low flows, Health Canada guidelines will not be exceeded.

Under normal flows (modeled in 2001 by URS [Jericho final EIS, Appendix D.1.2], Health Canada guidelines will not be exceeded.

At the Carat Lake water intake, even under extreme low flows, minimum dilutions are predicted to be 120:1 and no Health Canada guidelines will be exceeded.

2.1.3. Issue 53: The Need for Lake Oxygenation as Mitigation

Consequences to Fish of Increases in Phosphorus.

KIA/NTI Conclusions and Recommendations

1. However, Jericho is a semi-closed system – the second receiving lake (Carat Lake) is also the source of process water and drinking water. Therefore, unlike Ekati, there will be internal loading of nutrients, ions and dissolved metals in the Jericho project area. Hence, small releases of phosphorus will accumulate over time to produce larger concentrations of phosphorus;

2. The potential for winter declines of dissolved oxygen as a result of increased production of organic matter and for winter kill of fish must be examined. The mitigation scenario of aerating Lake C3 and Carat Lake to prevent winter kill of fish must be examined.

AMEC's Response

1. As indicated in the final EIS, only 1% of the total throughput of Carat Lake is drawn off. Also, as indicated in the final EIS, Carat Lake water completely turns over in approximately one year for an average runoff year. Internal loading effects are discussed by Greisman and Dunbar (2003) in their dilution modeling.
2. Tahera will commit to monitoring winter oxygen in Lake C3 and Carat Lake, as requested by Environment Canada, prior to mine discharge. A review by Welch (no date) suggests lakes less than 10 m depth may be subject to winter fish kills. Lake C3 is 16 m deep at its deepest point and Carat Lake is over 30 m deep. It is therefore possible that Lake C3 approaches winter kill conditions on occasion but unlikely that Carat Lake ever reaches that condition. Further, the presence of fish in Long Lake (maximum 8 m depth) and Lake C1 (also maximum 8 m depth) suggests that the critical depth for lakes at Jericho is less than 8 m. Both the named lakes are land locked and extremely low oxygen in any year since fish established in these lakes would result in no fish being found in the lakes. EKATI™ monitoring data (Rescan 2002) indicate a drop in oxygen concentrations in all mine area lakes whether influenced by mine activities or not, as would be expected from ice cover conditions and similar conditions would be expected at Jericho.

   In the extremely unlikely event that oxygen levels drop below *natural* levels in unfrozen (fish winter refuge) basins in either Carat or Lake C3 and this drop can be reasonably ascribed to discharges by the Jericho Mine, Tahera will commit to aeration of the lakes so affected. We note that at EKATI™, other than Kodiak Lake which was used for the deposit of raw sewage, no evidence of winter dissolved oxygen depression was detected in monitored lakes (Rescan 2002).

2.1.4. ISSUE 14: Lack of Moisture and Silt Content of Coarse PK

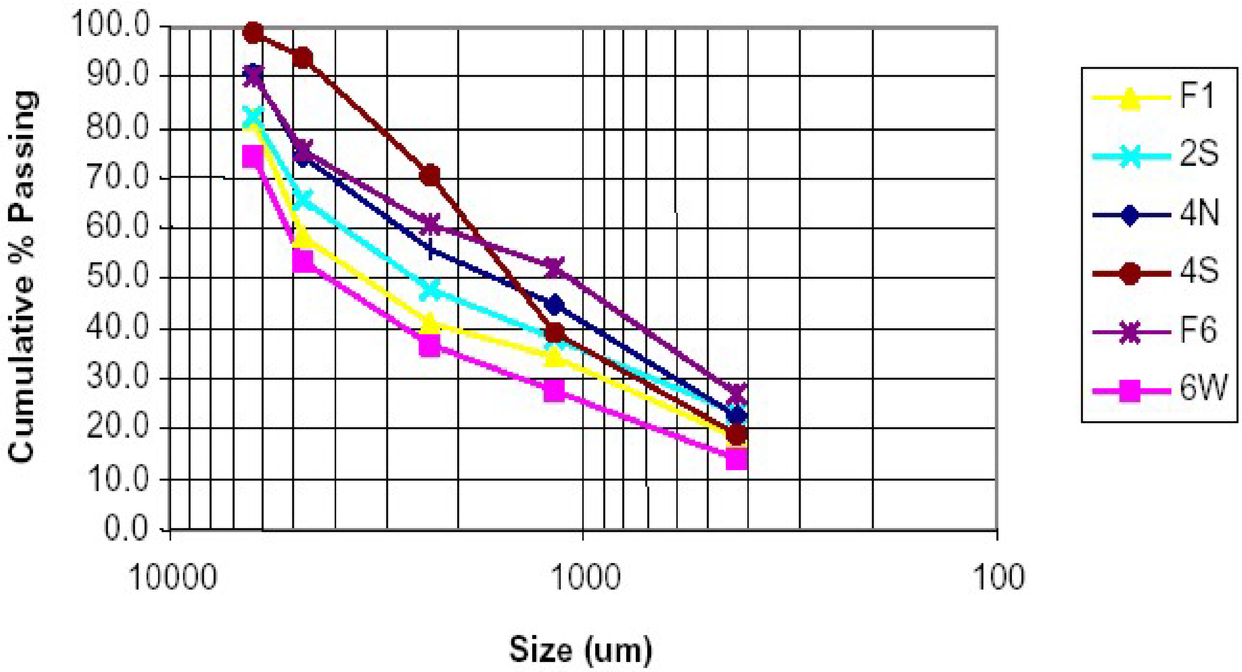
KIA/NTI Conclusions and Recommendations

The Air Quality Assessment (Appendix D.1.1) does not indicate the estimated silt content or moisture content for the coarse tailings stockpile. Tahera should provide a rationale (with support information on silt and moisture content) on why the coarse ore stockpile is ruled out as a source of fugitive dust.

AMEC Response

In the plant the coarse PK material is repeatedly washed until essentially all the fines are removed. The resultant material is deposited wet and is pea-gravel size for the most part. A particle size analysis done on pilot plant coarse PK which underwent considerably less washing than would occur in a full scale plant is shown below. The estimated moisture content of the coarse PK going to the stockpile is 12%. Finally, based on EKATI™ experience (EKATI™, pers. comm. 2003), fugitive dust emissions from their coarse PK dump have not been problematic since mine start up.

Figure 2.1.1-1 Coarse PK Particle Size



2.1.5. Issue 22: No Trigger Point For action on Lichen Metals Increases

More quantitative triggers should be established for metal concentrations in lichen.

KIA/NTI Conclusions and Recommendations

We agree that the lichen monitoring program is a viable indirect method to monitor ambient air quality, however there needs to be a more quantitative trigger defined when a 'significant' increase in the metals concentration in the lichens has occurred.

'Significant' should be defined in terms of actual increases in metal concentrations of lichens. For example, Tahera could define a 'significant' increase as 20 or 30% higher in the proximate sample than the distant sample.

Provide a more quantitative description of a 'significant' increase in metal concentrations in lichens for the Jericho air quality monitoring plan shown in the EIS.

AMEC's Response

An arbitrary increase of some percent should not necessarily require any action. Action may be required if CCME EQ guidelines are exceeded or if toxic levels of air contaminants ascribable from mine sources accumulate in lichens. For instance, aluminum, titanium and iron in lichen samples at EKATI™ were found to be up to 1.5 times higher in the project area than in the reference area, yet CCME guidelines were not exceeded, nor were toxic concentrations of these metals reached (MDA 2002). Therefore no action was warranted. Using KIA/NTI's reviewers criteria, the mine would have to take some action. Given that air emissions are already managed to the extent practical at EKATI™ it is hard to envisage what further action the mine might take.

2.1.6. Issue 32: Modify Figure 3.2 in Baseline Report

Figure 3.2 of Appendix B.1.1 (baseline Summary Report) does not show the location of station H-S3/4 nor does it show all monitoring locations stated in Section 3.2.

KIA/NTI Conclusions and Recommendations

Tahera should incorporate all monitoring locations in Figure 3.2. In addition, Tahera should distinguish between monitoring locations with staff gauges and those with automated dataloggers.

AMEC's Response

Modified Figure 3.2 attached as Attachment 2.1. WSC stations cannot be shown at the scale required for site stations.

2.1.7. Issue 43: Modify Aquatic Monitoring Program; add Site

KIA/NTI Conclusions and Recommendations

The boundary of effects for changes in water quality need to be moved further downstream of the Jericho Lake outlet. It is very likely that increased concentrations of conservative ions will be detected in elevated concentrations downstream of this point.

AMEC's Response

Tahera will commit to establishing a monitoring point for water quality downstream of the Jericho Project on Inuit Owned Lands; the nearest point to the Jericho site is on the Jericho River downstream of Jericho Lake. It should be noted that CCME guidelines are expected to be met before the outlet of Carat Lake for average flows and before the outlet to Jericho Lake for extremely low flows given that mine discharge is to Lake C3 through Stream C3. If spray irrigation is used, guidelines will be met closer to the project site.

2.1.8. Issue 44: Modify Aquatic Monitoring Program: Expand Sediment Sampling

KIA/NTI Recommendation

A summary table should be produced which includes the minimum, maximum, average, standard error or deviation, and sample size. These are minimal statistics required to assess the variability of baseline sediment quality parameters concentrations which is an essential part of the review process.

AMEC's Response

Sediment data analysis was an issue with Environment Canada as well. A revised sediment analysis report was completed (AMEC 2003c). However, Environment Canada's issue was that sediment data should be dis-aggregated which makes the statistical analyses requested by KIA/NTI's reviewer of little meaning.

2.1.9. Issue 45: Expand Sediment Quality Assessment

KIA/NTI Conclusions and Recommendations

Insufficient information is presented for sediment quality data to assess if Tahera has fulfilled the assessment guidelines. In addition, no evidence was found to compare baseline sediment quality data from the proposed Jericho Project area to other ecosystems that are free of impacts.

Sample depths, locations within the lakes and streams and raw data should be included as well as sediment sampling depths. Do not compare stream and lake sediment quality. No apparent attempt is made to compare sediment data with other unimpacted areas within the north.

AMEC's Response

1. Sediment data were re-evaluated as discussed (AMEC 2003c).
2. Comparison of sediment data from regions of differing geology are of limited value since undisturbed area sediment quality is largely determined by watershed bedrock geology perhaps coupled with glacier movements. Descriptions of baseline sediment quality from other regions would provide no useful insights for management of the Jericho Project impacts.

2.1.10. Issue 56: Water Quality Replicates and Sampling Depths

KIA/NTI Conclusions and Recommendations

No mention is made as to the number of water quality replicates to be collected from each station or the depths at which the samples are to be collected. To ensure an adequate AEM program, replication is necessary for statistical analyses. The number of replicates required to detect effects at a specified level (e.g., 50% change) and at a pre-determined significance level is estimated through power analysis of existing baseline data.

AMEC's Response

A water quality monitoring plan was presented in the Jericho Final EIS. The program will be modified to add an additional upstream control site and additional sampling site(s) on Inuit Owned Lands. Water quality sampling methodology proposed is similar to that which was employed throughout the baseline sampling program. Examination of the data will reveal that most water chemical constituent concentrations are near, or below, detection making power analysis of limited utility in determining variability.

2.1.11. Issue 60: Compare EKATI™ and Diavik Water Licences for Conditions

KIA/NTI Conclusions and Recommendations

Use EKATI™ sediment monitoring program as a guide in proposing a sediment sampling program for Jericho.

AMEC's Response

The proposed sediment sampling program for Jericho will have two components:

- chemical analyses from grab samples collected in the same manner as was done in 2000 for baseline sampling, i.e., Ekman grab from deep basins in lakes, total extractable metals analyses by ICP, triplicate samples (unless variability analysis indicates another level of replication). Tahera will use EKATI™ program as a guide. See AMEC 2003c for more details.
- sediment sampling from traps as part of the AEM program, as detailed in the Final EIS proposed aquatic monitoring program.

2.1.12. Issue 97: Metal Bioaccumulation in Wildlife Using PKCA

KIA/NTI Conclusions and Recommendations

Periodically sample wildlife at Jericho for metals bioaccumulation, specifically small mammals.

AMEC's Response

The most abundant small mammals at the site are microtine rodents. They do not live long enough to bioaccumulate metals (maximum two years). Arctic ground squirrels are only active during the brief summer (8 weeks) and hibernate the rest of the year. Arctic hares move out of the immediate mine area. There is therefore no appropriate vector to sample for metals bioaccumulation.

Elkin (1997) reports on baseline levels of organochlorine, heavy metal and radionuclide contaminants in caribou. Of interest to the Jericho Project are heavy metal concentrations. "Samples were collected from the Bathurst herd at several different times throughout the year." Barren ground caribou had "moderately elevated levels of cadmium in both kidney and liver tissues." "These cadmium levels are considered normal because of their relatively high levels on a circumpolar basis." "Mercury levels were generally low in all caribou herds." For caribou assessed, almost all mercury was in the relatively non-toxic inorganic form. Health Canada health risk assessments indicated levels of contaminants examined pose no human health risk at any quantity of consumption.

2.1.13. Issue 98: Incinerator Type and Performance

KIA/NTI Conclusions and Recommendations

Information regarding the incinerator is important to assessing its adequacy in dealing with the camp's projected garbage production, and particularly its suitability for incinerating waste oil. This information is also important to assessing the incinerator's impacts on air quality.

AMEC's Response

The incinerator at Jericho will not be used to burn waste oil. Some information on a suitable incinerator for a 300-person camp is attached as Attachment 2.2. The incinerator will only be operated a few hours per day and will have a very small influence on site air quality. Additional information is provided in the Levelton response (Levelton 2003). It was not modeled for the Final EIS because it is an intermittent point source.

The incinerator used as an example is installed at Diavik. Emissions from the manufacturer are listed in Table 2.1.13-1 and exceed CCME 2006 guidelines according to the manufacturer.

Table 2.1.13-1

Emission	CCME (mg/m^3)	CY-50-CA (mg/m^3)
Particulate	20	4.4
HCl	75	<1
CO	57	3
SO_2	260	<1
NOx	400	21
Dioxins/Furans	0.5	<0.056

2.1.14. Issue 99: Temporary Storage of Hazardous Wastes

KIA/NTI Conclusions and Recommendations

Information regarding the hazardous waste storage facility is important to assessing whether it will provide adequate containment or [sic] materials, and protection from potential spills or leakage. The information in the EIS should be expanded to include details on the facility to store the anticipated hazardous waste.

AMEC's Response

Standard, accepted industrial practices will be employed at the Jericho Mine site. Housekeeping will be inspected continuously by management and the Health, Safety and Environment Committee, and corrective action taken where indicated.

1. Waste oil will be recycled in the empty storage cubes used to transport oil to the site. All cubes will be stored in a bermed and lined area to catch any routine drips or spills and to retain the contents of a cube should it rupture or fail. Cubes will be stored outside in locations where they will be required, e.g., the plant mechanical shop (see Final EIS, Map A).
2. Used batteries to be recycled will be stored in the hazardous materials building on pallets. The building will be built on a concrete pad as discussed in the hazardous materials handling plan in the Final EIS.
3. Used petroleum containers and products (e.g. grease cartridges, oil filters, etc.) will be stored in barrels or bins in the mechanical shops where they are used. When filled, bins or barrels will be transferred to a dedicated area in the hazardous materials building until removal from the site on the next winter backhaul.

2.1.15. Issue 100: Adequate Spill Containment Berm Areas

KIA/NTI Conclusions and Recommendations

Information about the berm's construction is important to assessing its ability to adequately contain a spill. For instance, the location of tanks relative to the berm is another factor in determining the berm's height.

AMEC's Response

The final construction details of the berm will be provided as part of detailed engineering when the project is constructed, i.e., after approval. Management of fuel at the Jericho Mine site will be consistent with northern mining practice and National Fire Code requirements. The berm will be high enough to contain 110% of the capacity of the largest tank and the distance from the tanks will be consistent with requirements to hold a surge of fuel from an adjacent storage tank upon catastrophic failure. Clearances will meet all building and National Fire Code requirements. The fuel farm liner and berm liner will be continuous and will be petroleum resistant HDPE of an approved manufacture, likely API standard. Figure 2.1.15-1 shows a conceptual design for the fuel storage area. Figure 11.1, Final EIS Appendix A.1, provided essentially the same information.

Alternates for fuel storage provided by the proposed mining contractor are attached (Attachment 2.3)

2.1.16. Issue 101: No Details on Landfill Issues

KIA/NTI Conclusions and Recommendations

The EIS provides no details about the volumes of materials to be disposed of, the design or procedural aspects of the landfill. Expand the description to include these details.

AMEC Response

As indicated in the Final EIS, Appendix A.1, the landfill will be placed at the north end of Waste Rock Dump #1 on a pad of crushed rock and esker fill material thick enough to ensure the pad remains permanently frozen, thus affording an impermeable seal. This approach has proven to be successful at EKATI™. The thickness of the crushed rock-esker pad will be determined in the field and will depend on the underlying soil/bedrock. Conceptually 1.5 to 2 m total thickness will be required. The total area is conceptually envisaged to be 2500 m^2. The detailed design presented for permitting will include an analysis of actual areal requirements. We note there is adequate area at the proposed site to considerably expand the size of the landfill.

The pad will be sloped so that any surface runoff drains west where it will be intercepted by the Sed Pond #1 drainage ditch system where treatment can be effected as discussed in the Final EIS.

Projected volumes of wastes will be estimated as part of detailed design prior to landfill construction in consultation with the chosen mine and catering contractors. Anticipated wastes include:

- incinerator ash;
- broken wooden palettes that are no longer serviceable;
- unrecyclable scrap metal.

Dust generation will be managed by covering wastes that generate dust, e.g., incinerator ash. No hazardous wastes and no unincinerated food wastes will be placed in the landfill.

To the extent they may apply, NWT guidelines for solid waste sites (Ferguson Simek Clark 2003) will be employed. It should be noted, however, that any runoff and leachate will be directed to a treatment facility and not directly to the environment.

2.1.17. Issue 117 Adequacy of Revegetation Plans

KIA/NTI Conclusions and Recommendations

The Mine Reclamation Plan present as part of the Jericho EA does not provide adequate plans for revegetation of disturbed areas using native plant species. Rescan recognizes that the establishment of native plant communities in arctic environments is challenged by both limited nutrient sources as well as short growing seasons.

AMEC's Response

There is no recognition of the challenges to re-establishment of vegetation in Arctic environments in the KIA/NTI review. It would appear the reviewer has drawn entirely on revegetation practices common in southern Canada. Further, no rationale is provided for the KIA/NTI recommendation.

The Final EIS reclamation plan was based on a literature review of reclamation research spanning 30 years and also made use of experience at the EKATI™ mine. EKATI™ has been a pioneer in the area of revegetation of arctic mine disturbed areas and is having some success in its efforts. Since the Final EIS was written, additional revegetation research information from EKATI™ was made available (Kidd and Max 2000a, 2000b, 2001, 2002; Martens & Assoc. 2000, 2001, 2002; Reid 2001a, b, 2002). The general conclusions from these studies are similar to results quoted in the Jericho Final EIS and do not change the general direction suggested for revegetation attempts at Jericho:

- except on mesic to moist soils, fine-grained soils, establishment of vegetation without amendments is problematic;
- addition of fertilizer will speed initial establishment, but, in combination with cultivars (agronomic species) can retard establishment of native vegetation;
- for treatment of erosion, there is no practical alternative to fast-growing agronomic species (other than, e.g., riprap);
- the availability of native Arctic vegetation, except for natural seed sources, is extremely limited.

Tahera will monitor EKATI™ and Diavik efforts through published reports and direct exchange of information, as indicated in the Final EIS. Should Snap Lake and Gahcho Kué be developed, success at those operations will also be monitored. The prescriptions given in the Final EIS reclamation plan were based on the 30 years reclamation experience published in the literature. It was clearly stated that these prescriptions were presented as a starting point. Further, the level of detail provided in this conceptual reclamation plan was in excess of that normally provided at the project approval stage. Additional detail cannot be provided in the absence of site experience.

Discussion will be required by the mine operators and landlords (DIAND for the mine site) in consultation with KIA and communities as to how to proceed with reclamation in cases where native plant species cannot be established. Presently the alternative is rock armoring to prevent erosion. The Final EIS proposes fertilizer and agronomic species to provide initial cover as a more acceptable alternative based on the reclamation experience previously cited.

