Review of Entech-Rem Environmental Screening Report (ESR) Human Health Risk Evaluation (HHRE):

Formulated for Port Hope Residents 4 Managing Waste Responsibly by Dr. Stan R. Blecher

In the following I comment on **1)** the nature and scope of the HHRE; **2)** the content of the HHRE, discussed here under the headings used in the HHRE. The HHRE headings are reproduced here with double underlining; **3)** what is conspicuously absent from the content of the HHRE, i.e. what an HHRE on a potential source of major pollution ought to deal with, but which this HHRE totally avoids mentioning. I start with a Summary.

SUMMARY

The ESR HHRE is a meager and inadequate document that is rife with factual error, scientific misunderstanding, flawed methodology and false conclusions. It provides very scant documentation by way of references to the scientific literature, and none from the peer reviewed literature. It is also riddled with typographic errors, some of which render the intended meaning uninterpretable.

The HHRE purports to predict the concentration of toxic emissions at "Point of Impingement". For any such prediction it is necessary to know what the concentration of actual emissions would be, but, as I document extensively in this review, Entech-Rem has no relevant track record to use as a basis for estimating this, and "modelling", the use of abstract numbers to make calculations, is, as I also document, notoriously unreliable. However, in listing purported "Total Facility Emission Rates" the HHRE does not even provide "modelling" information to explain how these figures were derived. Thus, for the only really important data relating to "risk assessment", namely emission rates, the reader is left to conclude that the figures are entirely fictitious.

In promoting the Company's claim to have extensive experience, especially in the Far East, the HHRE highlights a plant in Hong Kong (ESR, Appendix P, page 3). However, as documented in this review, it is not clear whether Entech is in fact active in Hong Kong at this time, nor whether those at the decision-making level are aware of this issue.

Of the 18 named noxious chemicals that the HHRE lists as possible emissions, it incorrectly declares only 4 to be carcinogenic (cancer producing), whereas, as I document, in fact 16 of the 18 of them are carcinogens. The HHRE speaks of "air concentrations that are protective of a cancer risk level" - the author(s) is or are evidently unaware of the fact, or they knowingly fail to state, that cancers are the result of genetic mutations, and that there is no level of a mutation-causing and cancer-causing poison that is safe. The document makes no mention of the lethal nanoparticles that this incinerator would emit, and no mention of accumulation of emitted toxins in the food chain.

Unsurprisingly, for a document paid for by the Company, the HHRE concludes that if an incinerator were to be built by Entech-Rem, "potential risks through the dermal and ingestion pathways are expected to be negligible". This conclusion is, as fully documented in the present review and in even greater detail in a letter to the Ontario Minister of the Environment, totally and blatantly false.

1) NATURE AND SCOPE

The HHRE comprises a little more than 3½ pages of text (pages 95-98), and one page for a table (Table 7) placed at the end of the ESR, out of a total 132 pages of what is called the "Main Report" of the ESR. The Main Report is itself one of 17 sections, the other sections being Appendices A-P. Many of the appendices are substantial in length; the total number of pages of the entire ESR, including the Main Report and all the Appendices, is 1,671. Taking the total length of the HHRE to be 4.5 pages (3½ pages of text and 1 page for the table), it comprises 0.003 or 3 one-thousandths of the total ESR. This gives a clear picture right up front of the importance that has been placed on concerns about human health. Furthermore, by this measure of importance, this figure of 3 one-thousandths actually over-estimates the attention paid to health issues, as the first 1¼ pages of the HHRE text deal with "framework" and "Problem Formulation" and do not tackle health concerns at all.

The HHRE provides documentation for its statements by way of 4 references, inserted as footnotes. Of these four, zero out of four (0/4) are peer reviewed scientific articles.

In the world of science, the legitimacy of claims and statements in documents or articles is judged by the extent to which those claims and statements are backed up by documentation in what are known as peer reviewed journals. The term "peer reviewed" has a totally different meaning in science to the meaning implied in non-scientific use. In science the process is very rigorous, and in the case of the best journals, known as prestigious journals, most articles submitted do not get accepted. The process is arm's length and anonymous - the author has no choice in selection of reviewers and is not told who they are. The journal's Editor evaluates a submitted manuscript to determine whether it is worthy of review, and if deemed to be so the Editor decides on the referees (reviewers) and submits the article to them with no input from the author.

In addition to this HHRE, a separate assessment of the health risks of the Entech-Rem proposal exists, in the form of a Letter by Dr. Stan R. Blecher addressed to the Ontario Minister of the Environment (available at www.phr4mwr.ca). That assessment has 18¼ pages of text and ten pages of references, with in all 105 references of which 43 are peer reviewed scientific articles. The contrast in scope and documentation between this latter assessment and that of the HHRE provides a hint of why I need to devote an entire section of this review to "what is conspicuously absent from the content of the HHRE".

2) CONTENT OF THE HHRE

As mentioned, the first 1¼ pages of the HHRE text deal with "framework" and "Problem Formulation". The reader is treated to such pearls of wisdom as:

> "The potential for adverse health risks is directly related to the exposure pathways. If there is no pathway of exposure to a chemical, regardless of its toxic potency, there would be no potential for the development of adverse health outcomes from that chemical."

and

> "Potential chemical releases from the proposed Facility will occur through air emissions. Thus, air is the only exposure medium of concern considered for the Risk Evaluation. Potential exposure to off-Site receptors is the primary exposure pathway of concern for the Risk Evaluation."

Having thus filled more than a third of its allotted text space, the HHRE then addresses the issue of

Exposure Assessment (page 96 of HHRE)

It is stated that:

> "Maximum Point of Impingement (POI) concentrations at the Facility boundary were ***predicted*** for the anticipated chemical releases due to the Facility operation. POI concentrations were ***predicted*** [emphasis by ***bold and italics*** added] based on the advanced air dispersion models required under Ontario Regulation 419/05, and are presented in Table 7, following text. The POI concentrations at the Facility boundary represent the worst-case level of off-Site receptor exposure due to Facility emissions."

Emissions of a proposed Entech plant in Port Hope

From a scientific point of view the concentrations of toxic substances that people, livestock and vegetation would be exposed to if this plant were allowed to be built are critically important data. The information quoted here appears to be intended to give the impression that the data have been provided, and elsewhere in the HHRE it is concluded that these data are satisfactory. In fact the figures provided in no way addresses the issue, and the situation is very far from satisfactory.

The statement quoted above indicates that POI concentrations were ***predicted,*** "based on the advanced air dispersion models required under Ontario Regulation 419/05". As I will return to later in this review, "models" are considered in research science circles to be fictional starting points for hypotheses, which need to be confirmed by actual experiment and measurement. To use one's hypothesis as if it were a fact is fallacious. Basing predictions, and specifically predictions about incinerator emissions, on "models", has been rejected by for example the Massachusetts Department of Environmental Protection, because **"actual operating performance for Massachusetts WTE [Waste to energy] facilities has been shown to produce far higher emissions than the modeled figures"** (see Greenyes Archives, 2008 in Reference list) .

