Concerns/Issues/Questions With the Human Health and Ecological Risk Assessment, July 31, 2009 By Wendy Bracken

Please find below a number of concerns, issues, and questions I have identified with the Human Health and Ecological Risk Assessment Technical Study Report by Jacques Whitford and released July 31, 2009.

Please note the issues and concerns are not ordered according to importance.

Issues With The Assessment Scenarios

The Assessment Scenarios are defined on in Section 3.4 (pages 33-45) of the Executive Summary of the Human Health and Ecological Risk Assessment Technical Study Report (HHERA).

Concerns with the Assessment Scenarios are as follows:

- **It appears there is no scenario to evaluate the emissions from the Facility operating at upset conditions in combination with existing baseline conditions *and* existing traffic emissions**; it states that the "upset conditions were evaluated in combination with existing/baseline conditions", but it does NOT state that the Process Upset Project Case would include all of the emissions assessed in the Traffic Case; **emissions from all offsite and onsite traffic, both Facility-related and non-Facility related, will in reality be present when the Facility is operating under upset conditions and therefore must be included in the Process Upset Project Case scenario**; Presently it appears there is no Assessment Scenario in the HHERA to address this important scenario;

- The Traffic Case as stated is unclear to me; on page 34 it states that the Traffic Case "involved the assessment of emissions from offsite and onsite traffic associated with the Facility and baseline traffic conditions in combination with onsite stationary source emissions for the Facility"; The preceding statement motivates the question: **Does the Traffic Case include only baseline *traffic* emissions or does it include the baseline concentrations from all emissions sources?** Furthermore, a later statement seems to define the Traffic Case and what it includes differently. On page 42 it states that "Maximum GLC predictions from the CAL3QHCR model for offsite vehicle traffic were conservatively combined with the maximum GLC predictions for the Facility air emissions and measured background concentrations."; **Is there a scenario to appropriately reflect the normal operating reality which would include *all* potential onsite and offsite emissions? This scenario would have to include all Facility related emissions plus modelled traffic emissions (for both Facility-related and non-Facility related sources) plus existing baseline conditions which include emissions from other community and industrial sources.**

- While the Future and Existing Conditions Case assesses the Facility emissions in combination with future or existing sources of air emissions it does so only QUALITATIVELY. There is, however, a quantitative assessment giving estimates for the expected emissions from the Highway 407 expansion and link in Table 4-9, on page 71 of the Air Quality Assessment Technical Study Report (Jacques Whitford, July 31, 2009). The 407 Environmental Assessment is very far along and the proposed link is very close to the proposed site (it is stated on page 69 that the proposed link terminates approximately one kilometre northeast of the Project Site). The aforementioned Table 4-9 shows that the Highway 407 expansion will contribute very significant amounts of carbon monoxide (CO), nitrogen oxides (NOX), Particulate Matter, PM10 and PM2.5, and Volatile Organic Compounds (VOC) to the area. . Why did the Project Team, knowing that NO2 and PM2.5 were chemicals of elevated concern in this study, decide NOT to include a quantitative assessment for the 407 link project in the HHERA? The HHERA results show that NO2 and PM2.5 levels are at very concerning levels with regards to public health and exceedances of benchmarks are reported for both chemicals in the HHERA. Considering the results of the HHERA and understanding the public health concern regarding NO2 and PM2.5, to be protective of human health it would only be prudent to evaluate and include these estimates for the 407 impact into the HHERA and perform a QUANTITATIVE analysis for this scenario. The present qualitative assessment is not adequate to address public health concerns for these chemicals of serious concern.

Concerns With the Executive Summary

- With regards to the Inhalation Assessment at 140 000 Tonnes/Year, on page vi of the Executive Summary it states that the results indicate that no acute or chronic exposures at the maximum ground level concentration exceed the regulatory benchmark; Question: Did any of the results for the Maximum Predicted Concentrations at Special Receptors at 140 000 tonnes/year exceed any benchmarks? Is it acceptable to use the maximum ground level concentrations (where some of the data was removed before analysis) instead of the maximum predicted concentration at special receptors?

- On page vii it is noted that for the Inhalation Assessment at 400 000 tonnes/year, **one exceedance resulted for Hydrogen Chloride modeled at the Commercial/Industrial receptor for the Process Upset Case**, with a CR = 1.0. The Assessment did not report for the Process Upset Project Case because there were no baseline measurements for HCl provided in this Study and HCl is not reported as a COPC measured at the Courtice Monitoring Station. Again, with results showing that HCl is **a chemical of concern triggering risk, why did the Project Team decide against baseline monitoring of HCl? Without it we do not know the cumulative effect of facility and baseline and that is especially**

concerning since the Facility alone results in an exceedance? Does the MOE find this acceptable?