2.2. DIAND Issues

2.2.1. Issue 2.3 Aquatic Effects of Mine Discharges

Issues raised in this section are answered principally by SRK (contaminant loading) and D. Trotter (aquatic toxicology). This response focuses on closure water treatment using the mined out open pit.

An issue raised at the June 17-20 Edmonton workshops was water quality on closure. The Jericho Final EIS suggests using the open pit as a long-term treatment facility for mine water after closure. With all mine drainage being directed to the open pit, approximately 20 years of storage prior to discharge could be effected. Water quality on closure is discussed further in AMEC 2003b.

A suggestion was also made at the workshop that the pit be rapidly flooded. If long-term storage of mine runoff water is required, rapid flooding of the pit would negate any natural treatment possibilities through pit water storage and would necessitate the use of a treatment plant which would require annual resupply of fuel to heat the plant, continued use of a winter road and continued generation of combustion emissions over the long-term as well as add substantially to closure costs, all to effect the same result as allowing the open pit to passively store water.

Jericho Mine operators will have a substantial database on mine runoff water quality collected over the eight-year mine life and a decision can be made at that time whether it is advisable to rapidly flood the pit or not.

2.2.2. Issue 2.4.1 Access Road Options and All-Weather Spur to Contwoyto

All access options for resupply of the Jericho Mine were not considered; no cumulative impacts assessment was provided for the Lupin Winter road option. More information was requested at the June 17 – 20 Edmonton workshop.

AMEC Response

<u>Supply Access for Jericho Mine</u>

The Final EIS stated (Section 8.0) that the only practical option for supply of the Jericho Mine was the Lupin winter road. Careful review of the Jericho Final EIS will reveal that the Lupin winter road and Bathurst Road were considered in the cumulative effects assessment and the Yellowknife all-weather road discounted following the lead of the DIAND CEAA review.

The Bathurst Road is in the approval stage with no timeline for completion of construction and no funds in place to construct the road. Supplies for Jericho would be a small increment of those required for Lupin, Izok Lake and George Lake (should Lupin continue to operate; should Izok Lake and George Lake commence operations) and further could be transported to the Lupin site year round, thus potentially reducing impacts from the campaign type of hauling required for the existing winter road. A quantitative assessment of incremental cumulative impacts of the Jericho Mine on transportation using the Bathurst road cannot be provided at this time because not enough is known about the potential traffic that might use the road.

An all-weather road from Yellowknife has been discussed conceptually for over 40 years with no result and was discounted as not being a real option by the CEAA review of the Diavik Mine EIS.

As stated in the Final EIS and reiterated here, for the Jericho Mine only the Lupin winter road is a practical option for the foreseeable future (life of mine at Jericho). If the winter road cannot be operated, the Jericho Mine cannot operate; there are no viable alternatives to supply of bulk materials including fuel and explosives. The cost of flying bulk materials to the mine would be considerably in excess of any profit from mining the diamonds and the cost of permitting and constructing an all-weather road, even from Lupin, could not be supported by the Jericho Mine alone and is therefore also impractical.

The aquatics, wildlife and cumulative effects assessment sections of the Final EIS discussed incremental effects of supply of the Jericho Mine on the Lupin winter road and DIAND is incorrect in stating that no cumulative effects assessment of use of the Lupin winter road was done for the Jericho EIS.

All-Weather Connection Between Lupin and Jericho

The reviewers were confused as to what options were being discussed in the Final EIS. The road access to the Jericho Mine site was narrowed to one option in the Project Proposal submitted 26 November 1999 to use of the Lupin Winter Road. A 1998 report by SRK had discussed three options which were examined in the context of trucking Jericho ore to the Lupin Mine for processing at a dedicated diamond plant on the Lupin site. Elimination of that option eliminated the need for or utility of other options to truck ore by all-weather or partial all-weather road to the Lupin site. These options were, therefore, not considered in the Final EIS and are considered outside the April 2000 NIRB guidelines requirements. Since supplies coming from, or through, Yellowknife require the use of the Lupin Winter Road as far as Lupin and bulk supplies that must be trucked to the Jericho Mine will only be transported during the winter road window, there is no reason to incur the substantial economic costs and additional environmental impacts that an all-weather road between Lupin and Jericho would create.

Contwoyto Lake Spur

Refer to Map A for the location. The spur all-weather road to Contwoyto Lake would be constructed during the first year of mine construction and operation. The winter road access through Lynne Lake (shown in blue on Map A) is required the first winter to bring equipment to the site, but it increases the supply risks since construction requires substantial snow fall or snow-making machines to provide the required base. An all-weather alternative will therefore be constructed to reduce this risk and potentially increase the window for supply transport to the Jericho Mine.

The spur will be located on the north side of Lynne Lake (shown on Map A in red). It will be a 1.5 km extension from the powder and caps magazine road to Contwoyto Lake. Site selection criteria were as follows:

1. Additional disturbance at the site is minimized because the magazine road already covers half the distance to Contwoyto Lake.
2. The spur does not cross any fish-bearing streams.

3. The spur crosses only intermittent streams that dry up soon after freshet.
4. An access road along the south side of Lynne Lake would theoretically be possible. However, this route has several disadvantages:
    a. the route crosses a fish-bearing stream (inlet to Lynne Lake)
    b. extensive blasting would be required along the south side of Lynne Lake; blasting would disturb nesting rough-legged hawks unless carried out outside the nesting season
    c. the rise out of Contwoyto Lake on the south side of Lynne Creek is much steeper than the preferred route and would require a longer access road to gain the required elevation
5. Moving the access road further north would make it longer and require traversing muskeg (see Map A) while providing no other advantages.

The spur road construction will be similar to that for other mine roads. It will be built on top of the tundra with a depth of fill field fit to the site to prevent permafrost melting as discussed in Section 8.0 of the Final EIS Project Description (Appendix A.1). Culverts will be placed in the road where intermittent streams cross the right-of-way.

The spur road beyond the magazines will only be used during the winter haul and to minimize any incidental disturbance to raptors, the road will be signed advising closure to vehicles after the winter haul. More aggressive methods of closure, such as a locked gate, will be considered if signage is ineffective.

2.2.3. Issue 2.4.2: Ice Lenses in Borrow Areas

The proponent was required to provide information regarding the location (with maps) of the borrow sites, describe access to the sites, describe how the pits will be operated and managed, describe contingency and reclamation plans, estimate the quantities to be extracted, etc. It appears this information is not presented in the final EIS.

AMEC Response

DIAND is incorrect in their assertions and are referred to the Project Description (Appendix A.1) and in particular Section 13 and Maps A and F. Reclamation is discussed in the Mine Reclamation Plan (Appendix B.3.2). Removal of borrow materials will not create pits as there is a total of 250,000 m^2 of esker that will be applied for use for the mine and approximately 50,000 m^3 m of esker fill estimated to be required. Ten test pits were dug at the south end of Area D and the existing laydown area by Tahera in August 1999. Water was typically encountered at approximately one metre, at which depth, pits were terminated. The purpose of the test pits was to obtain additional particle size information but the pits demonstrated that the thaw layer by the beginning of August was over one meter thick on the eskers. Given that esker material will not need to be removed below the thaw level, encounter of ice lenses is not expected.

Ice lenses at the nearby Lupin Mine site are occasionally encountered and can be as large as a pick-up truck (Lupin Mine, pers. comm.). Excavations of esker material at Lupin Mine (Fingers Lake area) is deeper than that expected at Jericho, however. Should ice lenses be encountered during removal of esker material at Jericho and thawing and drainage from the ice indicated to be problematic, the ice will be removed by backhoe if possible and placed in the PKCA.

2.2.4. Issue 2.4.3: Fuel/Hazardous Materials Storage

1. For consideration of existing soil contamination, DIAND is incorrect in its assertion that existing soil contamination was not considered. The Final EIS (Project Description, Appendix A.1, Section 11.0) states that existing contaminated soils would be treated in the mine's land farm. The Environmental Impact Assessment discusses the impacts of exploration, including fuel spills (Appendix B.2.1, Section 4.0). Effects of malfunctions and spills of petroleum and other hazardous materials are discussed in the Environmental Impact Assessment (Appendix B.2.1, Section 1.14.2). Management of hazardous materials is discussed in the Environmental Management Plan, Appendix B.3.1 (the land farm, Section 2.2.8; waste oil handling options, Section 2.5.2). As noted above, the mine will recycle waste oil and not consider incineration on site.
2. DIAND states that spills of hazardous substances may be a major contributor to environmental effects on soil and potentially to permafrost conditions over the life of the mine, but provides no rationale for the statement, nor examples to illustrate its contention. In an adequately managed mining operation, routine drips and spills are kept to specific small sites and can be relatively easily cleaned up. The risk of large spills is significantly reduced by restricting storage of these materials to contained areas and by institution of a hazardous materials management plan coupled with training, all of which were committed to and detailed by Tahera in the Final EIS.
3. DIAND states that the mine development proposal must provide specifics of the bulk fuel and waste hydrocarbon storage facilities. These plans were provided in Appendix A.1, Section 11, and are expanded here in response to KIA/NTI issue 100 (Section 2.1.3).
4. DIAND states that a hazardous materials management plan must be developed for the Jericho Mine. We refer DIAND to the Hazardous Materials Management Plan developed for the Final EIS, Appendix D.2.3. As stated in the EIS, a final plan will be developed in consultation with mine contractors once they have been selected.

2.2.5. Issue 2.5: Expanded CEA

CEA is discussed under separate cover (AMEC 2003d).

2.2.6. Issue 2.6: Green Cover/Revegetation

Discussed under KIA/NTI Issue 117, Section 2.1.15 above.

Regulators responsible for reclamation in Nunavut must decide whether Arctic mine land reclamation should be guided by stabilization of surfaces and return of natural vegetation or whether accelerated revegetation is desirable using agronomics and fertilizer. Until EKATI™ commenced its pioneering work on revegetation, no Arctic mine had successfully revegetated large disturbed areas of mine soils. If immediate stabilization is required, native, slow-growing Arctic tundra plants cannot be used. If agronomic species cannot be used, then physical stabilization, e.g. with riprap or coarse cover, is the only alternative.

The reviewers (DIAND, KIA/NTI and DSD) of the Jericho conceptual revegetation plans indicated a lack of understanding of the realities of Arctic growing conditions and suggestions and recommendations made were essentially impractical or impossible to implement. The aims and objectives of the conceptual reclamation plans for the Jericho Mine relied on both information from EKATI™ Mine and over 30 years of Arctic experience drawn from the literature. Prescriptions were proffered that have been demonstrated to work in Arctic climates not too dissimilar to that at Jericho and were considered a good first starting point. At the same time, a commitment to consult with other Arctic Mine operators, particularly EKATI™ and Diavik was made by Tahera. We submit that at the present early state of the art of revegetation in the low Arctic, nothing else can reasonably be expected of a mine operator.

2.3. DSD Issues

2.3.1. Issue 2.2: Additional Information Hazardous Materials Storage and on the Ammonium Nitrate Storage Pad

DSD Comments

1. Several materials considered potentially hazardous were omitted that will need to be addressed in the Plan including:

   paint, empty aerosol cans, batteries, capacitors and transformers, oil filters, rags and absorbents, ash from the camp and biomedical waste.

2. Tahera should provide ammonium nitrate storage within a building or on a pad that has a containment berm to prevent loss of ammonium nitrate from torn tote bags and to provide easier cleanup of any spilled material.

AMEC Response

<u>Hazardous Materials Management Plan</u>

The Hazardous Materials Management Plan provided was conceptual in nature to indicate Tahera had thought out this aspect of mine environmental management. The list of hazardous materials was incomplete. A revised hazardous materials management plan will be developed for mine operation. We note that EKATI™ was not required to provide an operational plan until well after the mine commenced operation.

Paint will be stored in the hazardous materials building (construction details provided in the plan). Empty aerosol cans will be placed in a container and shipped from the site on a backhaul if disposal of any such in the landfill is not allowed. Batteries are discussed above in Section 1.1.12. Capacitors and transformers will be brought to the site as required for construction and put in place; spares are not anticipated to be required. Ash from the camp will not be a hazardous waste and will be treated consistent with the practice at EKATI™ which is to landfill. Biomedical wastes will be very limited, since a nursing station, not a hospital will be located at the mine. Any biomedical wastes generated will be stored in approved containers and backhauled from the site during the winter resupply.

<u>Ammonium Nitrate Storage</u>

Ammonium nitrate will be stored on a pad. The proposed ammonium nitrate storage pad will be upgraded to have a perimeter berm. As indicated in the Final EIS, runoff from the area cannot enter surface water bodies directly. Reference to Map A shows the closest surface water body is approximately 200 m north and upslope from the site and is a shallow pond that freezes completely in the winter, i.e. is not fish habitat. The closest water body downslope is Lynne Lake, approximately 700 m distant.

2.3.2. Issue 2.3: Spill Contingency Planning

DSD Comments

The EIS presents three response plans are provided to address emergencies, spills and hazardous materials management. These plans are linked with common purposes and have many common sections that are repeated. Tahera should combine all these plans into a single plan that addresses all issues. The spill response plan has a number of deficiencies.

AMEC Response

The three plans referenced have different purposes:

- The Hazardous Materials Management Plan does not deal with emergencies or accidents and malfunctions, as do the other two plans.
- The spill plan specifically addresses accidental spills of liquids on the site.
- The emergency response plan deals with emergencies of all the main types that could occur at Jericho.

The plans were presented in the EIS as conceptual approaches to these issues. Detailed plans will be developed with the mine contractor prior to construction and reviewed and amended periodically as required when operating through consultation with the mine Health, Safety and Environment Committee. The deficiencies noted by DSD in the spill plan, other than suggestions for changing the document structure, cannot be addressed at the conceptual stage, e.g., site phone numbers for phones that do not exist. The spill plan was modeled after plans accepted by GNWT in the past. DSD concerns are noted and will be reflected where appropriate in the revised spill plan. Plans will conform to relevant guidelines that exist at the time construction of the mine commences.

2.3.3. Issue 2.5 Management of Process and Other Industrial Wastes

DSD Comment

No detailed drawings are presented for the sewage treatment plan and no mention of a septic tank.

AMEC Response

Since RBC wastewater treatment plans are standard, well-known technology, it was considered unnecessary to provide detailed drawings. The plant will be sized to treat domestic waste water from a 100 person camp. Off-the-shelf package plants are readily available with proven performance under Arctic conditions.

Information on a RBC plant of similar design to that for Diavik and drawing are attached as Attachment 2.4. Note that UV sterilization and not chlorine is used in this design. The final plant will be chosen as part of detailed construction engineering. We note that all plant designs presented here and in the Final EIS exceed NWT guidelines for discharge to **receiving water bodies**, whereas the plant at Jericho will be discharged to the PKCA. We would fully expect that accepted guidelines that apply for discharge of such plants to receiving water bodies would not be required to be exceeded for discharge to a controlled area.

The issue of phosphorus absorption was addressed by the DSD response and is similar to findings of Karen Patricia Graham of the University of Alberta (master's thesis available through University Microfilms™ *Investigation of the Fate of Wastewater Phosphorus Within the Processed Kimberlite Containment Area at BHP's EKATI™ Diamond Mine*. 2002). If phosphorus is remobilized under anoxic conditions, it will be readsorbed near the surface of the PKCA where oxic conditions are again found. Very little, if any pore water, where anoxic conditions will occur, will be released during operations or closure.

2.3.4. Issue 2.6 Management of Domestic Wastes

DSD Comment

1. Nunavut Guidelines for municipal solid waste do not endorse open burning. Incinerator design should be provided.
2. Incinerator ash is considered highly susceptible to leaching of metal elements. Ash from domestic solid waste incinerators is usually classified as hazardous.
3. No details or drawings of the landfill design are provided, nor are any monitoring plans associated with the landfill. In addition, the EIS does not outline any specific land filling procedures to avoid land filling of leachable materials.

AMEC Response

1. The Final EIS does not suggest municipal solid wastes (called domestic waste in the EIS) would be burned in the open. The incinerator design was not provide because standard, readily available technology of approved design would be installed at the Jericho camp suitable of handling domestic wastes from a 100 person camp. The incinerator would only be used intermittently for a few hours per day (compared to generators and other exhaust emission sources which would be operated continuously). It was therefore not considered in the air quality assessment.

   A camp incinerator of a design suitable for Jericho is provided in Attachment 2.2. Consideration of air quality impacts are discussed in the Levelton response (Levelton 2003).

2. Incinerator ash at EKATI™ mine is landfill directly in the mine's landfill site which has been demonstrated to have a permafrost (i.e., impermeable) base and is approved for operation by DIAND. A similar configuration will be used at Jericho based on EKATI™'s experience. No metals leaching has been identified at EKATI™ Mine. DSD should indicate on what basis incinerator ash from a mine camp is hazardous waste in Nunavut and not in NWT.
3. Detailed drawings were not provided for the landfill as only a conceptual design was presented in the Final EIS to indicate how the landfill would be operated. Detailed drawings will be provided as part of detailed engineering at the permitting stage. A verbal description of the proposed landfill and operation were provided in the Final EIS, Project Description, Appendix A.1, Section 17.2; Environmental Management Plan, Appendix B.3.1, Section 2.2.7.

   Additional information is provided under KIA/NTI issue 101, Section 2.1.14.

2.3.5. Issue 2.7: Waste Oil Burning

DSD Comments

More details should be provided on waste oil burning.

AMEC Response

Waste oil will not be burned, but recycled to the mine petroleum products supplier.

2.3.6. Issue 3: Project Description

DSD Comments

1. Baseline data collection has occurred “sporadically” since 1995.
2. In many cases detailed drawings would have greatly improved confidence that the proponent will be able to identify and manage environment effects of the project, e.g., no details were provided on water treatment sumps and options for excess runoff water from the open pit.

AMEC Response

1. DSD’s characterization of baseline data collection as “sporadic” is misleading and not justified in light of the considerable effort expended by Tahera in collection of baseline data since 1995. It is unfortunate that such characterization is now on the public record.
2. Detailed drawings will be produced at the detailed engineering design stage. It is incorrect to assert, as DSD has done, that no details on water treatment at the site were given. We refer specifically to Mine Waste and Water Management, Appendix D.2.1 and Environmental Management Plan, Appendix B.3.1.

2.3.7. Issue 4.1: General

DSD Comments

1. Baseline data reports prior to 2000 were not appended to the Final EIS.
2. Fish population level of effort was insufficient (addressed by R. Pattenden)
3. No quantitative estimates of the current effective size of wildlife populations was provided (addressed by B. Hubert).
4. Many of the monitoring plans and mitigative strategies remain to be developed.

AMEC Response

1. Baseline reports prepared by Canamera for Lytton Minerals and aquatic baseline reports by RL&L can be made available upon request. Those available include:
   - Canamera Jericho Baseline Reports for 1995, 1996, 1997
   - RL&L aquatic reports for 1995, 1996, 1997 and 1999

4. Mitigation was discussed in the Final EIS in the Environmental Impact Assessment, Appendix B.2.1; in the Environmental Management Plan, Appendix B.3.1 and in the Mine Waste and Water Management Plan, Appendix D.2.1. Specific issues were discussed in Occupational Health and Safety Plan, Appendix C.2; in the Air Quality Report, Appendix D.1.1; in the Spray Irrigation Reports, Appendix D.2.2; and in the Hazardous Materials Management Plan, Appendix D.2.3. Monitoring of the biotic environment is discussed in the Environmental Monitoring Plan, Appendix B.3.3.

   To address this issue of DSD, specifics will have to be provided as their general statement provides no insights as to what DSD considers inadequate or unsaid.

2.3.8. Issue 4.2: Flocculants

DSD Comments

Most issues raised by DSD will be addressed by SRK.

1. DSD asserts that no information on the use of flocculants is given in the Final EIS
2. Part of the runoff from Waste Rock Dump 2 and the coarse tailings (PK) stockpile would drain to the Key-Ash-Lynne Lake drainage basin. Further evidence that this drainage basin will not be affected should be provided and consideration should be given to monitoring water quality.

AMEC Response

1. Flocculant use is discussed in the Project Description, Appendix A.1, Section 6. Additional information provided to DIAND with respect to flocculants in response to their 25 April 2003 letter is attached to this report as Attachment 2.5.

   If flocculant addition is required in the PKCA to reduce suspended sediment concentrations, a plant will be installed at the outlet to the PKCA West Dam and all water discharged through the plant where flocculant addition can be effected.
2. Slight re-design of the subject stockpile and dump have resulted in all drainage flowing naturally to the north and no longer into the Lynne Lake system (SRK 2003).