I consulted the Ontario Regulation 419/05 mentioned here. It can be found at http://www.elaws.gov.on.ca/html/regs/english/elaws_regs_050419_e.htm#BK8, which is the web-site of the Ontario Environmental Protection Act: ONTARIO REGULATION 419/05. In that document, under PART II CONTAMINANT CONCENTRATIONS AND DISPERSION MODELLING, is a section entitled Dispersion Models, and under this is a list of Approved dispersion models. Section 6. (1) then lists 5 such "models", of which 1 is designated "Revoked". This leaves 4 others, and it leaves open to interpretation, for any scientist wishing to check the data provided, what combination of 2, 3 or all 4 models were used. Thus in addition to the inherent unreliability of "modelling", in this case it is impossible to know exactly what " modelling" procedure was followed in order to obtain the Dispersion factor used in "predictions" of the POIs.

To derive a so-called POI it would be necessary to have not only information on dispersion factors but also the actual emission figures. At this point in the HHRE (page 96) it is not explicitly stated that these data are needed, nor what figures were used for this purpose. In fact there is absolutely no available way of knowing these data at this time. I return to this in detail below.

Nevertheless, since it is stated that the POI values are presented in Table 7, I consulted the table, in an attempt to obtain some information on the basis of how the predictions of POIs was reached. In the table a

column headed "Max POI Concentration" appears, with a superscript (2), referring to a footnote (2). Here I copy and paste the text of that footnote:

(2) The flow rate of the source is based on the theore Ann ual

While some of the many typographical errors in the HHRE that were not discovered in proof reading are trivial, there are others, such as this one, that leave the reader with absolutely no way of deciphering the intended meaning. In this case the problem is critical, as the issue of how the declared POI predictions were created is central to the entire structure of the HHRE's arguments. It is not clear how any decision-making body can review or interpret these data.

Serious proof-reading omissions are disturbing not only because they can, as in this instance, render a section of the document incomprehensible; they are also, and more seriously, of concern in that they raise doubt in the reader's mind as to how well the actual factual content of the manuscript has been checked.

These concerns, serious as they are for scientists accustomed to the rigorous standards of prestigious peer reviewed journal articles, pale into insignificance compared to the major concern here, which is: So-called Point of Impingement (POI) concentrations of the poisons this gasification incinerator would emit (most of which are cancer-producing - see below) would depend on, first, the concentrations of the poisons emitted at point of exit from the plant and, second, on factors affecting dispersion between point of exit and point of impingement. Irrespective of the very weak arguments given to justify so-called "models" of dispersion, there is an even more disturbing issue that needs to be dealt with under a heading of its own:

The Company has absolutely no way of knowing what the actual emissions at point of exit would be.

I deal with this in the following and through to the middle of page 11.

A column in the HHRE's Table 7 is called "Total Facility Emission Rate". Adjacent to this heading is the superscript (1), referring to Footnote 1 of the Table, which states: "Based on mass and heat balance with an input of 30 day (sic)". Presumable the last word of this footnote should be "days". Ignoring the typo, it appears that this statement is intended to satisfy scientific scrutiny into how the so-called "Total Facility Emission Rates" were derived.

If submitted for peer review in a prestigious journal, a manuscript containing such a statement by way of documentation of how data were derived would not even be sent to referees by the Editor. As is fully demonstrated later in this review, the HHRE contains a large number of assertions that totally lack scientific documentation. Some undocumented statements are less important than others, but of all the information that is relevant to the issue of health risk evaluation of the proposed Entech-Rem plant, the actual emissions of toxic substances are most certainly absolutely prime.

It therefore truly defies belief that the HHRE provides absolutely no explanation of how these figures are derived. As will be documented in detail below, there are no previous authenticated data from comparable plants upon which to base predictions. As will also be documented below, the process of "modelling", i.e. using theoretical calculations rather than actual experience to derive predictions, is regarded as unacceptable (Greenyes Archives, 2008, in Reference list). But in this case there is not even information on a "modelling" process that has been used to produce these figures, and the reader is left with no alternative than to conclude that the figures given are entirely fictitious.

The Company has no way of knowing either the quantity or the range of the poisonous emissions that a plant of the proposed type would produce. This statement is explained and documented in the following.

The Company has no track record on which to draw and use as a basis for prediction of any new plant such as the one they want to place in Port Hope.

In the following I will explain the basis and provide documentation for this statement.

The Company states that the plant they want to build is a "gasification" plant, and they insist that it is not an incinerator. To start with, it is alarming that a Company that claims to be in the "gasification" business is not even aware of the fact that "gasification" plants are defined as being a kind of incinerator. For documentation of this statement, see EUROPEAN PARLIAMENT, (2000), Council on Incineration of Waste, Art 3.4 Directive [2000/76/EC]. (The complete citation information for this source is given in the Reference list below). Dictionary definitions concur: incineration is defined as producing ash by burning, and the Entech process produces ash by burning. The Ontario Ministry of the Environment Web Page's "Guideline A7" states: "Thermal treatment includes incineration, gasification, pyrolysis or plasma arc treatment". Citation information for this is also in the Reference list below.

The Company proposes to build a plant in Port Hope Municipality that would process Municipal Solid Waste (MSW). There are no Entech plants processing MSW anywhere in North America. Furthermore there are no gasification plants of any make processing MSW anywhere in North America, though there have been some, but all have failed and closed down (see Reference in list below: US EPA , US Environmental Protection Agency, 2012, pages 35, 38, 39). Gasification has no track record in North America to be proud of, and the company REM itself has no track record in gasification at all.

Entech has claimed to have a track record in Australia, Europe and the Far East. Although Entech is an Australian company, at the time it made the claim to be functioning in Australia it in fact only had an application to build a plant in Australia, and it has only very recently claimed that the application has been approved, so in fact no track record in Australia exists. Its claim to have a track record in Europe can also be misleading - most people might assume that a "track record in Europe" would imply many plants in Western Europe, but in fact the "European track record" comprises one plant, in former Soviet-controlled Eastern Europe. I will return to this plant below.