- Re: Human Health Multi-Pathway Assessment – **The Project Team makes a very broad statement regarding the baseline assessment**, stating on page vii that "***The only exceedances of regulatory benchmarks were from existing conditions in the Baseline Case. It is very important to note that the baseline chemical concentrations in environmental media sampled in the Clarington 01 area were determined to be no different than those that would be found anywhere else in southern Ontario. Therefore, these modelled potential baseline chemical risks would also be the same for anywhere else in Ontario***."; Is this statement true? Where is the data to support this statement? Did the Project Team do a comparative analysis of baseline conditions between Clarington and other locations covering all of Ontario? Furthermore, should the public and government not be concerned that the baseline conditions already show exceedances of benchmarks? Is it acceptable to add to a baseline already in exceedance with the significant emissions from an incinerator? Is the above statement made by the Project Team an attempt to diminish the importance of finding baseline exceedances?

- Furthermore the report states on page vii that:
  These Baseline Case modelled risks can be largely attributed to two sources of uncertainty in the risk assessment process, namely:
  - *the use of laboratory method detection limits as environmental media concentrations,*
  - *conservative receptor characteristics used to represent toddler receptor consumption patterns of homegrown produce and agricultural products,*
  - *conservative nature of risk assessment exposure calculations that lead to an overestimation of potential risk to humans.*

  Does the MOE agree with these comments about the baseline modelled risks?

Concerns with The Exclusion of Some COPC in The HHERA

It is stated in Section 4.3, page 54 that **ozone was not assessed as a COPC in the HHERA**. The authors state that "annual average project NO2 and VOC emissions are small relative to other sources of emissions" and that "current baseline ozone concentrations are generally high and indicate that ozone is a regional, rather than a local air quality issue" as part of their rationale for excluding ozone as a COPC. This logic seems very flawed and contrary to the approach that would be best to protect human health when ambient levels are already high. When there is knowledge of present over burden, would it not be prudent and indeed necessary to quantitatively estimate the health and environmental effects of adding additional amounts of ozone precursors to the air shed? Instead the authors use the evidence of already high levels of ozone as reason to dismiss the need to assess for it in the HHERA. The facility will emit significant amounts of the ozone precursors NO_2 (151 tonnes per year in the 140000 tpy scenario

and 428 tonnes per year in the 400000 tpy scenario under normal operating conditions) and VOCs (61.2 tonnes per year in the 140000 tpy case and 173.3 tonnes per year in the 400000 tpy case). Is the MOE in agreement with exclusion of ozone from the HHERA?

On page 53 of Section 4.2.2 it is stated that it is likely that acrolein will be emitted from the Facility, but, since the Air Quality Team was unable to locate any emission factors for acrolein and acrolein was excluded from the COPC list.

Another chemical, 1,3-butadiene, was identified as a COPC in the Air Quality Assessment, but was excluded from the COPC list for the HHERA. Again, it is stated that "no credible sources of emissions data for this contaminant were found". Section 4.4, found on page 54, states that dioxin-like congeners, which recent research indicates can be present in incinerator emissions, are NOT included in the emissions estimates and therefore are not assessed in the HHERA. These PCB congeners have dioxin-like properties and it is concerning that they were not assessed.

In summary, it is concerning that, despite knowledge that these compounds are emitted from incinerators, no emissions data is available from vendors, operators and the industry in general which again points to the problem of inadequate monitoring of a large number of compounds emitted by incinerators. Is it acceptable to the MOE to exclude these chemicals from the HHERA?

Concerns With The Small Sample Sizes of Environmental Media Collected to Determine Baseline Concentrations

Section 5.1 on pages 57 gives the following details regarding the number of samples taken for the various environmental media.

- 23 soil samples collected from 17 sampling locations
- 11 samples taken from 10 locations; all analyzed for metals, 5 analyzed for other chemicals
- 11 browse samples collected from10 locations
- 11 small mammal samples were collected from 5 sampling locations
- 6 surface water samples were collected from 5 sampling locations
- 4 sediment samples were collected from 4 sampling locations
- 6 fish samples were collected from 3 sampling locations
- 28 produce samples were collected from various locations from outside a 1 km radius of the site
- 5 crop samples were collected from 4 sampling locations within 1 km of the site
- 10 agricultural samples were taken from various location within the Study Area, but outside the 1 km radius

Note particularly the small number of samples collected for sediment, fish, crop and surface water. It is very concerning that this small set of samples were used to predict baseline concentrations which in turn become important inputs to the HHERA models.

That such an important, extensive and expensive study has used such small sample sizes to assess the baseline foundation is extremely concerning.

It is stated that the soil, terrestrial vegetation (forage, browse, and crops), small mammals, surface water, sediment and fish were sampled within a 1 km radius of the site. Is a sampling area of 1 km radius large enough? Are there MOE criteria or other standards for the radius?

With respect to agricultural produce and garden produce, it states that only one sample of garden produce was taken from the backyard of residents within the area surrounding the Site and the rest was obtained from local farmers' fields and markets where "general inquiries were made to confirm that the produce acquired had been grown locally". How was "local" defined in the inquiries, can these samples be traced to a locations within the study area and did anyone sign off where it was actually grown?