2.3.9. Issue 4.3: Air Quality

DSD Comments

1. Tahera should consider other mitigative measures to reduce dust as it is unlikely that reducing the speed of mining vehicles will be effective and road watering may only be effective for a portion of the year.
2. Fugitive dust may develop from deposits at the PKCA prior to closure with more coarse materials. The plans for dealing with this are deemed to be inadequate at the present time.
3. PM-2.5 should be considered [Levelton response (Levelton 2003).
4. Impacts to ecological VECs from particulates were not assessed.
5. An incorrect distance between Jericho and the Lupin Mine was used (Levelton 2003).

AMEC Response

1. As pointed out by Nuna Logistics at the June 17 – 20 workshop in Edmonton, in their considerable mining experience, water is the only effective mitigative strategy for mine dust control. Road watering will be most effective in the summer when dust will be most problematic. It will not be practical to completely eliminate dust from mine operations and that is reflected in the air quality assessment (Appendix D.1.1).
2. Plans to deal with dust from PKCA beaches were taken from existing mine experience at Lupin and EKATI™. DSD does not indicate why plans are "deemed to be inadequate", nor offer any rationale as to how that conclusion was arrived at.
4. Dust effects on vegetation were assessed in the EIS Environmental Impact Assessment (Appendix B.2.1) and a plan to monitor effects of particulates presented in the Monitoring Plan (Appendix B.3.3). Data on respiratory effects of particulates on mammals and birds are not available and no scientific studies appear to have been undertaken.

2.3.10. Issue 4.4: Soil, Groundwater and Permafrost

DSD Comments

1. The EIS does not provide any details of soil containment systems or operational procedures evaluated to protect the on site soil.
2. Permafrost effects require greater detail (see SRK 2003).
3. The EIS does not describe existing groundwater conditions or the impact that proposed mine facilities may have on the groundwater quality and the interaction with surface water features (see SRK 2003).
4. The EIS does not identify a containment system on the floor of the fuel farm, nor any groundwater monitoring nor any groundwater monitoring program associated with the fuel storage area.
5. The EIS does not address the potential for groundwater seepage from the low grade ore stockpile. Active layer groundwater monitoring should be considered.
6. A groundwater monitoring program should be considered to monitor seepage around waste dumps (see SRK 2003).
7. The EIS does not address groundwater monitoring of the landfill.

AMEC Response

1. Details are presented on the proposed landfarm system for treatment contaminated soils in the Environmental Management Plan (Appendix B.3.1). Operational procedures are provided in the Hazardous Materials Management Plan (Appendix D.2.3) and the Spill Prevention, Countermeasures and Control Plan (Appendix D.2.3) at at least equivalent detail as provided by EKATI™ Mine in their operational plans.
4. The Project Description (Appendix A.1, Section 11) clearly indicates an impermeable membrane will be used to line the fuel farm. The fuel farm will be located on bedrock with a crushed rock pad to level the ground. Downslope is toward the drainage ditch below the farm area where any seepage would be caught.

7. The landfill will have a permafrost base and any runoff/seepage will flow to the drainage control system for Sed Pond #1, as previously discussed in Section 2.1.14.

2.3.11. Issue 4.7: Re-vegetation

DSD Comments

1. The current capabilities for or limitations associated with the re-vegetation of the major community types described by Burt, 1999 were not discussed nor were the availability of land reclamation tools that work in this type of setting.
2. Reclamation planning does not take high diversity transition areas into account.
3. Detailed description of revegetation planning was absent from the EIS. Could the project footprint be further reduced?
4. Loss of wetlands and impacts to VECs should be discussed in more detail.
5. Use of non-native species impacts not acknowledged.
6. The project proponent apparently has not made any concrete commitments to specific research and development activities that would accelerate the development of viable re-vegetation strategies.

AMEC Response

1. DSD's assertion is incorrect. See the Reclamation Plan, Appendix B.3.2 which discussed limitations of revegetation and provides prescriptions that will be tried initially for the different mine land units.
2. Mine land units are treated as uniform in the Reclamation Plan, as is normal for conceptual reclamation planning. There will not be transition areas in most mining units, except aspect and slope changes, which are dealt with in the Reclamation Plan. DSD has identified concepts that largely do not apply to the post mining landscape at Jericho.
3. Revegetation planning was previously discussed. DSD provides no rationale for their opinion. There is considerable doubt as to whether vegetation can be successfully established over much of the mine disturbed area. This reality of Arctic climate appears to have been ignored by the DSD reviewer.

   Careful, considered examination of the Project Description (Appendix A.1) and Maps A and D will indicate that the mine plan is as compact as is safe and practical to make it. Further, due consideration of caribou migration paths was taken in mine site layout.
4. Very little wetland will be lost, as indicated in Table 2 of the Wildlife Effects Assessment (Appendix B.2.2) and no critical wetland habitat as discussed in the report.
5. See Section 2.2.6.
6. DSD's review again indicates the reviewer is unfamiliar with the limitations of Arctic climates; as well the Reclamation Plan does not appear to have been carefully reviewed. No rationale is given for the criticism proffered.

   A commitment to set up test plots and monitor revegetation activities at other Arctic mine sites is made by Tahera in the reclamation plan. Further, as previously discussed, prescriptions for the various mine land units is provided based on literature reviews.

2.3.12. Issue 4.10: Cumulative Effects Assessment

DSD Comments

1. "Adjacent" operations were not considered in local cumulative effects.
2. The CEA considered only those effects that would be operative during the life of the mine.
3. The effects of multiple mine sites and transportation corridors on caribou, large carnivores and raptors was seriously under-emphasized.

AMEC Response

1. There appears to be a semantics interpretation difference between the Final EIS and DSD's reviewer. There are no "adjacent" operations to the proposed Jericho site and operations would have to be within the influence of local (as opposed to regional) impacts from both operations for there to be a local cumulative effect. Neither of these conditions apply.
2. The Final EIS predicts that residual local impacts after closure would be limited to land disturbance and possibly water quality within the post closure monitoring period. Further, there are no other existing or planned operations within the region that could *measurable* act cumulatively with the Jericho Project on water quality. Thus, the only residual impact would be land disturbance.

   DSD discusses habitat fragmentation. While habitat fragmentation would occur on the Jericho site, it cannot reasonably be argued that significant cumulative habitat fragmentation in the region would accrue from the 222 ha of Jericho disturbance in combination with any other existing or planned development. Lupin Mine, the closest planned and existing development, is 29 km south, thus affording a very large corridor without any disturbance between the two operations. The concept of habitat fragmentation was never meant to encompass small areas separated by large distances but rather to describe areas that were so disrupted by disturbance as to interfere with the ecological integrity and functioning of organisms within the fragmented habitat. There is no evidence that Jericho Mine disturbance over the long term until vegetation reestablished would act in this manner.
3. No rationale or supporting reasons or evidence are given for this statement by the DSD reviewer and it appears to be a personal opinion, not supported by evidence from recent mine EIS's. BHP, Diavik and Snap Lake EIS's concluded effects on caribou, carnivores and raptors would be local or subregional and limited to areas close to the mines. No scientific evidence to the contrary has ever been produced.

   Tahera acknowledged the importance of the Bathurst caribou herd warrants collective efforts by industry and government to monitor the herd's health to ensure any warning signs of negative impacts from developments in its range are detected in time to effect management changes designed to mitigate these effects.

2.3.13. Issue 5.1 Abandonment and Site Restoration – Infrastructure

DSD Comment

Detailed plans for burial of materials on site are not given. Closure planning should be based on removal of all infrastructure.

AMEC Response

Details for burial cannot be provided until detailed engineering has been completed. As well there is some doubt as to regulations when the mine closes. Therefore, the Final EIS states that transportation and cost estimates are based on removal of all equipment. We note, in situ burial of non-hazardous materials at remote mine sites is common practice.

2.3.14. Issue 5.2: Soil Handling Plan

DSD Comments

1. Designing soil stockpiles at this [angle of repose] angle could result in a high probability of slope failure and erosion.
2. Experience and practices of other similar sites is not presented, however, to provide a baseline of what is expected to be required [for soil amendments].
3. The proponent should seriously consider that some of the kimberlite or coarse processed kimberlite stockpile areas may exhibit metal concentrations, especially chromium, that exceed CCME soil quality guidelines for agricultural or residential/parkland uses.

AMEC Response

1. The run-of-mine toe burn is specifically designed to prevent slumping of the soil stockpile; any sediment will report to a controlled area.
2. DSD is incorrect in their assertion. The soil prescriptions are based on literature information that spans thirty years of Arctic revegetation experience, as indicated in the reference list.
3. The Jericho site will be a mine site, not an agricultural or residential or parkland site and therefore the referenced CCME soil quality guidelines do not apply. If such guidelines are applied to mine sites, it is unlikely any mine will be able to meet the guidelines.

2.3.15. Issue 5.3: Mine Water Management Plan

Most of DSD's issues are dealt with by SRK (2003).

DSD Comment

The explosives truck wash will have to be moved because it is in a different drainage than the mine. The DSD reviewer suggested the maintenance shop.

AMEC Response

A review of the *Mine Health and Safety Act and Guidelines* would have revealed to the DSD reviewer that the explosives truck wash could not be placed in proximity to worker accommodations or place of work and review of Map A would have revealed that there is no other site as suitable as the one chosen with respect to distance from waterbodies and the requisite safe distance from place of work and accommodations.

2.3.16. Issue 5.4: Revegetation Plan

DSD issues are dealt with in Section 2.1.15.

2.3.17. Issue 5.5: Reclamation Plan

DSD Comments

1. No detailed plan of the final conceptual closure contours of the waste dumps and stockpiles relative to the surrounding terrain is provided.
2. No detailed plans or cross-sections are provided in the EIS [of the pit rim berm]. To assess the stability and safety of the open pit, detailed plans and cross sections of the closure geometry would need to be prepared. The adequacy of the proposed rock berm to limit access to the pit for a long period of time seems limited and should be re-evaluated.
3. Given the outstanding major concerns regarding pit abandonment, however, there may be merits to critically evaluating an expanded range of options.
4. Limited attention to re-contouring of the lip of the pit at abandonment could potentially enhance the overall fisheries habitat value of the pit over the long term (addressed by SRK).
5. Little information provided on abandonment and reclamation of the underground mine works (addressed by SRK).
5. Grading down the causeway may not be acceptable.
6. Closure soil testing should be expanded.
7. Define practical in respect to aesthetics.
8. Commit to apply the Nunavut mine site reclamation policy.
9. Plans for progressive reclamation are addressed in a cursory manner.

AMEC Response

1. DSD is incorrect in their assertion. Recontouring is discussed in the Reclamation Plan (Appendix B.3.2).
2. DSD is incorrect in their assertion. The Project Description (Appendix A.1) provides a series of plan diagrams that show pit development, including final pit configuration. Further, DSD provides no rationale for their assertion that the adequacy of the proposed rock berm to limit access to the pit for a longer period of time seems limited. Use of rock berms is standard practice at mines and is proposed for the Jericho Mine in that light.

3. DSD provides no rationale for their assertion.
4. Recontouring the lip of the pit beyond that envisaged would lead to additional terrestrial disturbance for little or no benefit for fish habitat, given that at present, fish do not migrate upstream as far as the location of the proposed pit.
5. Grading down the causeway was suggested as one possible closure scenario. Employment of this option would depend on discussions with the landlord (DIAND), DFO and KIA at closure as discussed in the Final EIS.
6. Closure soil testing will be consistent with requirements for mine site soils at the time of closure. This is not an approval issue.
7. Practical with respect to aesthetics means whatever can be done in a cost effective manner to make the landscape better fit in with its surroundings. Cost effective means commitments the mine operator can make consistent with reasonable return for dollars expended, e.g., refilling the pit with waste rock is not reasonable and such a requirement as part of mine approval may result in a decision to abandon construction.
8. Tahera will employ the Nunavut minesite reclamation policy.
9. Progressive reclamation is addressed to the extent possible. The reclamation plan and cost estimate indicate all areas no longer in use after completion of open pit mining will be reclaimed. A schedule and cost are provided. Further, it is stated that revegetation prescriptions will be consistent with test plot findings and those of other Arctic mines. No rationale is given by DSD for their assertion.

2.3.18. Issue 6: Level of Confidence and Certainty Not Explicitly Dealt With

DSD's contention is not supported by the EIS. Whereas DSD maintains only the aquatic impact assessment deals with level of confidence and certainty, the EIA report discusses confidence and certainty for all residual impacts included in the analysis, consistent with CEAA guidelines.

2.3.19. Issue 7.4: Abandonment

DSD states that many of the plans for abandonment have yet to be formulated. This contention is incorrect. Conceptual reclamation and closure plans are provided in the Reclamation Plan, Appendix B.3.2. DSD is referred to that Appendix which discusses on-going and closure and abandonment scenarios. The conceptual plans lay out the approach to be used for stabilization of surfaces and re-vegetation prescriptions that will be used as a starting point for reclamation trials during operation. Further, the amount of earth moving required for final reclamation was calculated and detailed in the plan, as well as the number of back haul loads required to remove all infrastructure from the site. A map showing the final reclamation configuration for the site was provided.

2.4. Environment Canada Issues

2.4.1. Issue 28: Air Quality Monitoring

This is a permitting issue. Tahera would expect to draw on the experience of EKATI™ and Diavik mines prior to finalizing proposals for air quality monitoring.

2.4.2. Issue 29: Use of Low Sulphur Diesel

Tahera would expect to use the same grades of diesel fuel used by EKATI™ and Diavik diamond mines.

2.4.3. Issue 31: Phone Number Correction

Tahera notes the correction in phone number; all phone numbers will be updated as required in all mine plans.

2.4.4. Issue 32: Disposal of Liquids and Contaminated Soils

Handling of contaminated soils and disposal of hazardous liquids are both covered in the EIS. To restate: petroleum-contaminated soils will be landfarmed in a manner similar to that employed at EKATI™. Hazardous waste liquids, including waste oil, will be backhauled to Yellowknife, or point of origin to be disposed of by licensed contractors, or through petroleum product dealers. The Jericho site soils will be cleaned up to the standard required at the time of mine closure—CCME contaminated site guidelines was used as an example guideline that might be followed. A conventional landfarm system that is suitable for the Jericho site is presented in Attachment 2.6.

2.4.5. Issue 33: Disposal of Contaminated Sorbents

For clarification, all sorbents used for absorption of petroleum products or any other hazardous waste will be backhauled to Yellowknife for disposal by a licensed contractor. The landfill will not be used for hazardous substances.

2.4.6. Issue 34: Treatment of Routine Spills

Mine equipment will be serviced either at the mine mechanical shop or the explosives truck shop (refer to Map A). Spills that occur during servicing will be to concrete floors and will be cleaned up with sorbents. Routine drips and spills that occur on soil will be handled as indicated in the EIS (see Section 2.4.4).

Accidental spills near water bodies have the potential to result in significant environmental impact and will be cleaned up immediately with sorbent materials as discussed in the spill prevention, countermeasures and control plan. Further, Tahera commits to monitor these adjacent water bodies for petroleum hydrocarbons should such spills occur. A monitoring program would be discussed with Environment Canada and be tailored to the nature of the accident. Mine equipment will not be routinely serviced near water bodies or muskeg where migration of contaminants is a risk.

2.4.7. Issue 35: Storage of Ammonium Nitrate

See Section 2.3.1.

2.4.8. Issue 36: Cumulative Effects Assessment

This issue is dealt with under DIAND issue 2.5

2.5. NIRB Issues Arising from 18 August 2003 Directive

2.5.1. Issue 1: Traditional Knowledge

NIRB Directive

- Justify as being adequate the current definition of TK.
- Demonstrate how TK was incorporated into the FEIS, including how it was used in baseline data description and the development of mitigation and monitoring programs.
- Describe in more detail the level of community participation, including that of Kugluktuk.
- Include TK regarding local vegetation.
- Consult with Inuit about possible impacts to caribou migration routes or water/fish health and ways to minimize these impacts. Consider implementing a caribou management and monitoring plan, which integrates traditional knowledge for minimizing potential effects.

AMEC's Response

TK Definition

The final EIS states that Thorpe et al.'s (2001) definition was used. The definition Thorpe et al. used was chosen in extensive consultation with Inuit of the West Kitikmeot and therefore Tahera feels it is representative of what the people of the area consider traditional knowledge to be. Further, NIRB provides no rationale as to what bearing a particular definition of TK has on the use of TK in an EIS.

Reference was made in Appendix C.4 to Section 4.1 if Thorpe, et al where the definition of TK was expanded as follows:

> *Inuit Qaujimajatuqangit (IQ) is "what has always been known" or, in other words, Inuit knowledge, insight, and wisdom that is gained through experience, shared through stories, and passed from one generation to the next. More than just knowledge, as it is typically termed, IQ includes a finely tuned awareness of the forever changing relationship between Inuit and nuna, hila, wildlife, and the spiritual world.*

Incorporation of TK in the Jericho Final EIS

Incorporation of TK in the final EIS was discussed in Appendix C.4.

Appendix C.4, Section 2.1 states:

> Tahera provided two opportunities, in 1996 and 1999, for Inuit elders from Cambridge Bay, Kugluktuk, Umingmaktok and Bathurst Inlet to visit the site. Both visits coincided with archaeological studies being conducted at the Jericho site. Elders were solicited for any relevant information on valued ecosystem components they may have wished to discuss. No new information with respect to caribou migration, movement within the area, or behaviour was obtained from the nine elders who visited the site, all of who were chosen because their families traditionally traveled in the region.

Appendix C.4, Section 5.0 states:

> Baseline data collection at Jericho commenced when the collection of traditional knowledge was at a rudimentary state. Baseline data collected for the Jericho Project was based entirely on scientific

> studies by knowledgeable scientists and engineers. Review of relevant traditional knowledge published through the aegis of WKSS indicates that Inuit and First Nations' elders (through the traditional knowledge) knew many of the things about the environment, especially caribou, that were revealed in studies for the Jericho Project.

There are no published TK studies concerning the Jericho region. Further, Inuit elders who visited the site provided no additional insights into caribou movements in the region, except that they knew caribou passed along Contwoyto Lake both migrating north in the spring and south in the summer. There are, further, no published TK studies concerning fish in the Jericho region; all information on fisheries at Jericho was derived from site-specific studies and the body of scientific literature cited in aquatic studies reports. Inuit elders who visited the Jericho site did not talk about fish at all.

With respect to mitigation, TK concerning deflection of caribou with flagged fencing may prove effective. Appendix C.4 states:

> For management of movement of caribou across the Jericho site Tahera may be able to use traditional methods of deflecting caribou tested by Gunn et al. at Lupin Mine (1998).
>
> **Dogrib Caribou Study**
>
> The study was conducted over four years from 1996 to 2000 with the purpose of gathering Dogrib elder traditional knowledge about caribou habitat, food, behaviour, and movement. Dogrib elders feel that traditional knowledge as well as western scientific information are required to properly manage caribou. Elders provided information on caribou migration patterns and health from 1917 to 1998. They pointed out that there did not appear to be a correlation between harvesting and mining activities. Their concern is that caribou habituate to human activities and thus caribou could be exposed to contamination from tailings and other sources. This points out the need to manage access at mine sites so as to prevent, to the extent practical, any exposure to contamination. Dogrib elders also pointed out that caribou rely on smell to find food and were concerned that the smell of petroleum products stored at mines may cause caribou to change their migration routes. At least in the case of the Lupin Mine, where caribou routinely migrate through the site where bulk petroleum is stored, this does not appear to be a deterrent.

With respect to monitoring, Appendix C.4 states:

> The forum for use of traditional knowledge will be community consultation and follow-up on recommendations from community liaison.

This statement was made in the context of operational monitoring and management.

Local Vegetation

There is no TK on local vegetation in the Jericho area unless it resides in the body of TK contained in the Naonayaotit Traditional Knowledge Study, begun in 1996 and partially funded by Lytton Minerals (Tahera predecessor) but unavailable to this date. TK with respect to vegetation relates to its use as food by caribou and thus there are some general observations available in published TK studies. The Tuktu and Nogak Project (Thorpe et al. 2001) reveals that Inuit of the West Kitikmeot know that caribou have favoured food depending on season (e.g., Arctic cotton grass – *Eriophorum* – and young willow) in the summer and that they will move away from an area vegetation becomes depleted. Caribou movement through the Jericho site is transitory and depletion of any food resources is a very unlikely possibility. Further, if spray irrigation east of Lake C3 is approved, more *Eriophorum* and willow are likely to be established in the area because of the generally wetter conditions during summer months when spraying occurs. Further, spray guns will pose no threat to caribou.