Hong Kong as a key element in Entech's track record

The Company claims to have plants in the Far East, specifically in Hong Kong, Taiwan, Indonesia, Malaysia and Korea. Of this list, Hong Kong is perhaps perceived as being the most advanced and "Westernised" of the Far Eastern countries, probably because of it having been under British rule for most of the second half of the 20th Century. The Company has no record anywhere in the Western or developed world - neither in Australia, Western Europe, North America or South Africa. It is presumably for this reason that the Company gives pride of place to Hong Kong in its claims of past record, by placing it first in the list of its claimed Far Eastern plants, and by placing it up front in **APPENDIX P of the ESR.**

Appendix P is entitled **ENTECH FACILITY EXPERIENCE/APPROVALS DOCUMENTS**. On page 3 of Appendix P one can read the following:

> "The ENTECH-WtGas-PGS TM shall be designed for municipal solid waste collected from Mui Wo Island, Hong Kong as follows:"

Below this statement is a table, with 3 columns, headed respectively:

> " ITM"; "DESCRIPTION"; "PERCENT (WT)"

The significance of these headings and of the data in that table is not immediately clear, but it is also irrelevant to the point to be made here, which is the following: **It is, to say the least, curious, that the Company would be promoting its experience in Hong Kong, to the point of placing it at the very beginning of its Appendix P, titled "Entech Facility Experience", when in fact it is not clear whether Entech has any operation in Hong Kong at this time.** The evidence that raise this question comes from three web sites that were found on searching for information on the Company's Hong Kong activities:

(1) http://www.companies-hongkong.com/entech-limited-6mg8/

(2) http://en.hkcomp.info/hongkong/cps.jsp?key=307325-2bf3bf81

(3) http://www.companies-hongkong.com/entech-products-hong-kong-limited-d7zk/

The following is Copied and Pasted from web site (1) above:

ENTECH LIMITED also knwon as **英德有限公司** is a dissolved business incorporated in Hong Kong on May 9, 1991. The company has been disolved on 06-OCT-1993. Their business is recorded as Local Company. It is not part of a group. The company has no filed accounts. The company was incorporated 22 years ago.

The following is Copied and Pasted from web site (2) above:

Company NO：	0308967
Company Name：	ENTECH LIMITED
Company Name in Chinese：	英德有限公司
Date of Incorporation ：	9 May 1991
Founder information：	Founding member Established：9 May 1991 ENTECH LIMITED was registered as a Local Limited Company(Private companies) in HongKong at 9 May 1991
NOTICE：	As so far this company has runing for 2 years， and it was Dissolved at 1993-10-06

limit：	05-09 → 06-20
Category：	Local Limited Company
Capital formation：	Private companies
Status：	Has now been dissolved
Memo：	已告解散(其他)
Liquidation mode：	
Dissolve date：	6 October 1993

From web sites (1) and (2) it appears that a company called Entech Limited existed in Hong Kong for two years, from 1991 to 1993, and was then closed down.

The following was Copied and Pasted from web site (3) above in October, 2013:

Name ENTECH PRODUCTS (HONG KONG) LIMITED

Name (hk) 英特卡機電產品(香港)有限公司

Identification number: 617263

Business type Private

Register date 16-JUL-1997

Active State Live

Entity type Local Company

Date 2013-10-08 18:19:21

And the following was also Copied and Pasted from web site site (3) in October 2013:

ENTECH PRODUCTS (HONG KONG) LIMITED also knwon as 英特卡機電產品(香港)有限公司 is a live business incorporated in Hong Kong on July 16, 1997. Their business is recorded as Local Company. It is not part of a group. The company has no filed accounts. The company was incorporated 16 years ago.

Key Financials are not available as ENTECH PRODUCTS (HONG KONG) LIMITED has not filed accounts. Accounts are required to be filed on or before 20/09/2013.

Note on date formatting and dates in Copy-and-Paste items re Hong Kong

In the above Copy-and-Paste items relative to Entech activity in Hong Kong, two different formats for presenting a date are used, and in items from all three sites both formats are used. In the first format the date is given in the sequence Day, Month (spelled out, as in "May" or as abbreviated in "Jul"), and then Year. In the second format the date is given in the sequence Year, Number, Number, where the two latter numbers could each either be month or day. Fortunately, in web site (2) the same event, namely "Dissolve Date", is given in both formats, which allows interpretation of the second format to be Year, Month, Day, as follows:

From the two Copy-and-Past items from site (2) one can interpret the date format of 1993-10-06, in the bottom line of the first item, to be read as Year-Month-Day (and not Year-Day-Month), because the "Dissolve Date" is given in both the first and the second item, and in the second item it is clearly stated as the 6th Day of October, i.e. the 10th Month (of 1993). This is important for interpretation of this date format in web site (3), as follows:

The date format in the bottom line of the first Copy-and-Paste item of site (3) pasted above, 2013-10-08, is interpreted as indicating 8th Day of October, Year 2013, as explained above. This was the date that the web-site was evidently updated. A copy of a previous version of information from the same web-site, dated 2013-09-08, i.e. a month earlier, is copied and pasted below. On that date the deadline that "Accounts [were] required to be filed" had not expired, whereas when the web page was updated as above, the deadline had expired.

The following material was Copied and Pasted from site (3) in September, 2013:

ENTECH PRODUCTS (HONG KONG) LIMITED
Local Company

Business Summary

ENTECH PRODUCTS (HONG KONG) LIMITED also known as 英特卡國際產品(香港)有限公司 is a live business incorporated in Hong Kong on July 16, 1997. Their business is recorded as Local Company. It is not part of a group. The company has no filed accounts. The company was incorporated 16 years ago.

Business informations

Name	ENTECH PRODUCTS (HONG KONG) LIMITED
Name(hk)	英特卡國際產品(香港)有限公司
Identification number:	617263
Business type	Private
Register date	16-JUL-1997
Active State	Live
Entity type	Local Company
Remarks	-
Winding Mode	-
Disolution date	-
Register charges	Available
Notes	-
Date	2013-09-08 12:35:29

*Our website contains only public informations on companies from Hong Kong.

Type informations

Most small to medium sized companies in Hong Kong are set up as 'private companies limited by shares' and are commonly referred to as 'private limited companies'. It is often chosen over other forms of business entities like sole proprietorships and partnerships owing to its many benefits.

A company limited by shares is the most common type of company for conducting business and trade. A company limited by shares has a share capital which is divided into a number of shares of certain value each. These shares are held by shareholders (investors) who are entitled to a share in the profits of the company and receive a dividend corresponding to their respective percentage of shareholding in the company.

In case of a loss, the shareholders will lose their investment in the shares of the company. For detailed information about setting up a private limited company, see Hong Kong Company Registration guide.

Key Financials

Key Financials are not available as ENTECH PRODUCTS (HONG KONG) LIMITED has not filed accounts. Accounts are required to be filed on or before 20/09/2013.