In the Draft HHERA which was released on June 12, 2009 (it is important to note that it was the document which the Durham Regional Council voted to accept on June 24 to send to MOE), the report authors chose to use the 95% Upper Confidence Limit of the Mean (95% UCLM) to determine contaminant concentration. In the MOE Peer Review dated June 25, 2009, of the Draft HHERA which is contained in Appendix P-4, the MOE expressed the concerns that "Although statistically valid, the use of the 95% UCLM for small numbers of samples creates inconsistency and uncertainty. The proponent should use the maximum concentration in all cases to avoid inconsistencies and reduce uncertainty, or the Method of Detection Limit (MDL) for non-detectable samples." The Final HHERA appears to have been partially revised according to MOE comments, however on page 60, it is stated that the 95% UCLM was still used for the soil samples and for inorganics in small mammals. Is this acceptable to the MOE? Even with the MOE suggested adjustments to the statistical analysis, are the samples sizes simply too small to perform meaningful and valid statistical analysis? Can an acceptable estimation of the true baseline concentrations be done with such small samples?

Adjustments made incorporating some of the MOE comments from the MOE June 25 peer review resulted in very significant changes to the baseline concentrations reported in the Final report released on July 31, 2009. The percent changes are shown in a table in Appendix B. The percent changes pre and post-MOE comments were dramatic which reflects how sensitive and potentially inaccurate the results can be when such small samples are taken.

Concerns With the Inhalation Assessment Results, Selection of TRVs/Benchmarks and Characterization of Risk

The results of the inhalation assessment demonstrate high levels of PM2.5 and NO2 for a number of assessment scenarios. Inhalation risk estimates, expressed as Concentration Ration (CR) values were shown to be high for these COPC in a number of scenarios. The CR values depend upon the selection of the toxicity reference values or health based

benchmark which the predicted ground level air concentrations are measured against (ie. predicted air concentration divided by TRV or health benchmark yields the Concentration Ratio (CR)). The selection of the most appropriate TRV/health benchmark is therefore critical to the characterization/assessment of risk. (page 163)

Section 7.6 on page 139 gives a summary of the TRVs and Inhalation benchmarks selected for Criteria Air Contaminants in the study. Some values from that table are shown below. Note that the values shown in the Value column is measured in micrograms per cubic metre.

CAC	Duration	Value	Critical Effect	Reference	Source
NO2	1-hour	400	Respiratory irritation	Benchmark	MOE AAQC, 2008b
NO2	24-hour	200	Respiratory irritation	Benchmark	MOE AAQC, 2008b
NO2	Annual Average	60	Health-based	Benchmark	Health Canada, 2006
PM2.5	24-hour	30	Health-based	Benchmark	CCME, 2006b

Question – Why were no TRVs/ Health Benchmarks presented for 1-hour and Annual PM2.5? PM2.5 is obviously a CAC of great concern given the results of this study, so it would be very useful and important to have annual and 1-hour results for PM2.5.

The choice of these benchmarks in the report has been criticized by peer reviewers. This is a VERY SIGNIFICANT concern since NO2 and PM2.5 levels are high and there are many cases where using the benchmarks chosen by the risk assessment team do not show CR values greater that 1 indicating health risk (estimated exposure is greater than the exposure limit), however evaluation against World Health Organization (WHO) benchmarks does result in health risks identified (CR values greater than 1).

In Attachment 14 of Municipality of Clarington Report PSD-071-09, Clarington peer reviewers of SENES state the following in their Comment 50:

> *"Not all of the values presented in the table as TRVs are actually TRVs. For example, the reliance on air guidelines as sources of TRVs may not be appropriate. Air guidelines may not be based on health effects and thus concentration ratios obtained using these values would not be considered valid. The values used to assess health risks in the HHRA must all be actual TRVs."*

In Comment 17 of the MOE Peer Review in Appendix P-4, the peer reviewer(s) state:

> *"SDB does not recommend the automatic use of air standards of AAQC to screen or characterize inhalation risks (Table 7-2). By definition, HQ are based on comparison of estimated exposure with TRVs (RfCs, REL,etc). AAQC or air standards are not necessarily TRVs and on an individual basis may not be health protective – for example, new science may have emerged since they were set. Appropriate TRVs should be used."*

The disposition of the Jacques Whitford Health Study Team in response to the above comment (which is also included in Appendix P-4) states in part: "The study team believes that using these health benchmarks does not compromise the integrity of the HHERA results."

I firmly believe the use of these health benchmarks may seriously compromise the integrity of the HHERA results because 1) the benchmarks chosen by the study team are not stringent enough and 2) the use of these benchmarks strongly affects the conclusions reported on one of the major public health concerns - air quality and inhalation risks. The study team's choice of AAQC and air standard benchmarks resulted in written conclusions which gave readers of the report the impression that there are no problems, however when the more stringent WHO benchmarks are used, the CR values do indicate the exposure estimate exceeds the exposure limit in some scenarios and the potential for adverse health effects may exist. **These are two completely different conclusions so the choice of appropriate TRVs is absolutely fundamental to what the health study concluded and what was presented as study results to decision makers (Regional committees and Regional Councils), to the public and to MOE.** How old are the AAQC and air standards chosen by the Project Team? What studies were they based on and when were they done? I firmly believe the high PM2.5 concentrations and NO2 concentrations in some scenarios for some of the averaging periods were not highlighted in presentations or in Executive Summaries to the public and to the political decision makers.