Inuit Consultation Regarding Caribou Migration Routes

The Jericho final EIS, Community Consultation report, Appendix C.5 discusses community input with respect to environmental issues at Jericho. As indicated in that report, the principal community concerns were for jobs, mine effects on caribou and mine effects on water quality. The issue of effects on migration routes were not specifically raised. From published information it would appear that this is more an issue with southern First Nations than with Inuit of the West Kitikmeot. Nonetheless, Tahera continues to consult with communities and this specific issue can be raised at an early opportunity.

Thorpe et al (2001) consulted extensively with Inuit of the West Kitikmeot with respect to caribou migration. Section 5 deals specifically with caribou migration. Inuit have observed that caribou are found everywhere throughout the tundra. Those with a generalist point of view do not believe migration routes are changing, while those with a narrower perspective believe caribou migration routes have changed. "*Changing migration routes must be considered in the context of questions of scale and peoples perceptions.*" (Thorpe et al. 2001: p. 97.) Scientific evidence also points to shifting caribou migration routes over time, but the cause or causes have not been determined. Some Inuit believe industrial activities influence caribou migration routes and others do not. The balance of scientific evidence from recent mine project EIS's is that local disturbances occur due to mining activities but that influences disappear at the subregional and greater scales.

2.5.2. Issue 2: The Inadequacy of Various Components of the Impact Assessment

Water Quality

Most water quality issues are addressed by Greisman and Dunbar (dilution modeling), SRK (contaminant loadings and discharge concentrations), AMEC (2003b – water quality impacts). Microbial Technologies (spray irrigation). All these items have been previously discussed in this report.

Baseline Quality of Ground Water at the Spray Irrigation Site

Groundwater at the spray irrigation site is very limited due to the thin nature of the soil at the site. Once spray irrigation commences, infiltration from spray water will account for most of the groundwater in the system and the groundwater will take on the characteristics of the sprayed water, modified through its path length as discussed in the spray irrigation report and supplemental information. If required, as part of the Project water licence, such groundwater as may exist at the site could be monitored prior to commencement of spray irrigation should this method of treatment be approved for the Jericho Project.

Aquatic Environment

The NIRB directive requires Tahera to:

- Conduct adequate baseline studies to properly determine the potential effects of the project on the aquatic environment. Include an expanded number of samples for all parameters, adequate control sampling sites, and information on variability between and within sampling sites.

- Present more complete information on nutrients, TDS and pH.
- Address the potential toxic effects of predicted nitrate concentrations on all aquatic life.

Adequacy of Baseline Studies

This issue is addressed separately by Mainstream Aquatics Ltd. (2003). We note that aquatic studies were conducted at the Jericho site since 1995 and detailed in several reports provided to NIRB as well as the Jericho final EIS. The amount of effort expended for aquatic studies more than addresses guidelines requirements and is equivalent to aquatic studies conducted for the much larger southern diamond mines. We note some additions were requested for aquatic studies by government review, but that in no way indicated that aquatic studies were inadequate.

More Complete Information on Nutrients, TDS and pH

NIRB is referred to the water quality section of the final EIS baseline report (Appendix B.1.1, Section 6) wherein water quality studies since 1995 are detailed. Nutrients, TDS and pH were included in the parameters analysed. We note that the agency responsible for water quality, Environment Canada, did not have any issues with the water quality analyses provided in the final EIS.

Aquatic Toxicity of Nitrates

Predictions of nitrate concentrations in receiving water bodies was addressed by SRK (2003) and AMEC (2003b). Toxicity was addressed, based on these findings (AMEC 2003a). We note that nitrate toxicity to aquatic organisms is a new issue and no toxicity from nitrate concentrations in receiving water bodies has been noted in several years of aquatic monitoring at the EKATI™ mine.

Wildlife and Habitat

The NIRB directive contains the following:

- Provide a complete examination of the potential for bioaccumulation and biomagnification and the implications in terms of environmental protection and management.
- Clear up the inconsistencies in the FEIS surrounding the presences of “species of concern.”
- Undertake more rigorous waterfowl breeding and staging surveys in a variety of habitats and around the potential project footprint and conducted at different times of the summer to capture different lifecycle stages. More detail must be provided on the impacts of the Project on waterfowl.
- Provide more detail on the mitigation of wildlife impacts especially those impacting caribou or fish. Quantifiable measures of success must be used for the mitigation of wildlife impacts.

- Present further analysis of the semi-permanent loss of approximately 220 hectares of vegetated habitat as a resource for microtine rodents (which in turn support raptor populations on their breeding ground) or other wildlife.
- Provide a more detailed explanation of the efforts planned to keep wildlife and waterfowl away from the PKCA and consider more stringent strategies if necessary.
- Provide more complete baseline studies to determine the impacts of the proosed mine on migratory birds. Include an estimate of the density of migratory bireds that may be lost or displaced in each habitat type affected by the mine footprint and buffer zone.
- Include the following potential impacts to migratory birds: collisions between birds and aircraft or automobiles, displacement of nesting birds, and oiling resulting from birds landing in hydrocarbon contaminated water.
- Implement a management plan to mitigate all potential impacts on migratory birds that conforms to the *Migratory Birds Convention Act* and *Migratory Bird Regulations*.

Bioaccumulation and Biomagnification

Aquatic bioaccumulation and biomagnification are discussed in AMEC 2003a. An extensive examination of metals, organochlorides and radioactive burdens in Bathurst caribou (Elkin 1997) concluded that metals levels in caribou were not of a concern. While cadmium levels were somewhat elevated, a human health risk assessment by Health Canada concluded that consumption of caribou at any amount was not a concern. This finding, reported by Elkin, suggests that there is not a management issue for bioaccumulation or biomagnification in caribou. Other terrestrial animals are not eaten extensively by humans.

Except for microtine rodents, fauna found at the Jericho site are migratory, or spend only a short period exposed to disturbed areas. Therefore any conclusions about accumulation of metals would be confounded by factors external to the Jericho Project, except for microtine rodents. Microtine rodents live a maximum of two years and will not accumulate metals to any appreciable extent and are therefore a poor monitoring subject. We note that EKATI™ has conducted metals analyses on microtine rodents as part of their monitoring studies and results from their studies will be examined with the possible view to including metals sampling in microtine rodents trapped at Jericho should EKATI™ data indicate useful information is derived from this source.

Tahera would contribute to any multi-party study of bioaccumulation of metals in the Bathurst caribou herd as long as it was directed by a scientifically credible organization, such as DSD or RWED.

Inconsistencies

Clarification is required with regard to what NIRB means by “inconsistencies” surrounding “species of concern.”

Loss of Rodent Habitat

The total area of disturbance of the Jericho site is estimated to be 222 ha composed of community types listed in Table 2.5-1.

TABLE 2.5-1

APPROXIMATE AREAS OF SURFACE DISTURBANCE BY ECOLOGICAL ZONE[1]

Component	Ecological Zones and Areas Affected (ha)[2]							
	WGBM	**MBM**	**DBT**	**DRT**	**LK**	**CRH**	**EKD**	**Total**
Mine								
Open Pit	2.7		3.7	3.7				10
Waste Rock Dumps	17.5		22	13				52.5
Overburden Stockpile		5.07	3	4.2				12.3
Low Grade Ore Stockpile		5.3	2.7	5.07				13.1
Coarse Kimberlite Stockpile	1.85		5.95	6.7	2.14			16.6
Roads								
Haul (22 m width)	0.7	0.4	0.9	0.9			1.1	4
Access (13 m width)	1.4		3.2	4.7		1.1		10.4
Airport (10 m width)							1.5	1.5
Airstrip							2.4	2.4
Plant-Related + Ore Stockpiles				22.7				22.7
PKCA	2.07	0.9	9.6	10.9	11	0.14		34.6
Expl Camp, Truck Wash, Explosives		0.3	0.2	2			3	5.5
Sediment Collection Ponds	0.5	0.6		1.1				2.2
Borrow Areas							34	34
Subtotal Disturbance	**26.72**	**12.57**	**51.25**	**74.97**	**13.14**	**1.24**	**42**	**221.8**
% of Total	**12.05%**	**5.67%**	**23.11%**	**33.80%**	**5.92%**	**0.56%**	**18.94%**	**100%**

Notes

1 Based on maximum areal extent of surface disturbance

2 WGBM = Wet grass/birch meadow, MBM = Moist birch meadow, DBT = Dry barrenground tundra DRT = Dry rocky tundra, LK = Lake, CRH = Cliffs/rocky hills, EKD = Cliffs/rocky hills, Kame deltas

Evident from Table 2.5-1 is that 15 ha of the 221.8 total disturbance is either lake or cliff and not suitable rodent habitat. The airstrip and half the borrow areas are presently disturbed accounting for an additional approximately 17 ha. Roads currently in place at Jericho account for an additional 10 ha. Thus, development of the mine will affect an additional 179 ha of rodent habitat. Losses from the waste rock dumps (52.5 ha), low grade ore stockpile (13.1 ha), coarse kimberlite stockpile (16.6 ha), and borrow areas (34 ha) will not occur immediately, but will be staged over the first 5 years of mine life. Following that time, the waste rock dumps and low grade ore stockpile will remain undisturbed and thus will provide habitat for rodents again, albeit of lower quality than that lost with the creation of these mine units. However, the stockpiles will provide perching sites for raptors and thus potentially slightly increase hunting opportunities for these birds, i.e., the subject mine facilities will not be a sterile environment devoid of life.

It is not possible to predict the loss of microtine rodents from mine development with any accuracy, since population densities vary considerably as evidenced by the three years of baseline trapping conducted at Jericho.

Table 2.5-2 lists the areas of the mine site that will be permanently altered.

TABLE 2.5-2 PERMANENTLY DISTURBED AREAS	
Mine Unit	**Area (m^2)**
Open Pit	100,700
Dump #1	217,000
Dump #2	210,900
Coarse Kimberlite	91,600
Low Grade Ore	108,000
TOTAL	**728,200**

As areas begin to green up, they will again provide habitat for rodents. The open pit will slowly fill with water and the amount of habitat suitable to rodents will be limited because of the steep nature of the walls which will be in bedrock. Only the ramp into the pit will provide suitable habitat for the most part and that will slowly disappear over about 20 years, based on the current plan to direct mine drainage to the pit.

The coarse kimberlite will likely be used almost immediately by ground squirrels for burrows once it is no longer active. This will encourage vegetation (from aeration of the substrate and fertilization) which in turn will slowly attract other rodents, such as voles and lemmings.

Dumps and the low grade ore stockpile will provide some habitat but rodents, especially shelter, but the density of rodents in these areas, based on microtine rodent trapping studies which showed rodent densities were lower in rocky tundra areas than upland tundra and birch seep areas, is likely to be less than that before creation of these mining units.

In summary, only the open pit will remain essentially alienated from use by rodents or an area of about 10 ha out of the total 222 ha to be disturbed.

Management of Wildlife Access to the PKCA

The PKCA, unlike gold or base metal mine tailings ponds will not contain highly or moderately toxic tailings supernatant water. In fact, the PKCA water will essentially be similar to lake water except for much higher sediment concentrations and elevated metals and major ions (TDS). The thixotropic nature of the tailings beaches will discourage caribou from entering the active PKCA. Birds landing on open water areas in summer are unlikely to experience any harm. The PKCA, being essentially devoid of aquatic life, will not be attractive to waterfowl. Should bird deaths occur attributable to the PKCA, actions will be taken to discourage waterfowl landing on the PKCA. We note that bird deaths are not an issue at Lupin (a gold mine) or at EKATI™ (a diamond mine).

Points 3 – 9

Points 3 to 9 are addressed by Hubert and Associates (2003).

2.5.3. Vegetation

The directive in the 18 August 2003 NIRB Decision, p. 34 ignores the work done by Page Burt and reported in the 1999 Vegetation Report, discussions in the Impact Assessment Report (Appendix B.2.1) and the report on background levels of metals in lichens at the Jericho site (Appendix B.3.3, Attachment 5.1):

> *"Expand the information in the FEIS to include a supported discussion of the general baseline health of vegetation species and communities in the study area, baseline information regarding the current contaminant loadings in lichens and representative vascular plants in the study area, the impacts of the proposed project on contaminant loadings of vascular plants and lichens."*

Health of Vegetation

Page Burt sampled vegetation at the Jericho site in 90, 5 x 5 m square plots over the range of community types found at Jericho (see the Vegetation Report, Appendix B.1.2 of the Jericho Final EIS). Maps 2 to 4 of the report show the locations of plots with respect to planned developments at Jericho. No direct comment on plant health was provided by Burt. However, Burt does indicate that plant communities were typical of those in the region. Hubert, in his wildlife report (Appendix B.1.3), indicated plant communities were healthy. Further, there is no indication of stressed plants at the Jericho site. Photo verification of this statement is available from the plot photos taken for the survey which are available upon request. Sample photographs of representative plant communities is provided in the vegetation report.

Impacts from Mining on Vegetation Contaminant Levels

Other than direct elimination of vegetation in 222 ha of the Jericho site from mine developments, indirect effects will be due to dust. Dust has not been found to negatively affect most plant communities under much higher dusting conditions than will be found at the Jericho site (Auerbach, et al. 1997[1]) and thus no significant effects from the presence of dust on vegetation are expected. Nonetheless, potential dust effects will be monitored at Jericho as discussed in the Final EIS Monitoring Plan (Appendix B.3.3, Section 5.2).

Some increase in exposure to metals could occur to plants from dust from mineral soil and rock dust transported as a result of mining activities. Most dust would be washed off plants

1 Auerbach et al. (1997) studied effects on vegetation adjacent to the gravel Dalton Highway in northern Alaska. Highway traffic had generated dust for 15 years prior to the study. Levels of dust from the highway are considerably higher than would be generated by internal roads at a mine site, but the study is valuable in providing insights into the effects of long-term high dust levels on tundra vegetation. Auerbach et al. found earlier snowpack meltout near the road due to dust-induced albedo changes. Vegetation biomass of most taxa was reduced near the road (from 50 to 80%); some plant species were more tolerant than others, which accounted for the difference in biomass effects. For instance, non-acidic moss (*Tomentypnum*) was virtually unaffected by dust, whereas acidic *Sphagnum* moss was nearly eliminated near the road. Alteration of moisture regimes was found to be as important as dust in effecting roadside changes in vegetation in general.

during rain and snow melt in the summer when most dust exposure will occur, however, some absorption of metals dissolved in the snow or rain water could be possible. The amount of leaching possible from this source of water is extremely low due to the very short exposure period of water and dust particles. Further, dust does not commonly contain high levels of metals or other contaminants (ABR 1999) whereas snow can exhibit anomalous metals concentrations near sources (MDA 2002).

Lichens and mosses are better indicators of metals accumulation over vascular plants for several reasons (ABR 1999):

- ease of collection;
- lichens and many mosses lack roots or similar absorptive structures and thus their main source for nutrients (and contaminants) is atmospheric deposition;
- mosses and lichens possess high surface to mass ratios and thus can accumulate trace metals and other contaminants at relatively high concentrations;
- lichens have a slower growth rate than mosses which allows accumulation of higher levels of trace elements;
- there is a relatively large database for metals levels in lichens.

Finally, a ready comparison for Jericho exists at EKATI™ Mine, since lichen monitoring is being carried out at the minesite.

For reasons listed above, vascular plants are not as suitable for monitoring metals accumulations as lichens, or mosses. Primarily, vascular plant metals levels are likely to be more a reflection of soil metals levels (absorbed from roots) than air contaminants. This complication is likely exacerbated in slow growing Arctic plants.

Monitoring results from actual mine operations are considered the best predictor of potential metals accumulation effects at the Jericho Mine. Results of lichen monitoring at EKATI™ provided the following indications of impacts to metals levels (MDA 2002). Concentrations in lichens within the project and reference areas were found to be significantly higher in 2001 as compared to 1998. Most notable increases were for aluminum, titanium and ammonium. Increases correlate with impact zones found from snow chemistry monitoring. While increases were significant, they remained below CCME recommended maximum concentrations and none of the values were at phytotoxic levels. A similar, though less pronounced, result would be expected for the Jericho Mine site; less pronounced because of the much smaller size (1/25th) of the Jericho Diamond Mine. As indicated in the Final EIS Monitoring Plan, Tahera is committed to monitor lichens at the Jericho site as an early warning system for impacts on plant communities.

Air Quality

Most of the issues raised by the NIRB directive are discussed in the response by Levelton (2003). Bullet item three states the following:

Provide a rationale (with support information on silt and moisture content) on why the coarse ore stockpile is ruled out as a source of fugitive dust.

KIA/NTI raised the issue of dust from ***coarse PK*** (Issue 14). This is the first time the issue of dust from coarse ore has been raised and is thus a new issue. There does not appear to be any information on silt and moisture content of coarse ore. Moisture content should be ambient, since water is not involved in ore extraction. Ore stockpiles can be watered during summer months if dust becomes problematic. This is not expected because of the coarse nature of run-of-mine ore.

Socio-economic Impact Assessment

These issues are dealt with by Hornal and Associates (2003).

2.5.4. The Inadequacy and/or Lack of Detail Contained in Specific Plans and Strategies

Processed Kimberlite Containment Area

Issues raised in the NIRB directive are addressed in the SRK report (2003).

Water Management

A number of issues are raised in NIRB's directive. Water management is dealt with in SRK's report (2003).

Chromium toxicity is addressed in the aquatic toxicity report (AMEC 2003a). As evidenced by six years of water quality monitoring, natural chromium levels in the watershed are low; the toxicity assessment provides recommendations for management of chromium in the PKCA.

An amendment to the spray irrigation information in the final EIS is provided by Microbioal Technologies (Sobilewsky 2003).

Spill Contingency Plan and Hazardous Materials Management Plan

Most of the issues raised are dealt with in earlier sections of this supplemental report, or by others as noted. Bullet 4 states:

Provide detailed design work for the "secure area designated for storage of contaminated soils."

By this we assume NIRB is referring to the landfarm. More details than provided in the final EIS can be found in Attachment 2.6. Clearly, detailed design is well beyond the requirements of the Jericho Project guidelines and beyond normal requirements for an EIS. A conceptual design for a landfarm is provided in the aforementioned attachment. As well, experience from operation of the EKATI™ landfarm will be employed in construction and operation of the facility at Jericho.

Bullet 8 states:

Develop a best management practice manual for ANFO storage and use, which severely limits ammonia and nitrate release to the environment.

Ammonium nitrate is a fertilizer, not a toxic substance and we are puzzled by a request to treat it as a toxic substance. This directive of NIRB is well beyond the requirements of the Jericho Project guidelines. EKATI™ for instance, was not required to provide detailed management practices manuals until well after commencement of mining. Tahera has committed to constructing a berm around the ammonium nitrate pad (ammonium nitrate is not stored with fuel oil and is thus not ANFO until mixed by the explosives truck which will be done down hole, as is normal practice in mining operations). Again, as explained elsewhere in this report, the proposed ammonium nitrate pad is at least 700 m upslope from any water body. Ammonium nitrate may stimulate plant growth if released near the pad. Experience from EKATI™ indicates ammonia is almost completely absorbed by traverse across 100 m of tundra, or approximately one-seventh of the distance from the ammonium nitrate pad to the nearest water body at Jericho. Ammonium nitrate will be delivered in the winter as part of the winter supply, lifted off transport trucks and placed directly in the designated storage area.

Handling of ANFO will be the responsibility of the explosives and mining contractors and a management plan for ANFO must await engagement of these contractors. ANFO will be handled as required by the *Explosives Act* and the *NWT Mine Health and Safety Act* and *Regulations*. Since ANFO is mixed down hole in the pit, the chance for environmental release is considered to be zero.

Closure and Reclamation Plan

Closure and reclamation have been dealt with previously in this supplemental report.

Tahera will follow the *Mine Site Reclamation Policy for Nunavut* of DIAND as was indicated in the company's 25 April 2003 response to DIAND.