Related companies

CIS SHOWROOM LIMITED
LASER CITY AUDIO AND VIDEO EQUIPMENT LIMITED
FULLEARN DEVELOPMENT LIMITED
LASER CLUB ASSOCIATION LIMITED

Hong Kong Dollar Exchange Rate	in HKD
Un. Arab Emirates Dirham	2.11
Argentine Peso	1.35
Australian Dollar	7.26
Bulgarian Lev	5.35
Brazilian Real	3.45
Canadian Dollar	7.52
Swiss Franc	8.53
Chilean Peso	0.0155
Chinese Yuan Renminbi	1.27
Czech Koruna	0.409
Danish Krone	1.4
Algerian Dinar	0.0948
Estonian Kroon	0.669
Egyptian Pound	1.12
Euro	10.5
British Pound	12.5
Croatian Kuna	1.37
Hungarian Forint	0.0349
Indonesian Rupiah	0.0007
Israeli New Shekel	2.17
Indian Rupee	0.125
Iranian Rial	0.0003
Iceland Krona	0.0638
Japanese Yen	0.0787
Korean Won	0.0072
Sri Lanka Rupee	0.0588
Latvian Lats	14.9
Mexican Peso	0.593
Malaysian Ringgit	2.41
Nigerian Naira	0.0479
Norwegian Krone	1.3
New Zealand Dollar	6.45
Philippine Peso	0.179

Site (3) is evidently an active web site, as it was updated on 8th October, 2013. From site (3) above it appears that after the Company Entech Limited closed down in 1993, a different company, Entech Products (Hong Kong) Limited was established in 1997. It appears that as per 8th October 2013 this company had "not filed accounts", but accounts were "required to be filed on or before 20/09/2013", i.e. 20th September, 2013. The deadline for "filing of accounts" appears to have been passed without the filing having occurred. From this it appears to be unclear what the status of the company Entech Products (Hong Kong) Limited is at present. It is also unclear whether the Company has informed decision makers, such as the Port Hope Municipal Council or the Ontario Ministry of the Environment, of the closure of the company Entech Limited in 1993, and the status of unfiled accounts of the company Entech Products (Hong Kong) Limited, as of the deadline in October 2012. If these bodies have not been informed then the Company has misled them, and in any event it would appear that the *public* has been misled, as it has not been informed of these problems with Entech in Hong Kong.

We have at present no further information on Entech plants in the Far East. We do not know how many such plants exist, nor how many of them that do exist are actually processing MSW (Municipal Solid Waste). However, even with respect to any that may be processing MSW, the Company's experience from such plants **can not be directly applied to plans for running a plant in Port Hope**. This is because, first, the nature of MSW in North America differs from that in the Far East, where the waste has a much higher proportion of food remnants in the feedstock than does MSW in North America. (See for example References Visvanathan and Trankler, 2004; Zurbrügg, 2002). Food remnant content is much easier to process and should theoretically produce lower levels of noxious effluents. Second, the declared capacity (number of tons to be processed per day) of the proposed Port Hope plant is vastly greater than the Company evidently has attempted before. This and other data on past performance of Entech plants comes from published information available on one plant only: the Company's one and only plant in Eastern Europe.

Entech's showcase plant: Kuznica, Poland

The Company's "showcase" plant is in Kuznica, in Poland - it is to Kuznica that Entech-Rem took representatives of the Municipality of Port Hope, for them to do a site visit. It is not immediately clear why the Company chose Kuznica to show off its wares. It becomes even less clear when one searches the literature, because it transpires that there are, as mentioned, published reports available on the performance of the Kuznica plant, and as will be explained below, these data do nothing to flatter the Company's reputation. However, it appears to be the only Entech plant for which published data are available.

The data available from the plant in Kuznica, on which representatives from the Municipality of Port Hope evidently base their conclusions, do not provide an appropriate basis for making a decision that might allow construction of a plant in Canada. The following specific information on the test done on the Entech plant in Kuznica comes from a Report done by the University of California, Riverside (see University of California, 2009 in list of References):

1. The data presented for the Kuznica plant are evidently based on one single assessment.

2. That one single assessment was done as a "Demo Test", i.e. on a pre-arranged date - the Company knew in advance that the test would be done. By analogy with drug testing of athletes, testing of waste processing plants can only provide meaningful data if done at unannounced and random times.

3. The test was done in 2004. Far more sensitive methods are now available than were at that time.

4. The stated functional capacity of the plant in Kuznica, Poland is given, in data provided by the Company, as 25 tons per day, but on the day the test was done **only 3.5 tons were processed**. Entech-Rem has informed the public that if it were allowed to establish a plant in Port Hope, it would process up to **165,000**

tonnes per year (Entech information package, 2013) or 200,000 tonnes per year (Entech-Rem "Proposed Gasification Plant Fact Sheet", 2013 (blue sheet)). This works out to **452 or 548 tonnes per day**, depending on which Entech-Rem document is providing the correct information. An average of these would be about 500 tonnes per day, **more than 140 times the capacity that was tested in Kuznica**. This would truly be a **"mega" incinerator**; it is clear that the data for the plant's performance in **processing only 3.5 tons, on one day, in 2004, when the Company knew in advance that the tests were to be done,** are not a reasonable basis on which to base a critical decision for Port Hope's future today.

5. Notwithstanding all of the above factors that heavily biased the odds for that test's outcome in the Company's favour on the day of the Demo Test, the actual test results reveal that **the Company's performance in this case did not compare favourably overall to the performance of other plants tested under similar circumstances, in the Far East, at about the same time.** For example, the University of California, Riverside Report (University of California, 2009), on the page preceding the Entech Kuznica results, gives data on a "Fluidized bed gasification/ash melting" plant, of a company called Ebara TwinRec, in Kawaguchi, Japan. Emissions, in mg/N-M^3 (milligrams pre cubic meter) @ 7% O_2 were respectively:

for HCL [Hydrochloric acid]: Ebara less than 2.8; Entech 7.9;

for Nox [Nitrogen oxide]: Ebara 41; Entech 254;

for Sox [Sulphur oxides]: Ebara less than 4; Entech 51.0.

These figures are from pages 12 and 13 of the reference University of California, 2009. The facts presented here do not give reason for any confidence in a Company that has absolutely no local track record to show that it can process anything at all over a protracted period.

In addition to the above, plants using the Entech technology produce numerous other lethally poisonous emissions, including nanoparticles, minute fragments of ash a millionth the size of a pin-head, (Synergetics, 2012b Appendix 18 in Reference list) which can penetrate into the brain and other organs. This issue will be discussed more fully below, in Section **3)** of this review, where I deal with issues not mentioned in the HHRE but which should have been discussed.

Thus, with respect to "track record", the Company has no credible record on which to base any estimates of what a mega incinerator in Port Hope would emit, let alone to claim that the emissions would be "safe" and the plant would be "green".