The Special Concern of PM2.5 and the Selection of TRVs to Protect Human Health

The Clarington peer reviewers (SENES) also stated in Comment 53:

> *"The values for particulate matter PM10 and PM2.5 do not reflect the current science on particulate matter. The National Ambient Air Quality Objective for Particulate Matter has reference values for health based values of 15 µg/m^3 for 24-h PM2.5 and 25 µg/m^3 for 24-h PM10. In addition the California Air Resources Board (2008) provides a summary for the latest research on PM2.5. It should be noted that in some cases scientists think there is no threshold that is safe for exposure to PM2.5 and others think ranges from 3 µg/m^3 to 7 µg/m^3 are protective of health for PM2.5. The discussion in Appendix H is inadequate as it does not reflect the latest literature on particulate matter."*

The same Clarington peer reviewers were not satisfied with the disposition the study team provided in response to their comments. The study team indicated that the PM2.5 values were been updated with the WHO criteria. The Clarington reviewers did not accept the disposition of the study team stating:

> *"This is inadequate and as discussed in the original comment a proper discussion on the science relating to PM2.5 is requested. The WHO criteria are not protective of health and the WHO in their document indicate a level of 3 to 5 $\mu g/m^3$ where health effects have been observed. All of this should be discusssed and an appropriate value selected."*

Baseline Case

In Section 7.9.1.1 on page 170 the study team concludes in the report: "CR risk estimates do not exceed the regulatory benchmark therefore no adverse health risk is expected from exposure to baseline air concentrations of CACs". The study team makes no mention that when CR values are calculated using WHO benchmarks, values close to 1 result for the following CACs: Maximum Concentration Ratio Values Using Baseline Ground Level Air Concentrations , Table 7-10 p. 170

Using WHO Benchmarks:	Annual NO2 -	CR = 0.93
	24-hour PM2.5	CR = 0.82
	Annual PM2.5	CR = 0.98

Baseline Traffic Case

(Table 7-11, p. 171 – Maximum CR Values using Baseline Traffic Case Air Concentrations CACs)

Using WHO Benchmarks:	**Annual NO2**	**CR = 1.2**
	Annual PM2.5	CR = 0.99

They conclude "CR risk estimates do not exceed the regulatory benchmark therefore no adverse health risk is expected from exposure to baseline air concentrations of CACs including the effect of local vehicular traffic." However, if WHO benchmarks are used there *is* potential adverse health effect for annual NO2 concentrations.
The consultants also state "The exceedance of annual nitrogen dioxide was not unexpected as any urban area in Ontario would produce similar results. WHO benchmarks are not necessarily health-based"
Question: Where is the data to support the statement that *any* urban area would have the same results? Are the WHO benchmarks more up-to-date and/or more protective of human health than the ones used by the Study Team? How old are the AAQC and air standards the Study Team chose?

In my opinion, the Baseline Case results show that NO2 is a public health concern at the site with baseline annual NO2 and PM2.5 concentrations already very high. When traffic emissions are added in the Baseline Traffic Case, and assessed using WHO benchmarks, the concentrations are increased to the point where potential adverse health effects may occur.

Baseline Case – Inhalation Assessment Chemical Mixtures

Table 7-13 , page 174 Maximum Concentration Ratio (CR) and Lifetime Cancer Risk (LCR) Values using Baseline Ground Level Air Concentrations for Chemical Mixtures

Acute 24-Hour Respiratory Irritants	CR = 1.1
Annual Respiratory Irritants	CR = 0.94

Note these values would have been higher for the Baseline Traffic Case but they were not given.

The report states: "It should also be noted that these Baseline Case results would be expected for any community in Southern Ontario." Where is the supporting data for this statement?

The report also states: "To date, there have been limited to no mixture additive toxicology studies using this approach in human health risk assessment. This is a considerable source of uncertainty in any risk assessment being conducted in Ontario." P. 174

Inhalation Assessment Results For Facility Size 140 000 Tonnes/Year

Large increases in the concentration ratio are predicted for many of the criteria air contaminants under the inhalation risk assessment.

The following high CR Values are highlighted below. These values are taken from Table 7-21- **Concentration Ratio (CR) Values at 140,000 tpy for Criteria Air Contaminants at the Maximum Ground Level Concentrations**

Process Upset Project Case

Using WHO Benchmarks:	**24-hour PM2.5**	**CR = 1.03**
	Annual PM2.5	CR = 0.98
	Annual NO2	CR = 0.93

When the emissions for a 140 000 tpy Facility are assessed using WHO benchmarks, in, the result show potential adverse health effect (CR>1) for the Process Upset Project Case.