With regard to the PKCA reclamation, the final EIS Reclamation Plan (Appendix B.3.2, Section 5.3.3) indicates that up to 0.5 m of overburden material would be placed on the PKCA on closure. The material would be taken from the overburden salvage stockpile. The overburden is expected to be relatively low in organics due to the nature of soils at the Jericho site which are sandy or gravelly. Overburden would be preferentially kept for PKCA reclamation, as this mining unit has the best chance of revegetation success, based on the experience at EKATI™ (ABR 1996, 1997, 1998, 2000a, 2000b, 2001). Until reclamation trials are completed, additional information cannot be given. Native vegetation will be planted on the reclaimed PKCA if vegetation trials indicate the potential for success (limited success has been reported by EKATI™ for direct planting on fine PK.

DIAND and GN will have to decide whether their policies are to allow the use of fast growing agronomics and fertilizer to stabilize disturbed areas against erosion, or if use of native vegetation only will be insisted upon. If the latter course is taken and given that tundra vegetation grows only very slowly, other means of disturbed area stabilization will have to be employed by mine operators, which practically means use of rip rap. Both the government reviews of the final EIS and NIRB's directive ignore this reality of Arctic climate. We note, most of the issues raised under this heading were dealt with in the final EIS to the extent that information was available, or could be developed.

Water quality objectives for the Jericho drainage basin will be addressed by water licence requirements for the project and to the extent that water licence discharge requirements must be met on closure, these issues will also be dealt with by reclamation procedures and post closure monitoring as indicated in the final EIS. For clarity, final abandonment of the Jericho site will not occur until closure requirements of the Jericho water licence in force at that time are met. Walk away will likely require discharge water quality to approach or meet CCME guidelines. Water quality on closure is addressed further in AMEC 2003b.

With regard to soils testing at closure, guidelines in place for **minesites** at the time of closure will be followed. This will include petroleum hydrocarbons and metals. It should be noted that most jurisdictions in Canada and elsewhere in the world recognize that metals are often naturally elevated at mine site and adherence to agricultural, parkland or residential standards are not appropriate for minesites.

Water quality at closure is discussed in AMEC 2003b.

With respect to clarification of aesthetics at closure, it is not clear from the NIRB directive what the issue is. Aesthetics were discussed in the Jericho Final EIS. Regrading of slopes of waste dumps, revegetating disturbed areas that are amenable to such treatments and stabilizing other surfaces with rip rap or other non-erodable materials has been proposed. Some treatments to return the mined area to its pre-mined state are not practical as explained in the Final EIS, e.g., backfilling the open pit. All buildings will be removed, concrete foundations covered and the areas revegetated if practical, i.e., if reclamation trials indicate likelihood of success. All these issues were discussed in the Final EIS. Practical is taken to mean anything that can be reasonably done within the economics of the Project, keeping in mind that the site is remote. Specifically, “mining junk” will not be left when the site is cleaned up.

2.5.5. Deficiencies in Monitoring and Follow-up Strategies

Conceptual monitoring plans were provided in the final EIS and have been adjusted in light of concerns raised by government reviewers.

NIRB Directive	Response
Provide more detail on the AEMP including a description of the proposed QA/QC program	See Streamside Aquatics report (2003)
Include temperature and oxygen profiles for lake monitoring	Oxygen will be measured under ice in lakes prior to and during mine operation. Rationale for measurement of temperature is required as it adds nothing to the dissolved oxygen story.
Locate sampling stations in the middle of Lake C3 and Carat Lake and at the mouth of Stream C1 and add a second control site.	Tahera will commit to a second control site; Cigar Lake would make a good candidate because there are data available. Proposals for monitoring water and sediment quality are included in the final EIS. Tahera expects that some adjustment of sites will be required at the permitting stage.
Consider adding the following: TDS, calcium, magnesium, potassium, sodium, chloride and sulphate	Those parameters are already included in water quality monitoring proposal.
Add physical limnology, phytoplankton, zooplankton, fish community and periphyton diversity to the AEMP	Mainstream Aquatics has commented on Environment Canada’s request for addition of phytoplankton and zooplankton.
Sediment quality variables (physical, nutrient, metals and grain size) should be monitored on a routine basis in addition to sedimentation	There is already a commitment in the final EIS to monitor these variables.
During environmental monitoring, zooplankton collections must sample the entire vertical depth instead of being restricted to the euphotic zone.	Addressed by Mainstream Aquatics in their supplemental response.
Adhere to the commonly accepted techniques of analysing and displaying fish tissue metal concentrations.	Addressed by Mainstream Aquatics in their supplemental response. Fish sampling will have to be discussed with DFO and Environment Canada; depletion of a limited resource will likely require other than “commonly accepted techniques” to protect the resource.

NIRB Directive	Response
Provide details of the fish habitat loss compensation plan outlined in the FEIS.	A copy of the proposed compensation plan was provided in the Jericho Final EIS, Appendix B.3.1, Section 3.2; all details were presented pursuant to further discussion with DFO.
Clarify the proposed "fish salvage program" and take into account any resulting disruption of the natural system	The disruption of the natural system, as explained in the EIS will be the elimination of fish habitat in Long Lake. Fish salvage was demanded by DFO for burbot and will be discussed with DFO given the difficulty in successfully salvaging fish in winter and the necessity (to limit suspended sediment) of draining Long Lake while ice-covered. Conceptually fish salvage could be attempted the summer prior to draining the lake, although project approval and permits from DFO would need to be in place.
Monitor flows from the toe of stockpiles at several locations near each stockpile on a high frequency sampling schedule for total and dissolved ICP-MS metal scans. Year-round water quality monitoring for these trace metals should be carried out at sites shown in Figure 3.8, including (but not limited to) Water Quality sites CL-03, CL-04, CL-05, CL-06 and CL-07	Monitoring of seepage will be conducted at Jericho, as required by the Project water licence which will be negotiated at the permitting stage. Conceptually, samples will be collected during the open water season and analysed for contaminants of concern (e.g. metals and N species). A program for water quality monitoring was outlined in the Final EIS, Appendix B.3.3. As water in Carat Lake has been clearly demonstrated to mix, no information useful to environmental management will be gained by multiple sample sites in the lake.
Conduct long-term kinetic column leach geochemical testing on the six kimberlite rock facies	A more appropriate monitoring program is to monitor seepage which is done at EKATI™. Tahera will explore the most optimal way to monitor acid generation conditions at Jericho.
Re-examine the samples used for the leach extraction tests, if still available; otherwise redo the tests with fresh samples.	Samples are not available. There is no pilot plant to generate tailings and in any case, total metals analyses cannot be performed, as explained in the June Edmonton workshop.
Include post closure monitoring of the polishing pond as well as the humid terrestrial ecosystem created in the PKCA	Post closure monitoring of the polishing pond is proposed.
Include post closure monitoring of the polishing pond as well as the humid terrestrial ecosystem created in the PKCA	The PKCA will be reclaimed to dry land which could retain moisture during extremely wet periods such as freshet. Rationale for what purpose monitoring this area would serve is required as any surface runoff would report to the polishing pond. The polishing pond will be monitored as part of post closure monitoring.
Conduct ongoing monitoring of the mine pit effluent	Part of the water management plan proposed in the EIS.
Provide more details regarding the proposed wildlife monitoring programs	Addressed in the supplemental report by Hubert and Associates (2003).
Consider incorporating a detailed caribou management and monitoring plan	It was suggested at the Edmonton workshop that Tahera should make specific commitments to joint monitoring and management plans. Since caribou migrate over a very large area, any site-specific monitoring of caribou by the Jericho Mine should be integrated in a general management program which must be a joint effort of industry and government. Tahera is prepared to discuss participation in joint caribou management efforts and has so stated in the Jericho Final EIS.
Incorporate more quantitative measures of abundance for species other than caribou into the monitoring plan.	Tahera will commit to any practical monitoring efforts that improves management of wildlife at the Jericho mine site.
Address mitigation/compensation for the loss of wetlands as required by the federal No Net Loss of Wetlands Function policy	**This is a new demand.** Very little wetlands will be lost and the small pockets lost cannot be replaced. Wetlands lost will not affect the function of ecosystems at the Jericho site except at the local level.
Identify and develop a wider range of mitigation measures for socio-economic impacts.	See Hornal 2003. Mitigation is largely tied to the IIBA.

NIRB Directive	Response
Provide a socio-economic monitoring and follow-up plan that includes more detail on the proposed socio-economic monitoring committee and community liaison committee.	Tahera has committed to the formation of such a committee. The exact nature will depend on community needs and will need to be negotiated with affected communities when the project is approved. The key to successful functioning of this committee will be buy in by the communities involved which will require their active participation in formation. We expect this process to take several months during the pre-construction period.

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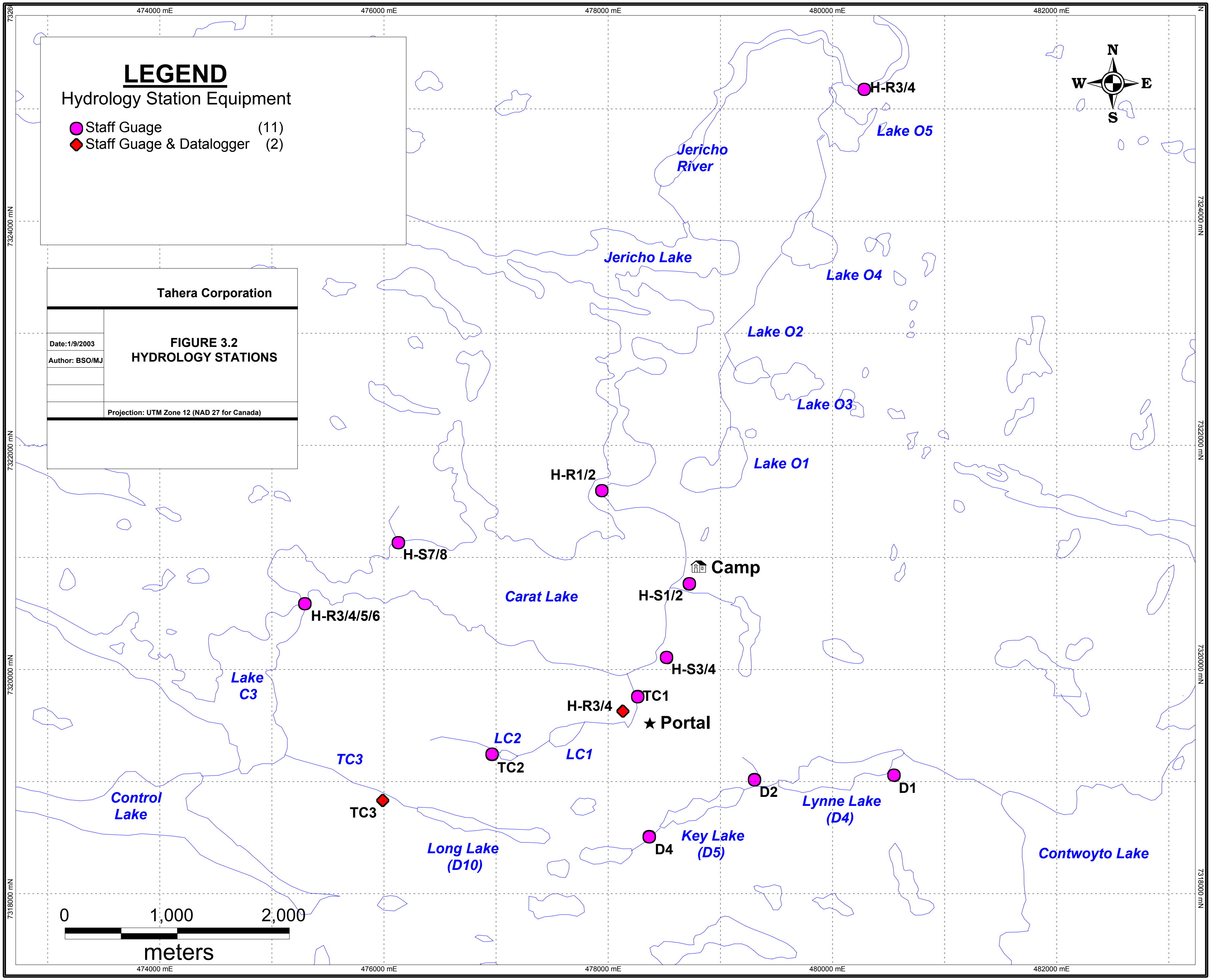
ATTACHMENT 2-1
FIGURE 3.2

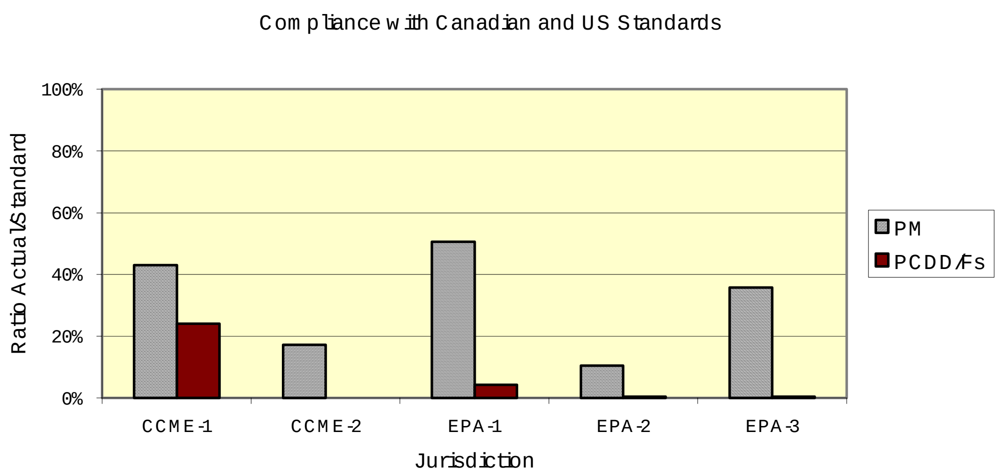

LEGEND
Hydrology Station Equipment
Staff Guage (11)
Staff Guage & Datalogger (2)
Tahera Corporation
Date:1/9/2003
Author: BSO/MJ
FIGURE 3.2
HYDROLOGY STATIONS
Projection: UTM Zone 12 (NAD 27 for Canada)
N
W
E
S
474000 mE
476000 mE
478000 mE
480000 mE
482000 mE
7324000 mN
7322000 mN
7320000 mN
7318000 mN
H-R3/4
Lake O5
Jericho River
Jericho Lake
Lake O4
Lake O2
Lake O3
Lake O1
H-R1/2
H-S7/8
Camp
H-S1/2
Carat Lake
H-R3/4/5/6
H-S3/4
Lake C3
TC1
H-R3/4
Portal
LC2
TC2
LC1
TC3
Control Lake
TC3
D2
D1
Lynne Lake (D4)
Key Lake (D5)
D4
Long Lake (D10)
Contwoyto Lake
0
1,000
2,000
meters

ATTACHMENT 2.2
INCINERATOR DESIGN

Westland CY-50-CA Thermal Oxidizer:
Emissions of Chlorinated Dioxins/Furans and Particulate Matter

The system was initially developed in a joint venture to meet the criteria of simplicity (low cost) and robustness to comply with standards for conventional pollutants. A control system was then added to automate operation with *any* waste composition. The latest development involved energy recovery for hot water generation and "fine-polishing" air pollution system for meeting standards for *all* pollutants.

Emissions of particulate matter (PM) and chlorinated dioxins and furans (PCDD/Fs) from Westland's CY-50-CA Thermal Oxidizer comply with standards in Canada and in the U.S. for *large incinerators* for municipal and biomedical wastes.



CCME (Canadian)-**1**: Municipal & Biomedical (new, >200 kg/h); **2**: Biomedical (old or <200 kg/h) – no standard for PCDD/Fs; **EPA** (U.S.) -**1**: Municipal (1.5 - 9 tonnes/h); 2: Biomedical (< 100 kg/h); 3: Biomedical (> 100 kg/h)

The capacity during the test was 34- 42 kg/h, with waste containing 19-24% plastics and 2.2-2.4% rubber - higher than those found in typical biomedical waste (14% and 0.7%).

Project Team: A. Chhibber, J. Dach, T. Kazmierczak, A. Liem*, and R. Milner
Product and business enquiries: anil@westlandincinerator.com 780 447 5052
*Author: albert@arc.ab.ca 780 632 8303

System Description

Figure 1 shows a schematic diagram of the system tested and the sampling location.

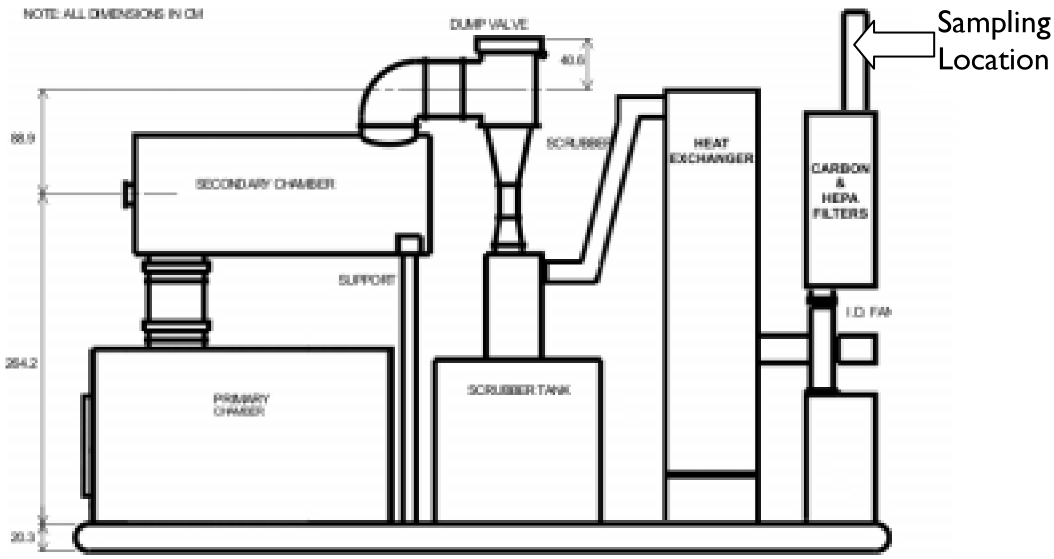


Figure 1. Diagram of the System Tested and Sampling Location

The system consists of two main components:

(A) A dual-chamber, starved-air combustion system followed by a venture scrubbing system, where the waste is oxidized and the flue gas is rapidly quenched and air pollutants removed;

(B) A heat exchanger and a "fine-polishing" air pollution control system, where energy is recovered and further removal of air pollutants occurs.

The system is modeled after the Alberta Research Council's pilot plant[1], and the design, operation and performance of component (A) were described previously. [2] The emissions of PM, HCl, SO_2, NO_x and CO met the standards for large incinerators in Canada and the U.S.

Waste is charged batch-wise into the primary chamber after preheating of the primary and secondary chambers. Under-fire air is fed into the primary chamber, where starved-air conditions are initially maintained, thereby generating combustible gases and soot. These are completely combusted in the secondary chamber by introducing flame-port air, and if necessary,

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[1] B. Pandompatam et al. *Waste incineration research at the Alberta Environmental Centre, Part 2: Facility design considerations*. In: Hazardous Waste Detection, Control, Treatment. Proceedings of the World Conference on Hazardous Waste. (Abbou, R., eds.), pp. 1421-1440. Elsevier Science Publishers B.V., Amsterdam, The Netherlands. October 25-31, 1987. Budapest, Hungary.

[2] A. Liem et al *Development of a small-sacle, simple and robust medical waste incinerator system.* 9th International Pacific Basin Conference on Hazardous Waste. Manila, Philippines. April 10-14, 2000

using an auxiliary burner. A control system is used to automatically regulate the under-fire and flame-port air flow rates to ensure complete combustion and to minimize auxiliary fuel use.

The hot flue gas from the secondary chamber is *rapidly* quenched in a venturi scrubber, which acts also as a pollution control device. Cooling from 1200 to 80 ^{0}C (maximum) occurred "instantaneously", which should prevent PCDD/F formation from gradual cooling of flue gas.[3]

The latent heat of the moisture in the cooled flue gas is recovered in a condensing heat exchanger to generate hot water. An induced draft fan is used to draw the flue gas and to discharge it to the atmosphere via HEPA and activated carbon filters. These filters act as "fine-polishing" air pollution control device.

The sampling for PCDD/Fs and particulate matter was taken from the stack downstream of all the pollution control devices [see Figure 1].