Having no data base for predicting performance, the Company has to resort to "modelling", which basically means creating theoretical, **imagined "facts"**, often using complicated formulae that have no relationship to the real world. In an article entitled Models in Science, at the Stanford Encyclopedia of Philosophy web site (Stanford University) (see Reference list), models are aptly described as Fictions. In research science, models are used to form Hypotheses, which are educated guesses on the basis of which experiments are designed. Scientific **facts are only obtained after the experiments are completed**; to confuse the hypothesis with the facts is very dangerous.

In the world of gasification incinerator emissions this has been clearly enunciated in a study released in 2008 by the Tellus Institute, commissioned by the Massachusetts Department of Environmental Protection (Greenyes Archives, 2008). This study found that "gasification and pyrolysis facilities are unlikely to play a major role in MSW management in Massachusetts by 2020." The reasons for this included that "For....waste-to energy incinerators, as well as the **gasification** and pyrolysis **plants**, the **emission factors** used to compare environmental performance are **based largely on modeling and/or vendor claims** for modern, state-of-the art facilities, **as opposed to actual operational data from real world experience**. For example, **actual operating performance for Massachusetts WTE [Waste to energy] facilities has been shown to produce far higher emissions than the modeled figures**.

Summary on emission data and "Point of Impingement Concentrations"

In summary, the information presented above clearly demonstrates that so called "Emission data" presented by the Company, in both their distributed material and in the ESR, are fictitious in nature. They are not based on scientific observation of past performance - the Company has no plants comparable to the proposed mega incinerator, and no plants functioning under North American conditions, from which to obtain this information. The figures offered by the Company are presumably based on "modelling", which as documented, is highly unreliable.

As mentioned above, calculation of so-called Point of Impingement (POI) concentrations, which the HHRE addresses on page 96, would be dependent on having available emission data and an understanding of dispersion factors. Since accurate emission data are not available, and since dispersion factors were evidently derived in a unrevealed manner, also based on "modelling", it is clear the the "POI" figures presented in the HHRE are not logically rigorous and have no real-world meaning.

Turning back to the text of the HHRE: On page 95 [third bullet] the term Toxicity Assessment is introduced and it is stated that this assessment involved

> "selecting current health-related Toxicity Reference Values (TRVs) ***based on the route of exposure*** for the chemical of concern" [emphasis by ***bold italics*** added].

On page 97 it is indicated that these values were obtained from Reference 1 of the HHRE.

On page 96 [middle of page], there is the heading:

Toxicity Assessment (page 96 of HHRE)

Under this heading the following is stated:

> "An inhalation RfC is an estimate of a continuous inhalation ***exposure concentration*** to people (including sensitive subgroups) ***that is likely to be without risk of deleterious effects*** during a lifetime [emphasis by ***bold italics*** added]. RfCs are reported in milligrams of chemical per cubic metre of air (mg/m3). The selected RfC value per chemical corresponds to the lowest of the acute, subchronic, and chronic values where they were available."

Virtually all the poisons under discussion (i.e. those listed in Table 7 of the HHRE) are substances that cause cancer (carcinogens). (The HHRE erroneously states that only 4 of the list are carcinogens - see below; for documentation of the statement that 16 of the 18 are in fact carcinogens, see below). Carcinogens cause cancer by producing mutations, i.e. damage to genetic material (DNA). It is a fundamental understanding of modern medical genetics that there is no dose of a mutagen (a substance, such as a carcinogen, that causes mutation) that is safe. **That is, there is no dose of a carcinogen that is so small that it can not cause cancer**. (References for this are given in Section **3)** of this review). Therefore any mention, as in the paragraph above, quoted from page 96 of the HHRE, of "(*an*) *exposure concentration that is likely to be without risk of deleterious effects*" demonstrates a **startling ignorance of modern genetics that is, to say the least, extremely disturbing to find, in a so-called Human Health Risk Evaluation that purports to assess risk to humans of a potential major pollution source.** It would be reasonable to expect that the "Human Health Risk Evaluation" section of an "Environmental Screening Report" would be reviewed for medical scientific accuracy prior to publication. This kind of misunderstanding can potentially be very misleading to those non-scientists who may be making decisions on the issue under scrutiny.

The HHRE goes on to state (page 96):

> An inhalation URF is the upper-bound excess lifetime cancer risk ***estimated to result*** [emphasis by ***bold italics*** added] from continuous exposure to a chemical at a concentration of 1 microgram per cubic metre (µg/m3) in air. The inhalation URFs were used to estimate air concentrations ***that are***

> ***protective of a cancer risk level*** [emphasis by ***bold italics*** added] of 1 × 10-6 (i.e., one in a million) by dividing the URF into the MOE's target cancer risk level of 1 × 10-6. URF values were only obtained for those chemical [sic] that are classified as carcinogens".

Four issues in this paragraph require comment:

1. This paragraph indicates that a "URF (Unit Risk Factor) is a risk ***estimated to result*** from a continuous exposure to chemicals at a given concentration. It is not stated how this estimation is made, but on page 97 it is stated that

> "The RfC and URF values for the chemicals emitted as a result of Facility operations were obtained from MOE (20111) and RAIS (20132), and are presented in Table 7."

This sentence is remarkable, for several reasons **which I return to below (see *, below)**.

2. The paragraph refers to air concentrations of substances, most of which are carcinogens, ***that are protective of a cancer risk level***. As mentioned above, since it is known that there is no safe dose of carcinogens, **there are no levels of carcinogens that are "protective of a cancer risk level"** (references cited later in this review). This statement in the HHRE demonstrates ignorance of the genetics of the issue, or failure to state the facts. It is irresponsible for such erroneous statements to be issued publicly, and in so doing lull the public into passive acceptance of a potential source of cancer-producing emissions.

3. It is then indicated that the figure designated to be the fictitious concentration of cancer producing emissions that is "protective of a cancer risk level" is **estimated** by dividing the **estimated** URF in to what is evidently also an **estimate**, the "MOE's target cancer risk level of 1 × 10-6". No literature source is given for the rationale of how this figure is derived, and a web search also failed to disclose the source. There appears to be no clear scientific validation for the authenticity of how these figures would relate to real world experience.

4. The last sentence of the paragraph (at the bottom of page 96 in the HHRE) reads: "URF values were only obtained for those chemical (*sic*) that are classified as carcinogens." Aside from the typo that was not corrected in proof-reading, this sentence is problematical for two other reasons.

Eighteen specific toxic emission substances (called "parameters" in Table 7) are listed in the Table (with dioxins and furans listed together). Since URF values are given in Table 7 for only 4 toxins out of 18 items listed, the *first problem* is that **no documentation is given** for the claim that only these 4 are carcinogenic. The *second and bigger problem* is **that this claim is false** - of the 18 items listed, in fact 16 have been shown to be carcinogenic; only for carbon monoxide, which is usually lethal within minutes, and for tin, is there no evidence of carcinogenicity. The 4 named carcinogens are Cadmium, Lead, Arsenic and Nickel.