Table 7-22 **Concentration Ratio (CR) Values at 140,000 tpy for Criteria Air Contaminants at the Maximum Ground Level Concentrations**

Traffic Case

Using WHO Benchmarks:	1-hour NO2	CR =0.97
	Annual NO2	**CR =1.2**
	Annual PM2.5	CR = 0.99

In Section 7.11.1.2 , page 200, it is stated "The exceedance of nitrogen dioxide is driven by baseline concentrations, and was not unexpected, as any urban area in Ontario would produce similar results". Where is the proof of the latter part of that statement? These comments make no statement about the public health concern of adding more NO2 to an already burdened air shed, and, in my opinion, have the effect of trying to minimize the NO2 problem. There is no mention of the high CR values for annual PM2.5 and acute 1-hour NO2 when calculated using the WHO benchmarks.

Table 7-24 **Concentration Ratio (CR) Values at 140,000 tpy for Chemical Mixtures at the Maximum Ground Level Concentrations**

1-Hour Respiratory Irritants	Process upset case	CR = 1.5
1-Hour Respiratory Irritants	Process upset Project case	CR = 1.9
24-Hour Respiratory Irritants	Process upset Project Case	CR = 1.9
24-Hour Neurological Effects	Process Upset Project Case	CR = 0.55
Annual Respiratory Irritants		CR = 0.95

Results – Inhalation Assessment - Facility Size 400 000 Tonnes/Year

Table 7-53- **Concentration Ratio (CR) Values for Criteria Air Contaminants at the Maximum Ground Level Concentration at 400,000 tpy**

Process Upset Project Case

Using WHO Benchmarks:	**1-hour NO2**	**CR =1.03**
	24-hour PM2.5	**CR = 1.1**
	Annual NO2	CR = 0.94
	Annual PM2.5	**CR = 0.99**

Process Upset Case (modelled at the Commercial/Industrial Receptor)

Using Study Team Benchmarks	**1-hour HCl**	**CR = 1.0**

Note that the 400,000 tpy scenario under normal operating conditions sees more than a doubling in the NO2 maximum ground level concentration (1 hour average) concentration ratio from the baseline. The upset scenario predicts more than a

tripling of the NO2 from the baseline and sulphur dioxide and PM also increase significantly.

Note that the HCl exceedance occurs for the Process Upset case where no baseline HCl concentrations were included. No baseline concentrations were provided for HCL in the HHERA. Why were they excluded and why was no baseline monitoring of HCl performed? We do not know how inclusion of baseline concentrations of HCl would affect the assessment. **Is it acceptable to the MOE that HCl baseline concentrations are absent given that HCl is a contaminant with this potential health risk identified using the Facility HCl emisssions alone?**

Table 7-54- **Concentration Ratio (CR) Values for Criteria Air Contaminants at the Maximum Ground Level Concentration at 400,000 tpy**

Traffic Case		
Using WHO Benchmarks:	**1-hour NO2**	**CR =1.3**
	24-hour PM2.5	CR = 0.90
	Annual NO2	**CR = 1.2**
	Annual PM2.5	CR = 0.99

Also note the following CRs for the Process Upset Project Case (where the Study Team's TRVs are used)

1-hour Lead	CR = 0.21
1-hour Cadmium	CR = 0.44
1-hour Formaldehyde	CR = 0.57

Table 7-56 Concentration Ratio (CR) Values at 400,000 tpy for Chemical Mixtures at the Maximum Ground Level Concentration

1-Hour Respiratory Irritants	Process upset case	CR = 2.6
1-Hour Respiratory Irritants	Process upset Project case	CR = 3.0
24-Hour Respiratory Irritants	Process upset Project Case	CR = 2.2
24-Hour Neurological Effects	Process Upset Project Case	CR = 0.55
Annual Respiratory Irritants	Process Upset Project Case	CR = 0.97

Question Regarding Alternative Methods

Section 7.8.1 states that: "The most commonly used risk assessment approaches are the National Illness Costs of Air Pollution (ICAP) model released by the Canadian Medical Association and the Air Quality Benefits Assessment Tool (AQBAT) released by the federal government". They are not used in this RA and the Study Team gives an explanation for this. Is the MOE satisfied with the rationale provided for not using these models?

Questions/ Concerns/Issues With The Multi-Pathway Assessment

In Section 6.0 on page 64 it states that "elemental mercury (Hg^0) is assessed for direct inhalation exposure but it is not included in possible food chain uptakes as it does not bio-accumulate; note, Hg^0 is not considered a COPC in this assessment."
Question: Does the MOE approve of this?
Also, is it acceptable that there were NO Background Concentrations reported for mercury? (Table 3-10, page 36) Mercury emissions from incinerators are a major concern. Why did the Study Team choose not to do ambient measurements for mercury at the Courtice Monitoring Station? Cumulative effects of baseline + facility related emissions are now impossible to determine. Will the MOE accept nothing reported for background mercury concentrations?