Sampling and Analytical Methods

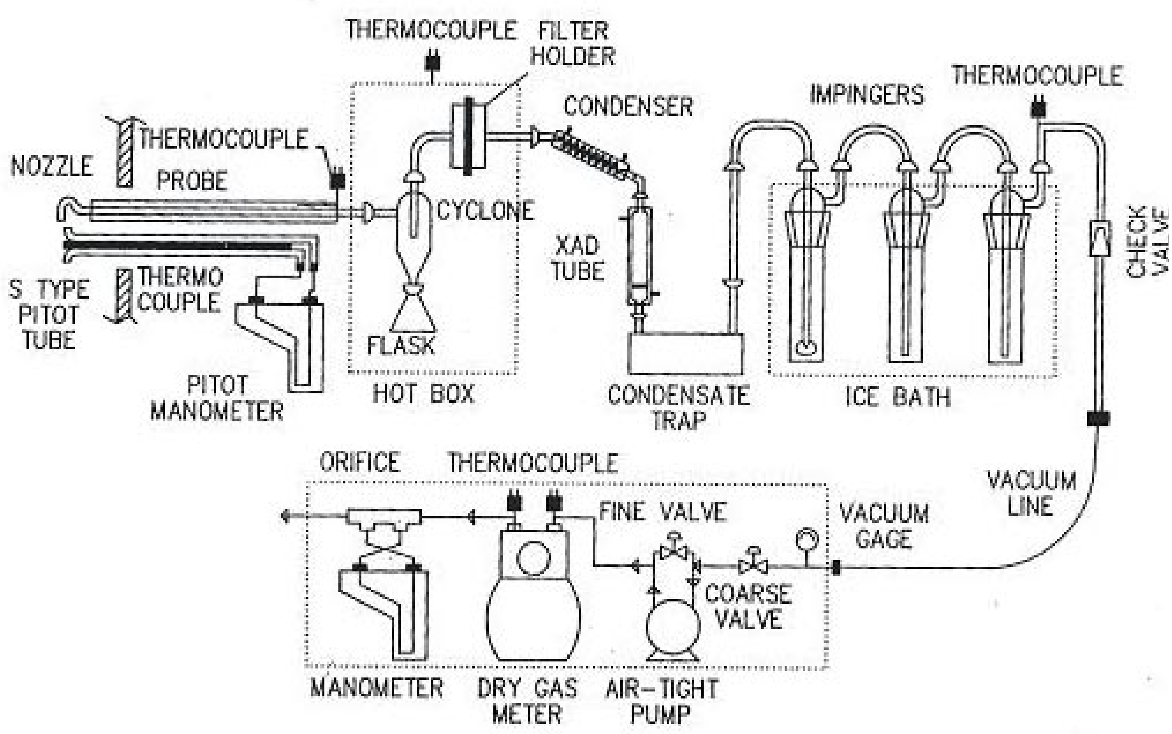


Figure 2. Diagram of Sampling Train

[3] Patrick F. Mahoney et al. *Minimum Dioxin with Maximum Resource Recovery.* 17th International Symposium on Chlorinated Dioxins and Related Compounds, Indianapolis, IN, August, 1997.

The semi-volatile organics (MM5) sampling train, as shown in Figure 2, and the reference methods for sampling, recovery and analysis were used.[4] Flue gas was sampled isokinetically[5] through a nozzle connected to a heated probe and a heated box to prevent moisture condensation. In this case, only a filter was used to capture PM due to its expected low concentration. The sample was then condensed and passed though an XAD tube to adsorb PCDD/Fs. In case of incomplete adsorption, an impinger containing an ethylene glycol solution was used. The sample then was passed though an empty impinger to remove carried-over droplets and an impinger containing silica gel to adsorb moisture in it. The sampling flow rate was controlled by a series of valves, and measured by an orifice meter (instantaneous value) and a dry gas meter (cumulative volume) located downstream of the pump. About 3 m^3 of sample was withdrawn.

Prior to sampling, oxygen and carbon dioxide measurements were made to determine the molecular weight of the dry flue gas, and to correct the emission results to the specified reference oxygen (or carbon dioxide) concentration. The moisture content in the flue gas was measured by weighing the condensate collected during the sampling period.

PM was measured by weighing oven-dried materials collected on the filter and the rinsing of the nozzle and the probe after sampling. PCDD/Fs were recovered by solvent extraction of the filter and the materials on it, the XAD tube and the ethylene glycol solution. The solvent was then “cleaned-up” to remove analytically-interfering compounds, and concentrated by vacuum evaporation prior to analysis.

The recovery and processing for PCDD/Fs are very complex and error-prone, thus it is necessary to use “surrogate compounds” for quality assurance. These are compounds with behaviour *similar* to the target compounds of interest, but are *analytically distinguishable*. Known quantities of surrogates are added to the XAD tube, and comparison between the measured and added quantities provides estimates of recovery efficiencies and detection limits.

[4] Environment Canada. *Reference method for source testing: Measurements of Releases of selected semi-volatile organic compounds from stationary sources.* Report EPS 1/RM/2. 1989

[5] Isokinetic means that the sampling velocity through the nozzle is the same as the flue gas velocity. This makes the nozzle “invisible” which is necessary to ensure representative sampling of particulate matter.

The analysis was conducted only at the homologue level, not for each specific congener.[6] This is a *screening* method to determine whether under the *worst-case scenario*, certain emission standards are met.

Results

The sampling was conducted on August 9 and September 4 in 2002.

Waste Composition and Capacity

A mixture of wood waste, plastics and rubber was used to provide consistency in waste composition and to simulate biomedical waste in terms of plastic and rubber contents. A summary of the waste composition and the capacity during sampling is shown in Table I, and the waste feeding "profiles" are shown in Figure 3, together with the start and stop times of the sampling, which lasted about three hours.

Table I. Summary of Waste Composition and Capacity During Sampling

Date (2002)	Composition (wt%)				Capacity	Thermal Capacity	
	Wood	Plastics	Rubber	Water	kg/h	GJ/h	10^6 Btu/h
Aug 9	72.5%	18.8%	2.2%	6.6%	42.4	0.63	0.60
Sept 4	73.2%	24.4%	2.4%	2.4%	33.9	0.56	0.53

The plastic and rubber contents in the mixture were higher than those found in typical biomedical waste in the U.S., which are 14.2% and 0.7%, respectively.[7] These components are responsible for "black smoke" generation, and hence the results show the robustness of the control system used. Notice that the mass capacity is dependent on the heating value of the feed, decreasing with higher heating values.

[6] Congeners with the *same number of Cl atom* form a homologue;a congener has the *locations* of Cl atoms specified

[7] R.G. Barton et al. *State-of-the-Art Assessment of Medical Waste Incinerators.* US EPA Report (Draft). EPA Contract 68-03-3365. 1991. Table 1.

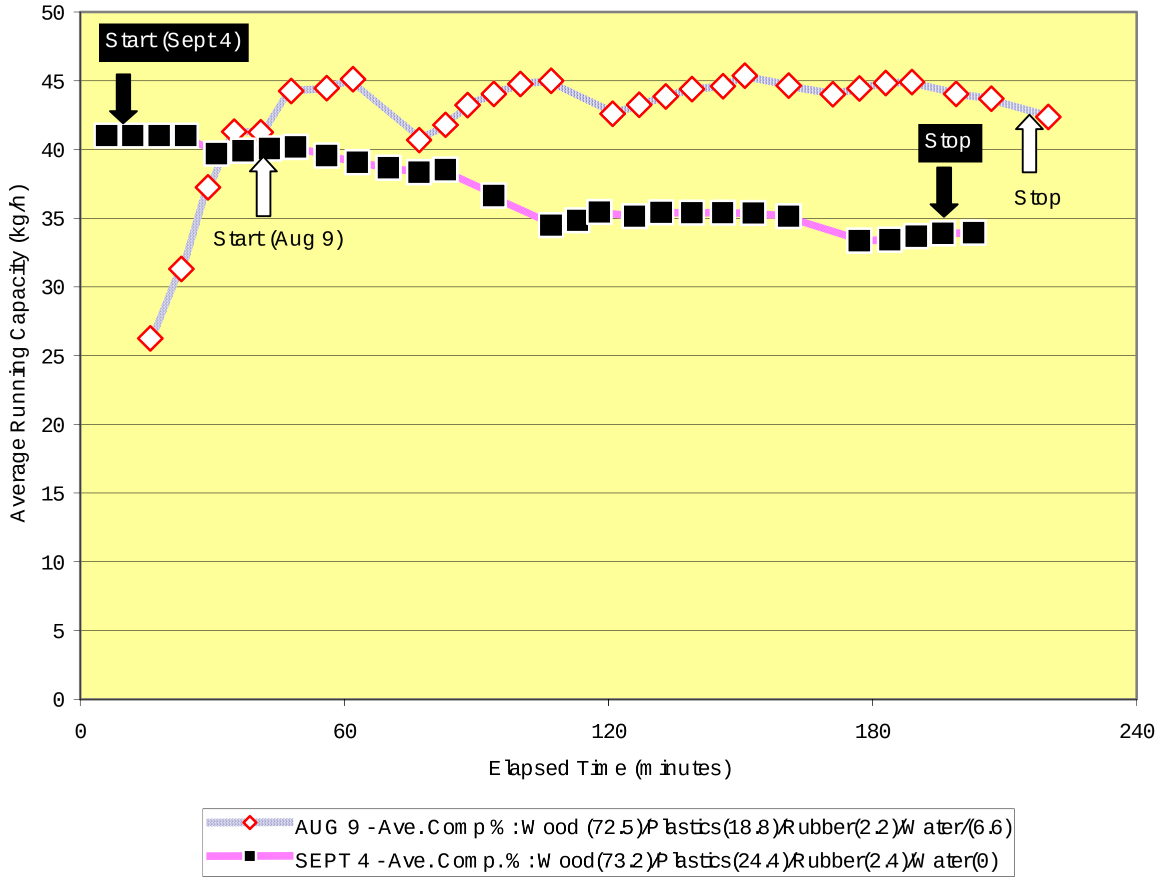


Figure 3. Waste Loading During Sampling and Capacity

The average running capacity W_n [kg/h] is defined as:

$$W_{n+1} = \frac{\sum_{i=1}^{n+1} L_i}{t_{n+1} - t_1} \quad n = 1,2,....$$

where L_i [kg] is the mass of the i^{th} batch and $(t_{n+1} - t_1)$ [h] is the elapsed time between the first and the $(n+1)^{th}$ batches fed into the primary chamber. W_n thus represents the *average over the indicated elapsed time after the first batch is loaded.*

The thermal capacity is computed based on the average mass capacity at the end of sampling, the average composition and the published heating value of each component.

Flue Gas Sampling

The details are given in Appendix A, and a summary is given in Table II. Several points to be noted from the results:

- Sampling was conducted until 100 ft^3, as read in the dry gas meter, of sample was collected. The inlet and outlet temperatures and the barometric pressure were measured and used, with the measured oxygen concentration, to compute the referenced volume collected.
- The oxygen concentration was not indicative of the combustion process. In order to reduce the relative humidity of the air entering the "fine-polishing" device, ambient air was "bled in" upstream of the induced draft fan at the heat exchanger outlet.
- The isokineticity results met the acceptable range (±10%) specified in the reference method.

Table II. Summary of Sampling Results

Sampling Date 2002	Composition, %		Volume sampled, m^3		Isokineticity
	H_2O	O_2 [a]	DGM [b]	Referenced [c]	%
Aug 9	8.9	16.5	2.80	1.10	98.3
Sept 4	4.5	17.5	2.80	0.87	97.1

Notes: **a**: Air "bled in" after heat exchanger; **b**: Dry gas meter reading at measured inlet and outlet temperature and pressure; **c**: corrected to 25 ^oC, 101.3 kPa, dry basis, corrected to 11% (vol) O_2

Detection Limits

As will be shown later, PCDD/Fs were not detectable. The relevant question is therefore "What are the detection limits?". In this case, the detection limits are *not unique*, determined *only* by the sensitivity of the analytical equipment used. Instead, they are determined by the recovery efficiency, the extent of solvent concentration and the volume of the gas sample collected. The following equation shows the relationship:

$$DL_M = \frac{DL_{AE}}{V_R \times F}$$

where DL_M is the *method* detection limit [say, pg/Rm^3]; DL_{AE} is the *equipment* detection limit [pg] which is a function of equipment operation and sensitivity *and* the recovery efficiency of the target compound, as determined by the surrogate analysis; V_R is the referenced volume of sample collected [m^3, see Table II]; and F is the ratio of the volume injected to the analytical equipment to the volume of the concentrated solvent [dimensionless].

The results are summarized in Table III and chromatograms of the analytical results are given in Appendix B. The detection limits for total PCDD/Fs are computed by summing the detection limit of each homologue. Therefore, this represents the *worst-case scenario* since it is statistically unlikely that all the homologues are present at their detection limits. The results are presented in terms of both toxicity equivalence (TEQ) and actual, where TEQ is computed by multiplying each detection limit with its Toxicity Equivalency Factors (TEF).

Table III. Surrogate Recoveries and Detection Limits

Surrogate	TEF [8]	Aug 9/02				Sept 4/02			
		Rec Eff	AE	Method, pg/Rm^3		Rec Eff	AE	Method, pg/Rm^3	
		%	pg	TEQ	Actual	%	pg	TEQ	Total
$^{13}C_{12}$ – 2378 TCDD	1	48	5.2	**47.3**	**47.3**	52	4.9	**56.3**	**56.3**
$^{13}C_{12}$ – 2378 TCDF	0.1	54	3.7	**3.4**	**33.6**	57	3.5	**4.0**	**40.2**
$^{13}C_{12}$ – 12378 PeCDD	0.5	64	4.7	**21.4***	**42.7***	66	4.5	**25.9***	**51.7***
$^{13}C_{12}$ – 123478 HxCDD	0.1	71	5.6	5.1	50.9	78	5.1	**5.9***	**58.6***
$^{13}C_{12}$ – 123678 HxCDD	0.1	63	4.7	4.3	42.7	67	4.5	5.2	51.7
$^{13}C_{12}$ – 234678 HxCDD	0.1	70	5.7	**5.2***	**51.8***	81	4.9	5.6	56.3
$^{13}C_{12}$ – 1234678 HpCDD	0.01	73	5.5	**0.5***	**50.0***	83	4.8	**0.5***	**55.2***
$^{13}C_{12}$ – OCDD	0.001	80	7.5	**0.1***	**68.2***	90	6.7	**0.1***	**77.0***
TOTAL PCDD/Fs (worst-case)				<105	<506			<125	<582

Surrogates: PCDD=dioxins; PCDF=furans; No. of Cl atoms: T=4; Pe=5; Hx=6; Hp=7; O=8; **TEF**: Toxicity Equivalency Factors **RecEff**: Recovery Efficiency; **AE**: Analytical Equipment Detection Limit (DL_{AE}); **Method** : method detection limit; **TEQ** = TEF * DL_{AE} /V_R /0.1, where V_R= referenced volume of gas sampled [see Table II], and 0.1 is the fraction of the concentrated solvent used in the analysis; **Actual** = DL_{AE}/V_R/0.1; **TOTAL PCDD/Fs** : worst-case scenario based on homologue analysis results; each homologue assumed at its detection limit; **bolded numbers** used in the summation, and * used for the corresponding furan homologues.

Compliance with Emission Standards

Particulate matter

The PM concentrations are shown in Table IV, together with the Canadian and U.S. Standards. Notice, therefore, that emission standards in Canada and the U.S. for *large municipal and biomedical waste incinerators* are readily met.

[8] CCME. *Operating and Emission Guidelines for Municipal Solid Waste Incinerators.* Report CCME-TS/WM-TRE003. June 1989. Appendix B.

Table IV. Particulate Matter Concentrations and Compliance with Standards (mg/Rm^3)

Date (2002)	Result	CCME-MSW[9]	CCME-BW[10]	US-MSW[11]	US-MWI[12]
Aug 9	12.2	20	20 or 50	17	82 or 24
Sept 4	5.0				

CCME : Canadian Council of the Ministers of the Environment; **US**: US Environmental Protection Agencies; **MSW**: Municipal solid waste incinerator; **BW**: Biomedical waste incinerator for [new, > 200kg/h] or [old or smaller]; **MWI**: Medical waste incinerator for [< 500 lb/h] or [larger]. **R** (CCME); 25 ^{0}C, 101.3 kPa, 11% O_2; **R** (US): 20 ^{0}C, 101.3 kPa, 7% O_2 – but values shown have been converted to CCME reference conditions.

Chlorinated Dioxins and Furans

PCDD/Fs levels were below the detection limits. For comparison with emission standards, the *worst-case scenario* was assumed, where the concentration of each homologue was assigned the value of its detection limit. The results are shown in Table V. Notice, therefore, that current standards in Canada and the U.S. are readily met.

Table V. PCDD/F Concentrations and Compliance with Standards (ng/Rm^3)

Date (2002)	TEQ		Actual		
	Result	CCME - MSW/BW	Result	US-MSW	US-MWI
Aug 9	<0.11	0.50	<0.51	13	125
Sept 4	<0.13		<0.58		

Concluding Remarks

- Smoke-free operation was attained with waste containing plastics and rubber at levels higher than those found in typical medical waste.
- With the use of the "fine-polishing" air pollution device, emissions of particulate matter and chlorinated dioxins and furans were *well below* current standards in Canada and U.S. for *large incinerators.*

[9] Ref. 7, Table 4.2.

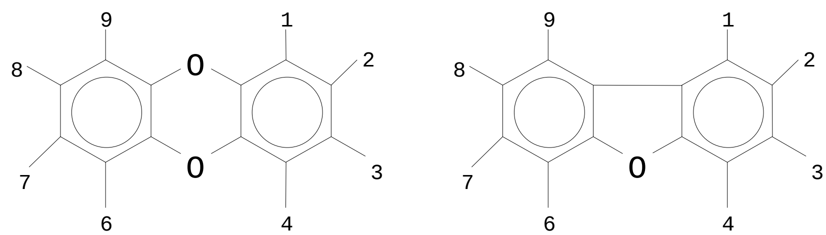
[10] CCME. *Guidelines for the Management of Biomedical Waste in Canada.* .CCME-EPC-WM-42E. (February 1992).

[11] U.S. EPA. Federal Register. 40 CFR Part 60. *New Source Performance Standards for New Small Municipal Waste Combustion Units; Proposed Rule.* (August 30, 1999)

[12] U.S. EPA. Federal Register. 40 CFR Part 60.*Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Hospital/Medical/Infectious Waste Incinerators.* Volume 62, No. 178. (September 1997).

Glossary

Dioxin Nomenclature. The following diagram shows the structure of (a) dioxins and (b) furans and the numbering of the positions that could be taken up by up to 8 Cl atoms.