While it is curious that **any** of the carcinogens were omitted, and that only 4 of 16 carcinogens were identified, **thus grossly understating the potential medical risks** of this proposed incinerator, it is more than just curious that amongst those in the list **not identified as carcinogens are the dioxins and furans**, **potentially the most dangerous of all incinerator carcinogens.** Considered to be " The Most Toxic Chemicals Known to Science (see Energy Justice Network, 2012 in Reference list) these poisons are of particular concern because of the proven enormous cancer-producing effect they have through their documented accumulation in the food chain in farming areas contaminated by incinerators (References: Commoner et al., 1996; WHO [World Health Organization], 2010; Lorber et al., 1994; Huwe and Larsen, 2005; Franzblau, et al., 2010; Fries, 1995; McLachlan, et al., 1990.). It is truly astonishing that the author(s) of the HHRE document do not know that dioxins and furans are carcinogenic.

Below, documentation is given, in the form of references from the peer-reviewed scientific literature, that refutes the HHRE's undocumented statement that only 4 of the 18 listed toxic items are carcinogens. Here the other 12 that are carcinogens are listed. Thus in fact 16 of the 18 listed emissions in the HHRE's Table 7 are carcinogens.

List of toxic emissions (called "Parameters" in Table 7) which are claimed in the HHRE to be non-carcinogenic, but which in fact are carcinogens.

For each carcinogen listed, a single example reference is given from amongst the large number available in each case, in the peer-reviewed scientific literature. See Reference list at end of document, for detailed citation information for each of the example references.

Sulphur dioxide: example reference: **Lee**, **W.J.** 2002.

Nitrogen oxides: example reference: **Oshima H. and Bartsch H.**, 1994.

Hydrogen chloride: example reference: **Bond G.G. et al.**, 1991.

Fluoride: example reference: **Gradjean P. and Olsen J.H.**, 2004.

Dioxins and Furans: example reference: **Flesch-Janus D. et al.**, 1998.

Mercury: example reference: **Barregård L. et al.**, 1990.

Chromium: example reference: **Langgrrd S.**, 1990.

Cobalt: example reference: **Gilman J.P.W.**, 1962.

Copper: example reference: **Wu T. et al.**, 2004.

Manganese: example reference: **Milde D. et. al.**, 2001.

Antimony: example reference: **Groth D.H. et al.**, 1986.

Vanadium: example reference: **Stern A. et al.**, 1993.

***** Returning to the sentence quoted in 1. above, there are three reasons why this sentence is remarkable.

First, though it is stated that these terms are "are presented in Table 7", neither the term "RfC" nor the term "URF" actually appears in Table 7. The column headings in Table 7 are, from left to right:

> Source, Parameter, CAS No., Total Facility Emission Rate, Max. POI Concentration, Averaging Period, MOE POI Limit, Limiting Effect, Percentage of MOE POI Limit, Non-Carcinogen Reference Concentration, Source, Above Non-Carcinogen Reference Concentration, Carcinogen Inhalation Unit Risk, Source, Carcinogen Inhalation Concentration, Above Carcinogen Inhalation Concentration.

Presumably RfC (Reference Concentration) is intended to refer to Non-Carcinogen Reference Concentration and Above Non-Carcinogen Reference Concentration, and URF (Unit Risk Factor) becomes Carcinogen Inhalation Unit Risk.

Second, reference is made to the values "for the chemicals emitted as a result of Facility operations". But the chemicals that would be emitted from a facility, if built, are unknown, since, as documented in detail above, the company has never built or operated a facility identical to the one depicted in the plans that have been published, and such a facility if built would potentially produce a much larger array of toxins than those listed in Table 7 - incinerators are known to produce literally hundreds of potentially toxic emissions that are often undetected and ignored (Jay and Stieglitz, 1995).

Third, and quite remarkably, it is indicated that the "RfC" and "URF" values used were obtained from " MOE (20111) and RAIS (20132)", i.e. the HHRE's References numbers 1 and 2. But the title of Reference 1 is

> MOE, 2011: Rationale for the Development of ***Soil and Ground Water*** Standards for Use at Contaminated Sites in Ontario, Table 2.23: Toxicological Reference Values (TRVs) for Derivation of Human Health ***Soil & Groundwater*** Standards, April 15, 2011 [emphasis by ***bold italics*** added].

That is, **the entire document, and specifically Table 2.23 from which the data are taken, deals with soil and groundwater standards**, whereas it is of course clear that **what is relevant is not poisons in soil or**

groundwater but those that would get pumped out into the air, as stated in this paragraph, quoted from page 96 of the HHRE:

> "As the primary point of exposure is ***through the inhalation of the ambient air concentrations as a result of the emissions from the Facility*** [emphasis by ***bold italics*** added], an evaluation of the predicted POI concentrations relative to human health-based TRVs was undertaken."

This situation is more than curious. We have here an Environmental Screening Report that presents **estimates of poison concentrations in <u>ambient air</u>** that are, as indicated above, derived from an elaborate set of calculations, the relevance of which to the real world is to start with questionable. In addition, we here learn that **those real world-challenged calculations are based on data on pollution <u>not of air but of soil and groundwater</u>**.

Thus it is not clear in what way Reference 1 of the HHRE, which deals with soil and ground water "Standards", was of assistance in estimating "RfC" and "URF" values relevant to ambient air.

Reference # 2 of the HHRE is

> RAIS, 2013: Toxicity values obtained from Risk Assessment Information System website
>
> http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem accessed on August 9, 2013.

A perusal of this source shows that it gives a list of "Chemical Toxicity Levels". However, several of the poisons, listed as "Parameters" in Table 7, are not mentioned in this list. Items absent from the list include the following:

Cadmium, a value for which is given for "diet", and another for "water", but none for air; Organic carbon; Nitrous oxide; Particles (listed as PM, PM10 and PM 2.5); and Dioxins/Furans, as mentioned possibly the most important of the life threatening toxins, as explained in Section **3)** of this review. (The chemical 1,4-dioxane is in the list but this is not the same as dioxin, and dioxacarb, a carbamate pesticide, is in the list, but this too is not a dioxin).

The HHRE states that its sources for the ambient air data provided for these toxins (Cadmium, Organic carbon, Nitrous oxide, Particles (PM, PM10 and PM 2.5) and Dioxins/Furans) are References 1 and 2, but no such data are evidently available in either source.

The final heading in the HHRE is

<u>Risk Characterisation (page 97)</u>

The first paragraph in this section reads:

> A comparison of the maximum POI concentrations to the RfC and URF values for each chemical is presented in Table 7. As shown in that table all the estimated POI concentrations are well below the RfC and/or URF values, which indicates that air concentrations associated with the Facility emissions will not result in risk and/or hazards ***above acceptable levels*** [emphasis by ***bold and italics*** added].