Section 6.2 – Soil Exposure Point Concentrations (page 74)

Note it is stated on page 74-75 that "For inorganic COPC (metals), it is assumed that soil losses due to abiotic degradation and volatilization are zero as these elements are neither biodegradable, nor volatile". This statement acknowledges that the metal emissions are of critical concern to public health as the metals persist in the environment.

High Soil Loading Predictions for Dioxins/Furans and Mercury

On page 75, it states "A dioxin/furan soil loading of 20 and 57% for the normal operation and process upset scenarios respectively was observed, as well as a 4.6 and 6.7% loading for inorganic mercury**". A dioxin/furan predicted soil loading of 20 and 57% is very high** and it is not clear if those values for the 140,000 tpy or 400,000 tpy scenario.

Question: The inorganic mercury soil loading values of 4.6 and 6.7% are for the 140,000 tpy size, but go up to 12 and 18% for the 400,000 tpy size – why were those values not highlighted as well? **In my opinion, these results clearly demonstrate that mercury soil loading from the incinerator emissions is very significant.**

When one looks at Table 6-1 on page 76, however, the dioxin/furan % soil loading values are different than those stated on page 75, which show soil loadings of 2.6 and 7.3% for the 140,000 tpy operating scenario and 8.1 and 12% for the 400,000 tpy. Is this an error? If not, please explain. What are the correct values? In either case, it is my opinion that **these predicted % loadings of dioxins and furans to the soil are very significant and should be carefully considered by the MOE**.

Concerns with Surface Water Exposure Point Concentrations Results

The figures below are taken from:

Table 6-2 Predicted Surface Water Loading as a Result of Normal and Process Upset Operation over a 30 Year Period for 140,000 tpy and 400,000 tpy

	140,000tpy		400,000tpy	
COPC	Normal % Loading	Process Upset % Loading	Normal % Loading	Process Upset % Loading
Cadmium	**9.3%**	**13%**	**25%**	**36%**
Cobalt	1.6%	2.3%	4.2%	6.0%
Lead	**3.1%**	**4.5%**	**8.2%**	**12%**
Nickel	1.9%	2.8%	5.2%	7.5%
Silver	**4.5%**	**6.6%**	**12%**	**18%**
Thallium	**17%**	**25%**	**46%**	**67%**
Tin	1.8%	2.6%	4.8%	7%

The above results show significant heavy metal loading to the surface water.

It is noted that the Pentachlorophenol numbers in Table 6-2 are very different than what was given in the Draft June 12th HHERA with %Loading values changing dramatically (from 367% loading to 2.6%, etc.) Where is the explanation for these huge changes?

Concerns with Predicted Sediment Loading of Heavy Metals and Dioxins/Furans

The figures below are taken from:

Table 6-3 Predicted Sediment Loading as a Result of Normal and Process Upset Operation over a 30 Year Period for 140,000 tpy and 400,000 tpy

	140,000tpy		400,000tpy	
COPC	Normal % Loading	Process Upset % Loading	Normal % Loading	Process Upset % Loading
Aroclor (PCB)	1.5%	4.3%	4.3%	12%
Dioxins/Furans	**33%**	**92%**	**101%**	**146%**

Mercury-Inorganic	**54%**	**78%**	**132%**	**192%**
Pentachlorobenzene	1.6%	4.6%	4.6%	13%

The predicted % Loading of DIOXINS/FURANS and INORGANIC MERCURY to sediments for are VERY SIGNIFICANT and CONCERNING. I believe they indicate that the facility emissions over the next 30 years will almost double the mercury that has previously accumulated in sediments over all time and will increase the present dioxin/furan sediment burden by one and a half times. I believe the results above serve as evidence that incinerator emissions are a very significant source of heavy metals, dioxins/furans and PCBs. Once again, the written summary on page 79 fails to bring attention to these very high values adequately. This is a public consultation/transparency issue. Once again, results that indicate potential health concerns with facility emissions are not highlighted with enough quantitative details to be understood clearly by the reader. The public should not have to go through detailed tables to determine the major findings. A table like the one I created above could have been provided to detail concerns. These findings were also not highlighted to the political decision makers.

Note also that again predicted %Loading values for CMAs have changed dramatically from the June 12, 2009 report (for example Pentachlorophenol % loading has changed from 220% to 1.6%). What is the explanation for this? Was an error made, and if so, why was the error not caught when the values stood out so much (high) in the June 12th table?

Tables 6-4 to 6-15 show Predicted Loading to various environmental media from the Facility (both sizes) over the next 30 years and again, significant % Loading is predicted to the various media for certain heavy metals (lead, mercury, cadmium, thallium and others), dioxins/furans and PCBs. All tables should be reviewed very carefully by the MOE. I draw particular attention to the table for predicted loading to fish.