(a) (b)

Weight units

Notation	Name	Value
pg	picogram	10^{-12} g
ng	nanogram	10^{-9} g
µg	microgram	10^{-6} g
mg	milligram	10^{-3} g

Conversion from Actual to Reference, Dry Conditions

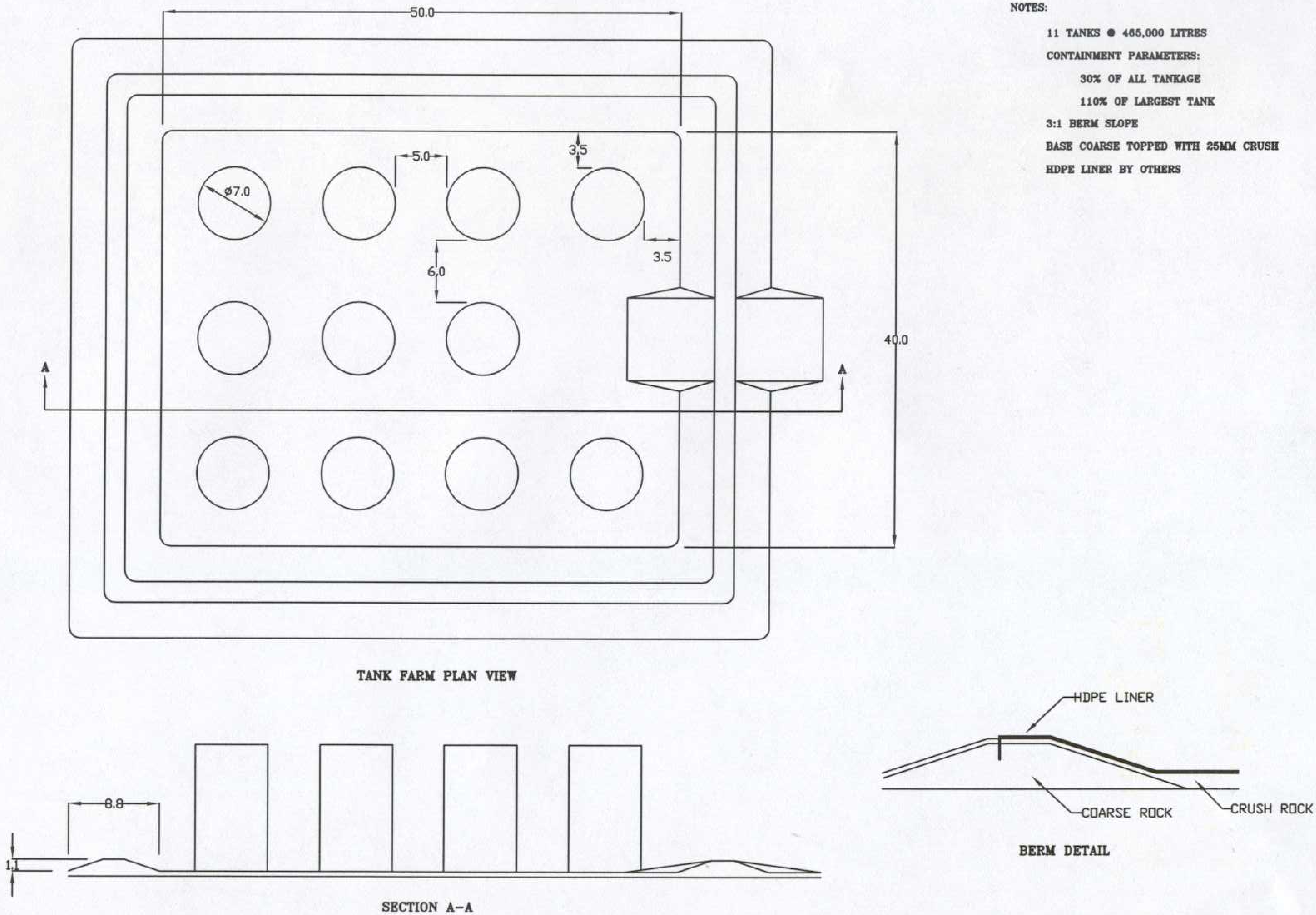
$$V_R = V_A \times \frac{T_R + 273}{T_A + 273} \times \frac{P_R}{P_A} \times \frac{20.9 - O_R}{20.9 - O_A} \times \frac{(100 - H_2O)}{100}$$

where **V**: volume; **T**: temperature (⁰C); **P**: pressure; **O**: oxygen concentration (vol.%); **H_2O**: moisture content (vol.%); and subscripts **R**: reference and **A**: actual or as measured. Any consistent units may be used for V and P.

Appendix A. Details of Sampling Conditions

Appendix B. Chromatograms of Analytical Results

ATTACHMENT 2.3
FUEL FARM ALTERNATE LAYOUTS



NOTES:

11 TANKS @ 465,000 LITRES

CONTAINMENT PARAMETERS:

30% OF ALL TANKAGE

110% OF LARGEST TANK

3:1 BERM SLOPE

BASE COARSE TOPPED WITH 25MM CRUSH

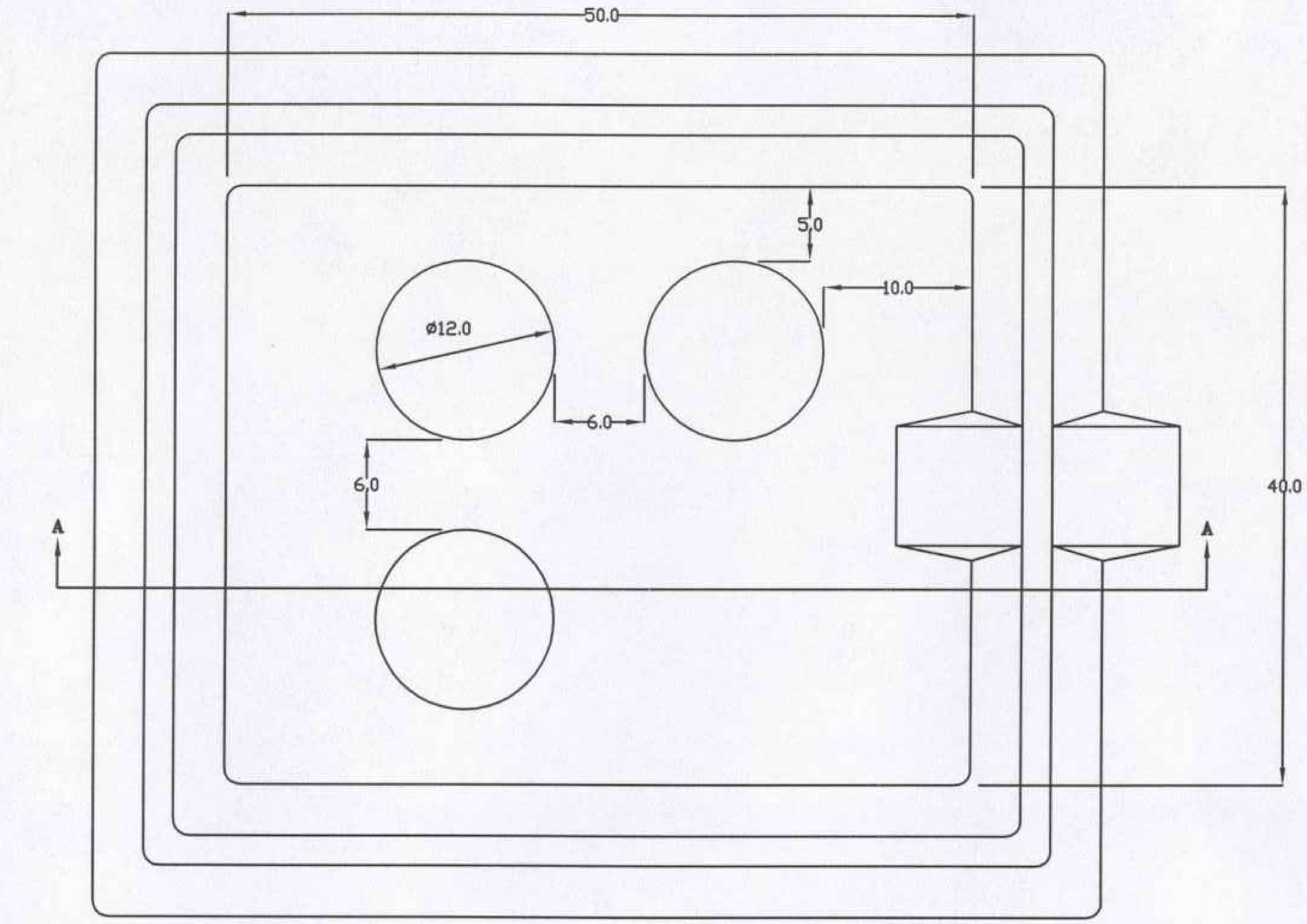
HDPE LINER BY OTHERS

NUNA LOGISTICS

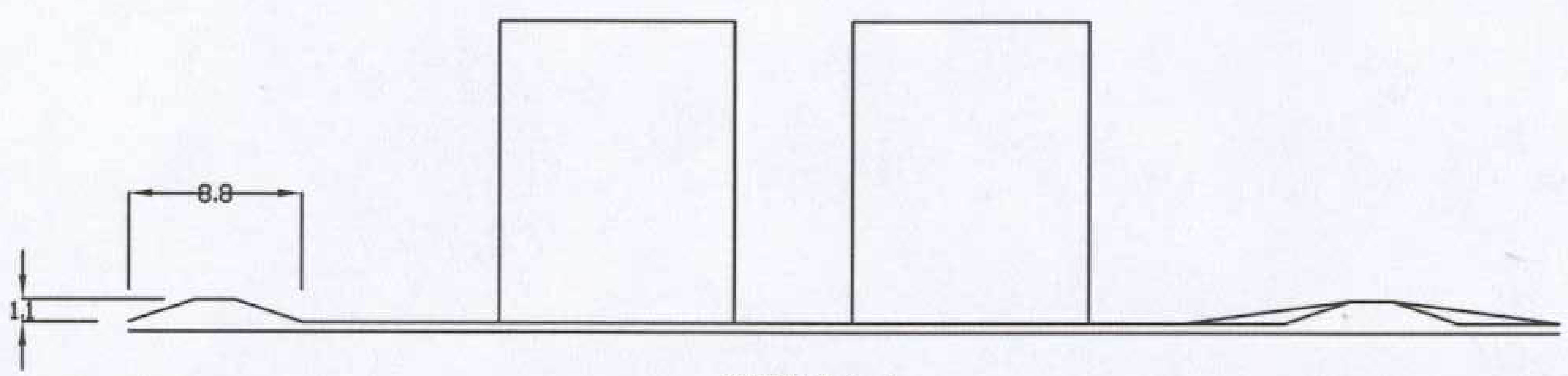
TAHERA – JERICHO PROJECT

TANK FARM – ALT 1

FIGURE 1



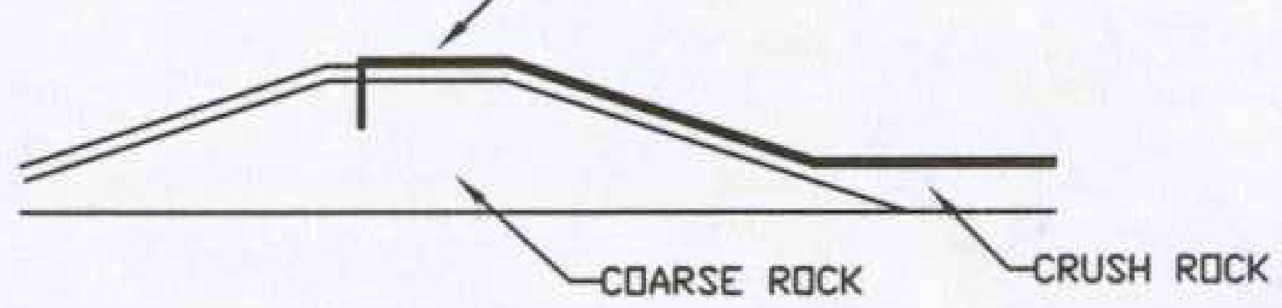
TANK FARM PLAN VIEW



SECTION A-A

NOTES:

3 TANKS ● 1,700,000 LITRES
CONTAINMENT PARAMETERS:
30% OF ALL TANKAGE
110% OF LARGEST TANK
3:1 BERM SLOPE
BASE COARSE TOPPED WITH 25MM CRUSH
HDPE LINER BY OTHERS



BERM DETAIL

NUNA LOGISTICS

TAHERA - JERICHO PROJECT

TANK FARM - ALT 2

FIGURE 2

REV 0

ATTACHMENT 2.4
WASTE WATER TREATMENT PLANT DESIGN

P.J.HANNAH EQUIPMENT SALES CORP.

UNIT #10, 8528-123RD STREET
SURREY, B.C. V3W 3V6
TEL: (604) 591-5999
TOLL FREE: 1-800-663-6793
FAX: (604) 591-9925
EMAIL: mail@pjhannah.com
www.pjhannah.com

UNIT #9, 151 BRUNEL ROAD
MISSISSAUGA, ONTARIO L4Z 2H6
TEL: (905) 712-0620
TOLL FREE: 1-800-353-3087
FAX: (905) 712-1240
EMAIL: mail@pjhannah.com
www.pjhannah.com

Please reply to above address

ENVIRONMENTAL AND INDUSTRIAL EQUIPMENT MANUFACTURERS AND SUPPLIERS SINCE 1973

THIS DOCUMENT SENT VIA EMAIL
DATE: 03/06/13
Ly-shu.ramos@amec.com

AMEC Earth & Environmental
2227, Douglas Road
Burnaby, B.C.
V5C 5A9

Our Ref: K 17550
Your Ref: Tahera Corp. Arctic Camp WWTP

Attention: Ly-Shu Ramos

Dear Ms. Ramos;

Thank-you for you recent inquiry regarding RBC wastewater treatment systems for your Tahera Corp. project. As we discussed, P.J. Hannah has supplied numerous treatment plants for use in Northern environments.

To assist you with your projects, we are pleased to provide information as follows:

- Sizing and Pricing information for a treatment system for 100 man camp.
- Reference list of some recent northern camp treatment plant installations.
- AutoCAD drawing of a 'typical' camp plant.

Our RBC wastewater treatment systems are designed and built to exceed the effluent discharge requirements for their installation location. We can meet virtually any effluent discharge requirement that may be applicable to your project. With over 1000 systems sold, we have treatment systems that range in treatment efficiency from basic secondary treatment (45 mg/l BOD_5 – 60 mg/l TSS) to very high efficiency treatment plants designed for extremely sensitive receiving environments (< 10 mg/l BOD5, < 10 mg/l TSS, < 10 mg/l NO3-N, < 20 mg/l Total N, < 1.0 mg/l Phosphorous < 2.2MPN Faecal Coliform)

Our treatment systems are extremely reliable, require minimal operator attention, are extremely quiet and use the least amount of energy of any wastewater treatment system.

Our equipment is designed, engineered and fabricated in our Surrey, B.C. and Toronto, Ontario facilities.

Based on the guidelines that you have provided, our **ITEM 2** will exceed the treatment requirements for the NorthWest Territories. To assist you with your project, we have also provided pricing and sizing information for a treatment plant based on the effluent discharge criteria as was recently required for the Diavik Diamonds project, (Our **ITEM 1**).

We are pleased to quote as follows:

Item 1 < 10 mg/l BOD_5, < 10 mg/l TSS, < 1.0 mg/l Phosphorous, UV Disinfection

ITEM	QTY	DESCRIPTION	UNIT PRICE
1	1	**P.J. HANNAH BIODISC®** sewage treatment plant model BS9F-BFP. Rated for a daily flow of 22.7 m^3 of camp strength sewage, to produce an effluent quality of < 10 mg/l BOD_5, <10 mg/l TSS,and less than 1.0 mg/l Phosphorous average. Drive motor 1/2 hp, 110/1/60 TEFC. Media area 1098 m^2. This is a complete corrosion protected steel package plant complete with primary clarifier, rotor treatment zone, final clarifier, filter feed and backwash chambers and effluent pumping chamber. Also includes the following if √ √ Internal flow balancing system. √ 25 mm spray foam insulation on all external walls and bottom. √ 25 mm spray foam insulation on underside of cover. √ UV disinfection system. √ Tertiary filter. √ Control panel. √ Phosphorus removal system. √ Effluent pumps √ Intrinsically safe heaters and lights within treatment plant. √ Flow meter. √ Grating and handrailing within treatment plant. **BUDGET PRICE** **Canadian Funds, F.O.B. Minesite, NWT**	**$ 200,000.00**

Item 2 < 20 mg/l BOD_5, < 20 mg/l TSS, < 1.0 mg/l Phosphorous, UV Disinfection

ITEM	QTY	DESCRIPTION	UNIT PRICE
2	1	**P.J. HANNAH BIODISC®** sewage treatment plant model BS9F-BFP. Rated for a daily flow of 22.7 m^3 of camp strength sewage, to produce an effluent quality of < 20 mg/l BOD_5 , <20 mg/l TSS,and less than 1.0 mg/l Phosphorous average. Drive motor 1/2 hp, 110/1/60 TEFC. Media area 1098 m^2. This is a complete corrosion protected steel package plant complete with primary clarifier, rotor treatment zone, final clarifier, and effluent pumping chamber. Also includes the following if √ √ Internal flow balancing system. √ 25 mm spray foam insulation on all external walls and bottom. √ 25 mm spray foam insulation on underside of cover. √ UV disinfection system. √ Control panel. √ Phosphorus removal system. √ Effluent pumps √ Intrinsically safe heaters and lights within treatment plant. √ Flow meter. √ Grating and handrailing within treatment plant. **BUDGET PRICE** **Canadian Funds, F.O.B. Minesite, NWT**	**$ 175,000.00**

Client Ref#: AMEC Earth and Environmental **P.J. HANNAH REF#: K 17550- ITEM 1**

Job Name Tahera Corp. **DATE June 13, 2003**

	DESIGN CRITERIA	SUMMER	WINTER
INFLUENT CONDITIONS	Design Flow m^3/day (avg)	**22.7**	**22.7**
	Design Flow m^3/hr (peak)		
	To be flow balanced to m^3/hr (design)		
	Anticipated Flow m^3/day (avg)		
	Anticipated Flow m^3/ (peak)		
	To be flow balanced to m^3/hr (Anticipated)		
	PH	**Assumed 6.5 to 8.5 all year round**	
	BOD_5 mg/ℓ (total)	**375**	**375**
	SS mg/ℓ (total)	**450**	**450**
	Fats, oils & grease mg/ℓ	**50 (max)**	**50 (max)**
	NH_3-N mg/ℓ		
	T.K.N. mg/ℓ		
	Phosphorous mg/ℓ	**13**	**13**
	Sewage temperature °C	**>12.5**	**> 9**
EFFLUENT REQUIREMENTS (All Average Values)	BOD_5 mg/ℓ (total)	**< 10**	**< 10**
	SS mg/ℓ (total)	**< 10**	**< 10**
Nitrification	NH_3-N mg/ℓ		
Dentrification	NO_3-N mg/ℓ		
	T.K.N. mg/ℓ		
	Total Nitrogen mg/ℓ		
	Phosphorous mg/ℓ	**< 1.0**	**< 1.0**
Disinfection	Fecal Coliform M.P.N./100 mℓ	**< 10 CFU**	**< 10 CFU**
	SOURCE OF WASTEWATER:	**Mine Camp**	

P.J.HANNAH EQUIPMENT SALES CORP.

UNIT #10, 8528-123RD STREET
SURREY, B.C. V3W 3V6
TEL: 604) 591-5999
Toll Free: 1-800 663-6793
FAX: (604) 591-9925
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http://www.pjhannah.com

Unit #9, 151 BRUNEL ROAD
MISSISSAUGA, ONTARIO L4Z 2H6
TEL: (905) 712-0620
Toll Free: 1-800 353-3087
FAX: (905) 890-7813
EMAIL: mail@pjhannah.com
http://www.pjhannah.com

Please reply to above address

ENVIRONMENTAL AND INDUSTRIAL EQUIPMENT MANUFACTURERS AND SUPPLIERS SINCE 1973

NORTH AMERICAN LICENSEE OF KEE PROCESS (FORMERLY KLARGESTER)

Client Ref#: AMEC Earth and Environmental **P.J. HANNAH REF#: K 17550- ITEM 2**

Job Name Tahera Corp. **DATE June 13, 2003**

	DESIGN CRITERIA	SUMMER	WINTER
INFLUENT CONDITIONS	Design Flow m^3/day (avg)	**22.7**	**22.7**
	Design Flow m^3/hr (peak)		
	To be flow balanced to m^3/hr (design)		
	Anticipated Flow m^3/day (avg)		
	Anticipated Flow m^3/ (peak)		
	To be flow balanced to m^3/hr (Anticipated)		
	PH	**Assumed 6.5 to 8.5 all year round**	
	BOD_5 mg/ℓ (total)	**375**	**375**
	SS mg/ℓ (total)	**450**	**450**
	Fats, oils & grease mg/ℓ	**50 (max)**	**50 (max)**
	NH_3-N mg/ℓ		
	T.K.N. mg/ℓ		
	Phosphorous mg/ℓ	**13**	**13**
	Sewage temperature °C	**>12.5**	**> 9**
EFFLUENT REQUIREMENTS (All Average Values)	BOD_5 mg/ℓ (total)	**< 20**	**< 20**
	SS mg/ℓ (total)	**< 20**	**< 20**
Nitrification	NH_3-N mg/ℓ		
Dentrification	NO_3-N mg/ℓ		
	T.K.N. mg/ℓ		
	Total Nitrogen mg/ℓ		
	Phosphorous mg/ℓ	**< 1.0**	**< 1.0**
Disinfection	Fecal Coliform M.P.N./100 mℓ	**< 10 CFU**	**< 10 CFU**
	SOURCE OF WASTEWATER:	**Mine Camp**	

P.J.HANNAH EQUIPMENT SALES CORP.