As discussed above and summarised under the heading **<u>Summary on emission data and "Point of Impingement Concentrations",</u>** the POI concentrations derived in this HHRE are logically meaningless. As also pointed out above, the RfC and URF values in this HHRE were derived from a table of "Toxicological Reference Values (TRVs) for Derivation of Human Health ***Soil & Groundwater*** Standards" [emphasis by ***bold and italics*** added], taken from the HHRE's Reference 1. From a scientific point of view, comparing "POI concentration levels" **derived by a method that is demonstrably not logically rigorous** with "reference concentrations" and "risk factors" **derived from soil and groundwater** standards, and from this to draw conclusions about **safety of ambient air concentrations**, is palpably absurd. Such a proposition would not pass muster in any research scientific assembly or for any peer reviewed journal.

Predictably, of course, the HHRE concludes from this comparison that "Facility emissions will not result in risk and/or hazards ***above acceptable levels*** [emphasis by ***bold and italics*** added]. What exactly constitutes an **acceptable level** of cancer induction in the community's children and adults is not specified.

The last part of the paragraph of the "Risk Characterisation" section discusses concentrations of "particulate matter". Again in this respect, predictably, the HHRE concludes that "the POI concentrations for PM_{10} and $PM_{2.5}$ for the Facility emissions will not pose a health concern".

The terms $PM_{2.5}$ and PM_{10} are not defined or explained in the HHRE. While it is not clear why this is not explained - this could be just one more omission that might suggest less than careful attention to detail - there is on the other hand an important reason why it should be explained, and when explained why it will be understood more fully that the HHRE's implied assurance that particulate emissions would not impose a health concern is totally invalid and directly misleading.

First, for particulate matter as for all the other poisonous emissions discussed above, the Company has absolutely no basis on which to predict accurately how great or small concentrations would be in their emissions, if they were given permission to build an incinerator in Port Hope. It should also be pointed out that Ontario and Canada have "guidelines", "standards", "reference levels" and "criteria" for these particles, but no "limits".

Second, while PM 2.5 and 10 particles are problematic, they are by no means the important and really dangerous particles that the HHRE should have mentioned but did not.

The letters PM stand for Particulate Matter, and the subscripts 2.5 and 10 indicate the size of the particles being considered, in microns. A micron is about a thousandth the size of a pin-head; the particles being discussed here are therefore 2.5 and 10 thousandths of a pin-head size. This is very small, and such particles can, under some circumstances, be harmful to health. However, the really serious particulate matter problem is not with particles of micron size, but particles a thousand times smaller yet - i.e. particles a millionth of a pin-head in size, known as nanoparticles. These are far more dangerous because they are so small that they quite easily pass through the minute filter system of the lungs, that normally only lets oxygen molecules into the blood, and keeps all foreign waste particles out. Incinerators produce nanoparticles of ash which, after entering the blood stream, can get in to the brain and all other organs.

The Entech technology has specifically been studied with respect to nanoparticles. I discuss this in detail in Section **3)** of this review, but here I mention, as a preview, that it has been shown that **the Entech system produces nanoparticles and that there is no known technology available that can filter them out** (see Synergetics, 2012b Appendix 18, in Reference list).

While no limits and only "guidelines", "standards", "reference levels" and "criteria" exist for PM_{10} and $PM_{2.5}$, it is of critical concern that there are absolutely no regulations for nanoparticles anywhere in the world. This is in part because the study of nanoparticles, including attempts to control their escape into the atmosphere, is new. The lack of attempts to regulate them by law may also relate to the impossibility of regulating them in practice. Thus a plant using Entech technology in Port Hope would pump out absolutely uncontrolled and uncontrollable amounts of a recently discovered and recently researched potentially lethal material which, because it can enter the internal organs, can cause deadly disease. As mentioned I provide further documentation on this issue in the next Section.

3) ITEMS OF FUNDAMENTAL IMPORTANCE NOT MENTIONED AT ALL IN THE HHRE

The HHRE errs seriously in its contents, as has been demonstrated in the preceding sections. However, the HHRE can potentially mislead its target readers, the decision makers, yet more seriously by its omissions. The most important of these are that HHRE makes no mention of:

Nanoparticles

The Linear-no-threshold law of mutagenicity, including carcinogenicity

The accumulation of carcinogens, typically dioxins, in the food-chain

Nanoparticles

NANOPARTICLES, also known as ultrafine particles, are minute fragments of material, much too small to be visible to the naked eye, a few millionths the size of a pinhead. In the case of incinerators, including gasification plants, the term refers to minute particles of soot or ash contained in the plant's stack emissions.

Because these particles are very small, they are able to get through the filter system in human lungs that prevents larger junk items from entering the body, and thus into the blood stream. Research on airborne nanoparticles from incinerators, as well as basic research on the fate of nanoparticles in the body and the resulting damage to health, have been performed on humans and in animal experiments,. These studies show that once in the blood, nanoparticles **can enter the lung, brain, heart, liver, spleen, kidney, testis, thymus - i.e. all organs studied** (e.g. Benninghoff and Hessler, 2008; De Jong et al., 2008; Balbus et al., 2007; Gutierrez-Castillo et al., 2006; Penn et al., 2005; Nemmar et al., 2004; Cernuschi et al., 2012; Song et al., 2009). In these organs the particles can cause **grave disruption to health**, simply by their presence as foreign debris, and also because they can carry the specific poisons they have been in contact with, such as carcinogenic (cancer-causing) furans and dioxins as well as lead, mercury and other toxins. **There are no regulatory standards or guidelines for release of nanoparticles anywhere in the world**, because scientists have only recently discovered the extent to which they can invade the body organs and the damage they can cause, and environmental regulations have not yet caught up with this medical information.

THE ENTECH SYSTEM RELEASES NANOPARTICLES, AND THERE IS NO WAY THIS CAN BE PREVENTED. For documentation of this statement see Synergetics 2012b in the Reference list below. Synergetics 2012b is a report developed by a company called Synergetics Environmental Engineering, situated in Melbourne, Australia. Synergetics was commissioned by another company, New Energy Corporation Pty Ltd, of Perth, Western Australia, to study and prepare a report on "**the potential for nanoparticle generation from the Entech process**" (**page 1 of Report**). The following is cited directly from that source:

"… **THE CURRENT TECHNOLOGY AVAILABLE TO INDUSTRY DOES NOT HAVE THE CAPACITY TO EFFECTIVELY REMOVE ULTRAFINE OR NANOPARTICLE PARTICULATES**" (**page 4 of Report**). I emphasise here that this statement refers **SPECIFICALLY TO THE ENTECH PROCESS** that the Company wishes to bring to Port Hope, and the statement that there is no way of preventing the nanoparticle contamination is **CURRENT AS PER 2012**.