Concerns with Predicted Fish Loading

The figures below are taken from:

Table 6-9 Predicted Fish Loading as a Result of Normal and Process Upset Operation over a 30 Year Period for 140,000 tpy and 400,000 tpy

	140,000tpy		400,000tpy	
COPC	Normal % Loading	Process Upset % Loading	Normal % Loading	Process Upset % Loading
Aroclor (PCBs)	1.2%	3.5%	3.2%	9.1%

Dioxins/Furans	1.4%	3.8%	3.6%	5.5%
Mercury-Inorganic	**0%**	**0%**	**-**	**-**
Methyl Mercury	**-**	**-**	**-**	**-**
Cadmium	**52%**	**75%**	**138%**	**200%**
Cobalt	2.8%	4.0%	7.4%	11%
Lead	**4.6%**	**6.7%**	**12%**	**18%**
Nickel	**3.8%**	**5.5%**	**10%**	**15%**
Silver	**4.0%**	**5.8%**	**11%**	**16%**
Tin	**108%**	**157%**	**289%**	**419%**

The heavy metal loading to fish by facility emissions is extremely concerning – note especially the very high % Loading for cadmium, lead, and tin. IT IS ALSO VERY CONCERNING THAT THERE ARE NO (OR ZERO) %LOADING VALUES FOR INORGANIC MERCURY AND METHYL MERCURY**.** What are the reasons for this and does the MOE approve?

Once again, the summary provided in the last paragraph on page 94 is completely inadequate and does not highlight key results or identify the magnitude of the %Loading concerns for certain chemicals in any way. This is a public consultation and transparency issue and, in my opinion, the repeated failure to highlight was an important factor in the political decisions that were made.

Multi-Pathway Risk Assessment Model Developed by Study Team

It is stated on page 133 that "Exposure estimation in the HHRA was facilitated through the use of an integrated multi-pathway environment risk assessment model developed by the Study Team. The model is spreadsheet based (Microsoft Excel^{TM}) with a number of more advanced add-ons or features."

Questions: Is it standard practice to use a model developed by the consultants involved or is it more common to use approved, well recognized and/or tested models available to risk assessors? Did the MOE peer reviewers thoroughly check the equations and all aspects of the model used by the Study Team? Did the peer reviewers, Dr. Smith and her associate, thoroughly check all aspects of the model used? I was present for the short presentation given by Dr. Smith and her associate to Regional Council on June 16th, 2009

and my impression was that there review was somewhat general. It was not clear if all of the equations and inputs were checked. Did any other peer reviewers check the model? I urge the MOE to be very thorough in their review of the model as it is new and not a previously used and tested model and errors on inputs, assumptions, equations, and calculations may have been made. Will MOE completely review all aspects of the model?

Concerns With Assessment of Fine and Ultrafine Particulate Matter

Section 7.4.3.1 acknowledges that "Fine and ultrafine particulate matter have the potential to cause adverse health effects due to their small size, high surface area, and their ability to reach the alveoli and penetrate the deepest part of the lung structure … Due to their small size these particles also tend to be present in greater numbers, and they possess a greater total surface area than larger particles of the same mass. As a result, ultrafine particles have the capacity to produce potential serious respiratory and cardiovascular complications."

At the end of this section the consultants state "The Air Quality modeling predicts both particulate phase and vapour phase concentrations of COPC from the stack of the Facility. For some COPC they are emitted as both a vapour (gas) and a particulate. By accounting for both phases of emissions the Study Team has captured the ultrafine (nanoparticle) phase of emissions; however, it is recognized that this is a source of uncertainty in the HHRA".

I firmly believe that this Risk Assessment does not and cannot adequately assess for the health risk of the ultrafine particulates/toxic nanoparticulates. Incinerators produce large quantities of fine and ultrafine particulate and incineration also produces many toxins which can adhere to the surface of those particles which, due to their small size are capable of ferrying these toxins into virtually any organ and tissue. Nanopathology is an emerging science and the study of the effects of these toxic nanoparticulates is ongoing. As the science has progressed, the risk has heightened. This could be one of the most key health threats of incineration and it is not understood and not adequately assessed for. It should have been highlighted as a major risk to this undertaking, but I do not feel that it was by the Project Team. It was the citizens who continued to bring this issue forward. Mass is not the best indicator of risk since these particles are so small mass does not necessarily reflect the great numbers of nanoparticulates. Alexandra Bennett did a number of delegations to Regional Council and Committees regarding various research around the world on nanoparticles and made them aware of the work of various scientists, Dr. Gatti of Europe, the paper by Cormier et al., etc. They should be included in the public record and I hope the MOE will review this material thoroughly. It is my understanding that in Ontario we do not have monitors for the ultrafine particulates so it is not possible to monitor them. In June 2008, doctors' organizations from Europe around the world (representing 33 000 doctors and scientists) sent letters to the European parliament expressing their concerns regarding incineration and made a special point of expressing concern about the ultrafine particulate matter and that it was not monitored in

Europe. Dr. Lesbia Smith acknowledged in her August 2007 report on the generic risk assessment that "Ultrafine particulate and nanoparticle exposure were not considered as there are currently no risk assessment methods to do so nor measurement technology in place to monitor." The Project Team then cannot properly assess this risk. This alone compromises the integrity of the HHRA in my opinion. I urge the MOE to review the current research on particulate matter and give opinion on whether the issues of fine and ultrafine particulate matter have been adequately assessed and that the assessment reflects current science on these issues. Also, is the MOE satisfied with the study team's assessment of secondary particulates and does it reflect current science?