UNIT #10, 8528-123RD STREET
SURREY, B.C. V3W 3V6
TEL: 604) 591-5999
Toll Free: 1-800 663-6793
FAX: (604) 591-9925
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Please reply to above address

ENVIRONMENTAL AND INDUSTRIAL EQUIPMENT MANUFACTURERS AND SUPPLIERS SINCE 1973

NORTH AMERICAN LICENSEE OF KEE PROCESS (FORMERLY KLARGESTER)

Reference Installations:

North American Palladium – Lac Des Iles, Ontario
Rob Normore – Tel: 807-448-2005, Fax: 807 448 2001, email rnormore@napalladium.com
Darryl Boyd – Environmental Coordinator – Tel: 807-448-2005 ext 16

350 man camp - ~ 95 m^3/day

Hydro Quebec – Various sites through-out Northern Quebec
Yves Barabe – Tel: 514-289-6318

AutoCAD Drawings:

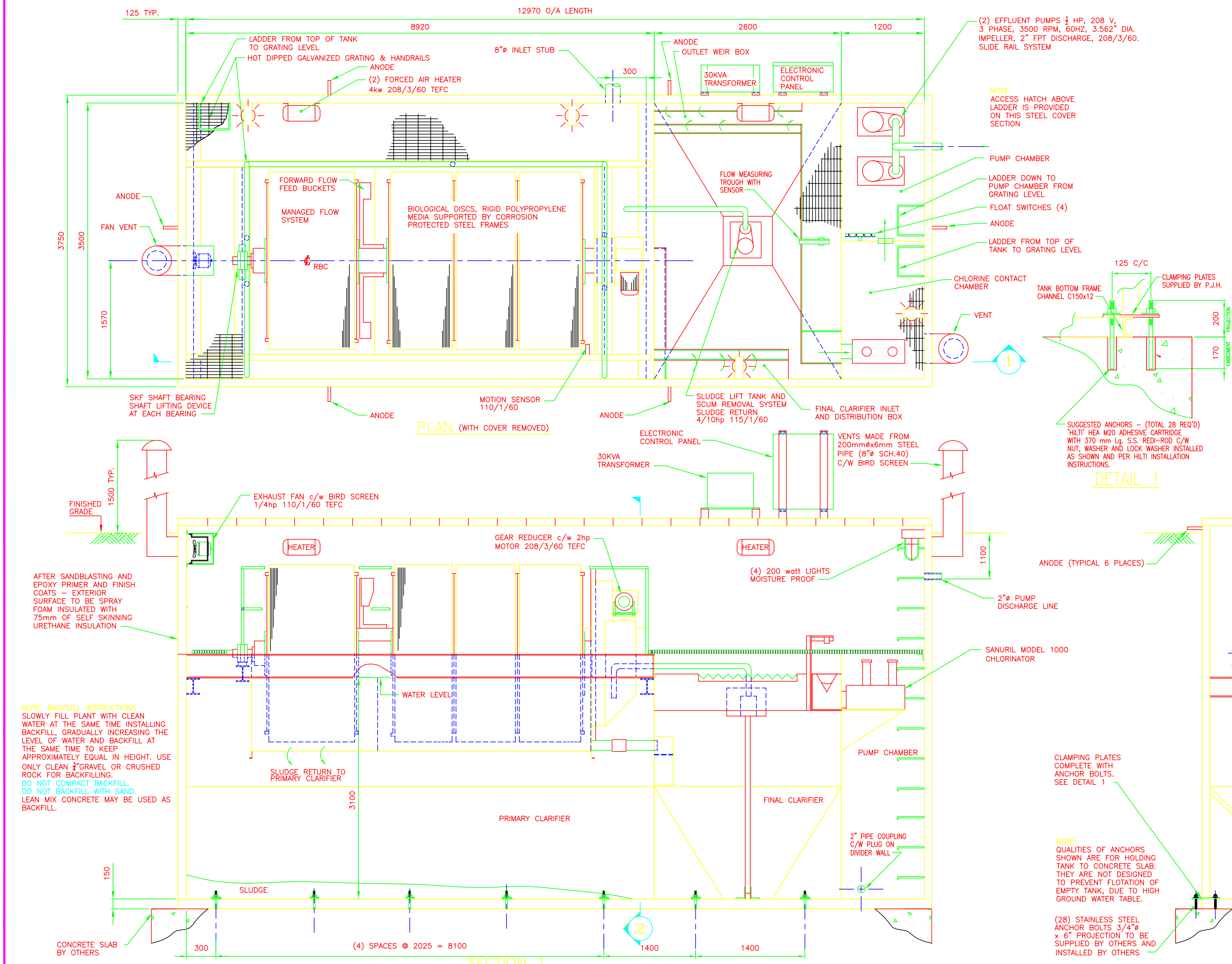
The attached AutoCAD drawing shows the treatment plant we supplied for North American Palladium several years back. While this is a good example of our factory-built packaged camp plants, it is considerably larger than your application (350 men vs. 100 men). At your request, we would be pleased to provide a basic lay-out drawing for a system suitable for your application.

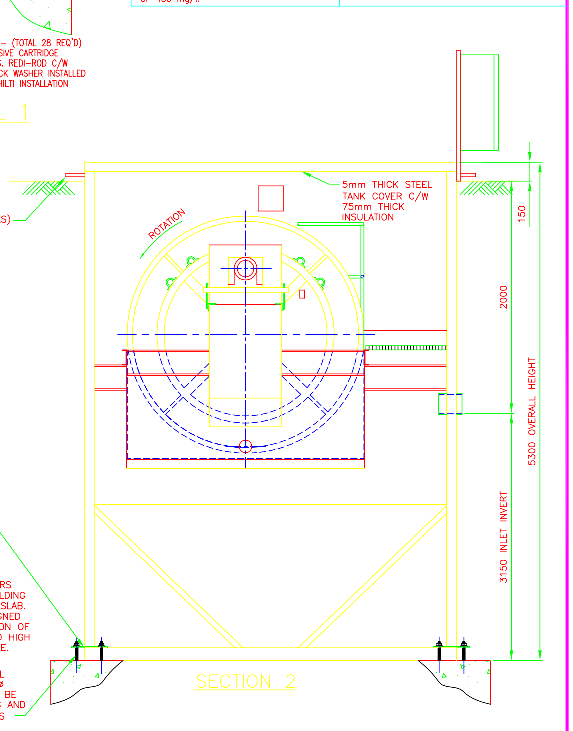
We trust that this is the information that you require at this time. If we may be of further service, please do not hesitate to contact us.

Yours truly,
P.J. Hannah Equipment Sales Corp.

Chris Merritt
Western Sales Manager

/cm





DESIGN CRITERIA	TYPICAL	UNITS	SPECIFICS TO PROJECT
AVERAGE DAILY FLOW		M^3/DAY	95
SOURCE: DOMESTIC SEWAGE			
PEAK FLOW		M^3/HOUR	35
FLOW BALANCED TO		M^3/HOUR	5
INFLUENT BOD TOTAL:		KG/DAY	42.75
INFLUENT BOD SETTLED		KG/DAY	29.93
INFLUENT SUSPENDED SOLIDS		KG/DAY	42.75
EFFLUENT BOD (AVERAGE)		mg/l	≤20
EFFLUENT SUSPENDED SOLIDS (AVERAGE)		mg/l	≤30
FATS, OILS & GREASE		mg/l	50
E. COLI		MPN/100ml	≤14
TEMPERATURE		°C MIN	13
		°C MAX	18
TECHNICAL INFORMATION			
BIO SUPPORTED MEDIA DIAMETER		M	2.35
BIO SUPPORTED MEDIA AREA		M^2	2500
DISC LOADING		g/M^2	13.44
PRIMARY CLARIFIER			
CAPACITY (INCLUDES SLUDGE)		M^3	64.5
BALANCING VOLUME		M^3	–
SLUDGE STORAGE CAPACITY		M^3	19
SLUDGE STORAGE TIME		DAY	44
TIME IS BASED ON SLUDGE PRODUCTION OF .5kg SLUDGE/1.0kg BOD @ 5% SOLIDS.			
FINAL CLARIFIER			
CAPACITY (INCLUDES SLUDGE)		M^3	20
SLUDGE STORAGE CAPACITY		M^3	–
SLUDGE STORAGE TIME		DAY	–
SURFACE AREA		M^2	6.3
CHLORINE CONTACT TANK			
RETENTION TIME		MINUTES	60
CAPACITY		M^3	5
PUMP CHAMBER			
CAPACITY		M^3	5
MINIMUM SIZES AS REQUIRED BY AVERAGE DAILY FLOW AT RAW SEWAGE STRENGTHS OF 450 mg/l.	SHIPPING WEIGHT		20 TONNES
	OPERATING WEIGHT		135 TONNES

PROTECTED BY CANADIAN PATENT #2,097,917, U.S. PATENT #5,407,578 AND OTHER NORTH AMERICAN AND WORLD WIDE PATENTS.
PROTEGER PAR UN BREVET CANADIAN N° 2,097,917 ET PAR D'AUTRES BREVETS NORD AMERICAIN ET INTERNATIONAUX.

THIS REVISED DRAWING SUPERSEDES ALL PREVIOUS ISSUES

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CONSULTANT
PROJECT / PROJET: NORTH AMERICAN PALLADIUM
OUR REF. # / NOTRE RÉF #: K17296
YOUR REF. # / VOTRE RÉF #:

GENERAL ARRANGEMENT
KLARGESTER BIODISC MODEL BSF-18-BFP

DRAWN / DESSINÉE	RP/SDW
DATE	00/06/08
SCALE / LÉCHELLE	NTS
CHECKED / VÉRIFIÉ	
APPROVED / APPROVÉE	
PLOT	1:20

DESCRIPTION	REV.	DATE

PJ HANNAH
EQUIPMENT SALES CORP.
VANCOUVER, TORONTO
Specialists in pollution control since 1973

DRAWING NO. / DÉSSIN. A1-K17296-7868
REV. –

ATTACHMENT 2.5
29 APRIL 2003 FLOCCULANT MEMORANDUM

Memo

To	**Greg Missal**	File No.	**VE51295**
From	**Bruce Ott**	cc	**File**
Tel	**604-473-5315**		
Fax	**604-294-4664**		
Date	**29 April 2003**		
Subject	**Flocculent Testing of Jericho Pilot Tailings**		

3.5 Biophysical Impact Assessment
Water Quality
Diamond Processing
Total Suspended Solids

Flocculent settling tests of Jericho pilot tailings were conducted by Allied Colloids (now CIBA Specialty Chemicals) for Tahera Corporation in 2000. Three test series were conducted for a total of 47 tests. Products tested included Percol E-10, E-156 and E-368. Settling rates ranged as follows:

E-10	20 – 60 m/hour
E-156	26 – 30 m/hour
E-368	23 – 60 m/hour

Tailings tested were final grind and representative of tailings that will be produced by the production plant. Settling times were satisfactory for E-10 and E-368 and these flocculants were chosen for use in the producing plant, pursuant to confirmation during plant commissioning.

Test results are attached.

Tahara-Kb and Cl Pipes

07-Apr-00

5 % (Wt/Wt) Solids as Tested

2.65 :Solids SG

5.23 : Initial % Solids

Dilution Water: 21.8 ml.

500 : Volume of Test Cylinder

Solids: 478.2 ml.

Volume of Dry Solids in: 500 Cylinder = 9.7 cc

Weight of Dry Solids in: 500 Cylinder = 25.8 Gr.

Mixed 3 Time per Addition

Floc in Solution = 0.05 %

Test #	Product One	Dose (ml)	Dose (PPM)	Dose (Gr/T)	Product Two	Dose (ml)	Dose (PPM)	Dose (Gr/T)	5 cm Settle Time	Settle Rate (M/Hr.)	Settle Rate in./Min	3 Min. Density (ml)	3 Min. Density (% Solids)	3 Min. Turbidity (Wedge)	Comments
1	Blank-Kb	0.0	0	0.0			0	0.0	V V Slow	---	---	---	---	---	
2	10	5.0	5	100.0			0	0.0	9	20.00	13.33	40	46.0	38	
3	10	7.5	7.5	150.0			0	0.0	8	22.50	15.00	36	49.6	46	
4	10	10.0	10	200.0			0	0.0	8	22.50	15.00	38	47.7	46+	
5	10	12.5	12.5	250.0			0	0.0	7	25.71	17.14	39	46.9	46++	
6	10	17.5	17.5	350.0			0	0.0	6	30.00	20.00	42	44.4	46+++	
7	10	22.5	22.5	450.0			0	0.0	5	36.00	24.00	46	41.6	46+++	
8	156	5.0	5	100.0			0	0.0	7	25.71	17.14	40	46.0	39	
9	156	7.5	7.5	150.0			0	0.0	6	30.00	20.00	41	45.2	45	
10	156	10.0	10	200.0			0	0.0	6	30.00	20.00	43	43.7	46	
11	156	12.5	12.5	250.0			0	0.0	6	30.00	20.00	45	42.3	46+	
12	156	17.5	17.5	350.0			0	0.0	8	22.50	15.00	46	41.6	46+	
13	156	22.5	22.5	450.0			0	0.0	8	22.50	15.00	47	40.9	46+	
15	Blank Cl	0.0	0	0.0			0	0.0	V V Slow	---	---	---	---	---	
16	10	5.0	5	100.0			0	0.0	4	45.00	30.00	37	48.6	46+	
17	10	7.5	7.5	150.0			0	0.0	5	36.00	24.00	37	48.6	46+	
18	10	10.0	10	200.0			0	0.0	3	60.00	40.00	37	48.6	46+	
19	10	12.5	12.5	250.0			0	0.0	4	45.00	30.00	37	48.6	46++	

Notes: 1)

Tahara-60% Kb Plus 40% Cl Pipes

07-Apr-00

5 % (Wt/Wt) Solids as Tested

2.65 :Solids SG

5.23 : Initial % Solids

Dilution Water: 21.8 ml.

500 : Volume of Test Cylinder

Solids: 478.2 ml.

Volume of Dry Solids in: 500 Cylinder = 9.7 cc

Weight of Dry Solids in: 500 Cylinder = 25.8 Gr.

Mixed 3 Time per Addition

Floc in Solution = 0.05 %

Test #	Product One	Dose (ml)	Dose (PPM)	Dose (Gr/T)	Product Two	Dose (ml)	Dose (PPM)	Dose (Gr/T)	5 cm Settle Time	Settle Rate (M/Hr.)	Settle Rate in./Min	3 Min. Density (ml)	3 Min. Density (% Solids)	3 Min. Turbidity (Wedge)	Comments
1	Blank-Kb	0.0	0	0.0			0	0.0	V V Slow	---	---	---	---	---	
2	10	15.0	15	300.0			0	0.0	9	20.00	13.33	41	45.2	46	
3	10	20.0	20	400.0			0	0.0	7	25.71	17.14	43	43.7	46+	
4	10	25.0	25	500.0			0	0.0	7	25.71	17.14	45	42.3	46+++	
5	10	30.0	30	600.0			0	0.0	6	30.00	20.00	46	41.6	46+++	
7	Blank	0.0	0	0.0	Blank	0.0	0	0.0	V V Slow	---	---	---	---	---	
8	368	10.0	10	200.0	10	12.5	12.5	250.0	8	22.50	15.00	52	37.9	46++	
9	368	10.0	10	200.0	10	17.5	17.5	350.0	7	25.71	17.14	55	36.3	46+++	

Notes: 1)

Tahara-100% Kb Pipes

24-Sep-00

2 % (Wt/Wt) Solids as Tested

2.65 :Solids SG

2.00 : Initial % Solids

Dilution Water: 0.0 ml.

500 : Volume of Test Cylinder

Solids: 500.0 ml.

Mixed 3 Time per Addition

Floc in Solution = 0.05 %

Test #	Product One	Dose (ml)	Dose (PPM)	Dose (Gr/T)	Product Two	Dose (ml)	Dose (PPM)	Dose (Gr/T)	5 cm Settle Time	Settle Rate (M/Hr.)	Settle Rate in./Min	3 Min. Density (ml)	3 Min. Density (% Solids)	Turbidity (Wedge)	Comments
1	Blank	0.0	0	0.0	Blank	0.0	0	0.0	V V Slow	---	---	---	---	---	
2	368	30.0	30	600.0	10	150.0	150	3000.0	6	30.00	20.00	---	---	Dirty	Not enough solids
3	368	40.0	40	800.0	10	150.0	150	3000.0	6	30.00	20.00	---	---	45	to measure density
4	368	50.0	50	1000.0	10	150.0	150	3000.0	7	25.71	17.14	---	---	46+	
5	368	30.0	30	600.0	919	150.0	150	3000.0	6	30.00	20.00	---	---		
6	368	40.0	40	800.0	919	150.0	150	3000.0	6	30.00	20.00	---	---		
7	368	50.0	50	1000.0	919	150.0	150	3000.0	7	25.71	17.14	---	---		
8	368	30.0	30	600.0	156	150.0	150	3000.0	6	30.00	20.00	---	---		
9	368	40.0	40	800.0	156	150.0	150	3000.0	6	30.00	20.00	---	---		
10	368	50.0	50	1000.0	156	150.0	150	3000.0	7	25.71	17.14	---	---		
11	368	30.0	30	600.0	TT-200	150.0	150	3000.0	6	30.00	20.00	---	---		
12	368	40.0	40	800.0	TT-200	150.0	150	3000.0	6	30.00	20.00	---	---		
13	368	50.0	50	1000.0	TT-200	150.0	150	3000.0	7	25.71	17.14	---	---		
14	368	40.0	40	800.0	10	200.0	200	4000.0	5	36.00	24.00	---	---		
15	368	40.0	40	800.0	10	300.0	300	6000.0	3	60.00	40.00	---	---		Clarity improves
16	368	50.0	50	1000.0	10	200.0	200	4000.0	5	36.00	24.00	---	---		and settling slows
17	368	50.0	50	1000.0	10	300.0	300	6000.0	3	60.00	40.00	---	---		with 368
18	368	60.0	60	1200.0	10	200.0	200	4000.0	6	30.00	20.00	---	---		
19	368	60.0	60	1200.0	10	300.0	300	6000.0	4	45.00	30.00	---	---		

Notes: 1)

ATTACHMENT 2.6
LANDFARM DESIGN AND OPERATION

LANDFARMING
Construction and Operation

The attached figure shows a typical landfarm construction for remediation of petroleum-contaminated soils. A system similar to that illustrated has been in operation at EKATI™ since operation of the mine commenced and has worked successfully (EKATI™, pers. comm.).

Landfarming is a form of bioremediation that uses naturally occurring microorganisms (yeast, fungi or bacteria) to metabolize or break down petroleum hydrocarbons. Natural processes include volatilization, aeration, biodegradation and photolysis. End products are microorganism protein, carbon dioxide and water. Stimulation of microbial growth and activity for hydrocarbon removal is accomplished primarily through the addition of air and nutrients (metabolism of hydrocarbons is mediated predominantly through aerobic microbes).

Construction

The area for landfarming will be prepared by removing surface debris, large rocks, and brush. A pad of run-of-mine rock will be laid down, or a part of Waste Rock Dump 1 will be dedicated to a landfarm. Crushed rock and or esker material will be spread over the landfarm pad and leveled. The area will be graded to slope toward a catchment area for runoff. Sand will be laid down and a geomembrane placed on the floor of the landfarm and continued up into a berm completely surrounding the area. More sand will be placed on top of the geomembrane to protect it from damage. A layer of esker material will be placed on top of the sand as a separator from contaminated soil to be placed in the landfarm area. A sump and pump with an oil-water separator may be placed at the low end of the landfarm to deal with runoff, if, based on EKATI™'s experience, this seems a necessary precaution. This will constitute initial construction.

Operation

Agricultural fertilizer will be added to the site to stimulate bacterial growth. High nitrogen fertilizer has been found to be most effective. Fertilizer will be added as needed during the biodegradation process. Soil containing petroleum products will be spread uniformly over the surface of the prepared area. The contaminated soil will be incorporated into the top 15 to 20 cm of the soil, either manually or with a tiller or disc harrow if large quantities of contaminated soil must be treated. Soil will be watered to prevent dust generation and to enhance biodegradation; saturation will be avoided. The same site will be used throughout mine life and after closure, as required. Soil hydrocarbon concentrations will be regularly monitored to ascertain the point where soils are no longer considered contaminated, based on CCME guidelines. EKATI™'s experience will be drawn on to determine monitoring intervals. There are no CCME guidelines for density of soil sampling, but one composite of ten samples per 25 m^3 should adequately characterize the soil's hydrocarbon levels if soils have been well mixed during the decontamination process. Decontaminated soils will then be used for reclamation purposes. Ultimate degradation rates are site-specific and cannot be predicted, although EKATI™'s experience can be used as a guide.

Typical Landfarming Operation