Section 7.8 - Risk Characterization

Question: Is the selection of a Hazard Quotient (HQ) of 0.2 appropriate and conservative? There is little rationale given for it and it seems quite arbitrary. It does not indicate if this is a standard selection in the industry. Does the MOE feel it is appropriate?

Concerns With the Multi-Pathway Assessment Results

Baseline Case

Hazard Quotients far greater than 0.2 are noted for a number of receptors and chemicals and they are shown below using the values given in:
Table 7-14 Maximum Hazard Quotient (HQ) Values Using Baseline Multi-Pathway Concentrations

COPC	Receptor	Hazard Quotient
Aroclor (PCBs)	**Resident-Infant**	**11**
Aroclor (PCBs)	Resident-Toddler	0.49
Aroclor (PCBs)	**Farmer-Infant**	**118**
Aroclor	Farmer-Toddler	4.2
VOCs	Farmer-Toddler	0.32 – 4.6
1,2,4,5 - Tetrachlorobenzene	Farmer-Toddler	0.40

1,2,4- Trichlorobenzene	Farmer-Infant	0.21
1,2,4- **Trichlorobenzene**	**Farmer-Toddler**	**20**
Antimony	Farmer-Toddler	0.24
Arsenic	Resident-Toddler Farmer-Toddler	0.32 0.57
Beryllium	Farmer-Toddler	0.42
Thallium	Resident-Toddler Farmer-Toddler	0.25 1.2

From Table 7-15:

Dioxins/Furans	**Resident-Infant**	**3.8**
	Farmer-Infant	**20**
	Farmer-Toddler	**0.72**

On page 178, it is stated that "The multi-pathway assessment for exposure of the resident infant receptor to COPC indicates that potential risks may exist from exposure to baseline concentrations of PCBs and dioxins/furans – associated HQ values for these COPC are 11 and 0.94, respectively".

The study team attributes exceedances of HQs to the use of MDLs and conservative assumptions, and states in many places that "these findings would be expected across Ontario and are not unique to this project". Where is the data to this statement? Does the MOE agree with their assessment? Are there indeed already problems with baseline concentrations for these chemicals? To add the emissions of an incinerator when the Baseline Case indicates exceedances for infants and toddlers would be unacceptable. Were MDLs used for dioxin/furan concentrations? I believe I did not find that to be the case when I looked at Tables 5-1 to 5-63 the Baseline Report (Jacques Whitford, 2009a).

Questions regarding Table 7-17 on Additional Exposures: Are the HQ values shown only for incremental risk? Should they be added in with other values?

Table 7-18 – Maximum Hazard Quotient (HQ) Values for Chemical Mixtures using Baseline Multi-Pathway Concentrations shows HQ values far above 0.2 for a number of receptors and a number of effects, as high as HQ = 117 for the Liver Effects to the Farmer-Infant.

Concerns with the Uncertainty Analysis (7.14)

I believe the uncertainty over the emissions estimates and predicted concentrations should be given less than a Neutral rating because there are uncertainties at every level of input and modelling. Baseline inputs, Facility estimates from Covanta, changing wasteloads, inadequate monitoring, meteorological modelling, air dispersion modelling, operating assumptions, uptake assumptions, multi-pathway modelling, … the list of factors with associated uncertainty goes on. I asked the Jacques Whitford study team with what confidence do they give their conclusions (i.e. How accurate is Risk Assessment? Plus or minus what percentage?), but they did not give me a quantitative answer, either verbally or in written form. What is the opinion of the MOE on this question?

I completely disagree with their Neutral rating on using the AAQC and air standards as TRVs as discussed earlier in this document this is a critical and sensitive part of the risk assessment.

I completely disagree with the Neutral rating on adequacy of estimation of risk due to ultrafine particulates for the reasons given earlier in this document.

In my opinion, the assessment seems to be missing a reference to the uncertainty regarding failure to acknowledge that there are hundreds of pollutants, not assessed here which are known to be emitted from incinerators, but which are yet to be identified and are of unknown toxicity.

In my opinion, the Uncertainty Analysis fails to recognize that ambient air monitoring done may underestimate ambient air quality over the longer term as during the time the monitoring was done there was a number of uncharacteristic shut downs for the St. Marys plant due to economic conditions. St. Marys is the major polluter in the area and emits very significant amounts of particulate matter, NOx and other acid gases and pollutants. The monitoring was also done during a period when we have experienced cooler than usual summers and fewer smog days.

In my opinion, the risk assessment does not adequately address synergistic effects which could result in significantly underestimating human exposures.