The HHRE makes no mention of nanoparticles and thus no mention of the Synergetics Report cited here. The Synergetics Report was prepared in collaboration with the parent Entech company and the results are known, or should be known, to local Entech officials. Also known to Entech officials is the fact that there are no government regulations concerning nanoparticles, and that since there is no known technology that can control their release by incinerators, the only way to prevent human damage by nanoparticles is to not produce them in the first case.

Mutagenicity and carcinogenicity

The HHRE discusses potential emissions of the proposed Entech-Rem incinerator exclusively in terms of so-called government "Standards", and ignores the fact that even minute amounts of carcinogenic (cancer-producing) mutagens (substances that damage genetic material, DNA) can cause cancer. The fact that concentrations of toxic substances lower than so-called "standards" can be harmful is gaining understanding. When the legitimacy is being examined of a proposal to construct a potentially contaminating incinerator it is unacceptable that this fact should continue to be ignored.

The following section is a citation from the Reference listed below as Synergetics, 2012a:

"A recent discussion paper (NEPC 2010 [National Environment Protection Council of Australia]), suggests a number of modifications of air quality regulation in Australia in the next few years, as summarised below.

It is very likely that ***allowable exceedances will be gradually phased out***. The literature consistently demonstrates that PM10 and PM2.5 in particular (but also NO_2, CO and SO_2) ***exert consistent, measureable adverse health effects on humans even below the current limits***. Basically this means that ***any concentration, small as it may be, has some sort of health impact***. The NEPM [National Environment Protection Measure] discussion paper (NEPC 2010), states that for these pollutants "the standards have been adopted with the acknowledgement that there is a level of residual risk associated with those standards". Given that there appears to be a linear relationship between exposure to NEPM pollutants and adverse health effects, any increase in air pollution levels (even within the standards) will lead to an increase in risk to the health of the population." End of citation. [Emphasis by ***italics*** and ***bold*** added].

[The term "Linear relationship between exposure and effects" means that even very low doses cause damage; there is no "threshold" below which levels are safe (see below).]

The above passage quoted from the **NEPC of Australia** discussion paper mentions "an increase in risk to the health of the population" that the items such as NO_2, CO and SO_2 might cause. This may bring to mind, for example, the extremely painful caustic effects and resulting deadly swelling of the lungs of NO_2 or SO_2, or the sudden death that can result from the lethal gas CO. To this list could be added lead, chromium, mercury, cadmium and numerous other potentially lethal pollutants, and all of these are substances known to potentially cause **immediate** serious affects to health. But such immediate, short-term consequences would only be the tip of the iceberg. There is an invisible and much larger part of the iceberg: the **long term** consequences.

These are the **mutagenic** effects of most of the above mentioned poisons, and in addition the furans, dioxins, polychlorinated biphenyls (PCBs) and many more. These toxins can all cause genetic mutations, with resulting cancer, birth defects, heart disease, brain disease and much more, and the most important but little understood part of this issue is that **THERE IS NO SAFE DOSE OF MUTAGENS**; this includes both chemical mutagens and physical mutagens such as radiation. As indicated above, the statement in the NEPC of Australia document that there is "a linear relationship between exposure to....pollutants and adverse health effects" means, in genetic terms, that even low doses cause mutation. Genetic principles predict that cancer-producing mutation can occur when even only **one molecule** of mutagen binds directly to DNA. As Professor Wallace LeStourgeon, a distinguished molecular biologist of Vanderbilt University, points out: "**There is simply no safe dose of mutagen. This is a central tenet in the fields of molecular toxicology and cancer epidemiology**", and "One must conclude that a single molecule of mutagen may cause a single mutation". These citations and more information on the subject can be obtained from the web-site **The safe-dose myth** (LeStourgeon, 2010).

It has been known for many years that a change in the very smallest unit of a gene, a "single base" in the DNA, is enough to create a mutation (e.g. Online Mendelian Inheritance In Man (OMIM), 2013). Research has confirmed that molecules of cancer-producing mutagens such as furans do bind to the DNA in a dose-related manner, down to low dose level (e.g. Neurwirth et al., 2012; Trent et al., 1996) and research has also confirmed the "Linear, no-threshold model" for a large variety of such mutagens. (See, for example:

Abramson-Zetterberg, 2003; Appleton et al., 1982; Beach and Gupta, 1994; Crebelli, 2000; Creek et al., 1997; Dunn, 1983; Peto et al., 1991; Schneider et al., 2011).

It is now well known that even minute amounts of carcinogens can cause cancer, and it is also well known that there are highly successful alternative methods of waste disposal, other than incineration, being developed all over the world, including Canada and indeed in Ontario. The HHRE should have pointed out but failed to, that in this day and age there is no justification for condoning a plant that would emit ANY amount of carcinogens, when non-polluting methods exist.

Accumulation of carcinogens in the food chain: from incinerator to crops, livestock and to human consumption

There is a second extremely important reason why maintaining concentrations of emissions below "standards" does not prevent risk of harm. This is that poisons accumulate in the food chain. Thus even minute amounts emitted can over time amount to substantial contamination. Also here the HHRE fails to address the issue.

It is well known to science that toxic pollutants of industrial origin, in air, water and soil, are a major potential threat to human health, being implicated in cancer (e.g. McCormack and Schuz, 2012), heart disease (e.g. Brook et al., 2010), diabetes (e.g. Lee et al., 2010; Lee and Jacobs 2011) and much more (e.g. DeYoung, 2012). A more recent discovery is that a major route to human poisoning is the transfer of toxicants of the air, through the food chain, to human consumption. This is unquestionably true of many of the noxious substances, such as mercury, lead, nitrous oxide and others released by gasification plants; here we will mention an important example that has been well studied: Dioxins.

Dioxins are highly toxic pollutants that are produced as by-products of industrial processes, and are released into the environment mainly by solid waste incineration (WHO [World Health Organization], 2010). Like their chemical cousins the furans and PCBs (polychlorinated biphenyls), they contain chlorine; the term "dioxins" is commonly used to include all of these (WHO [World Health Organization], 2010). What has only relatively recently been researched is that dioxins can be carried great distances in the air, that they contaminate crops, and that through use of such contaminated vegetation as food and as livestock feed these toxins enter the human food chain. It is now estimated that over 90% of human contamination by dioxins is through this pathway (Franzblau et al., 2010). It is also estimated that dioxin intake creates a life-time cancer risk in the USA population that is 500 - 1000 times greater than the "acceptable one-in-a-million risk" (Commoner et al., 1996).

The chain of events is as follows. The major source of dioxins is incinerators (WHO [World Health Organization], 2010; Health Canada 2013;) and particularly those incinerators that burn municipal and medical waste (Commoner et al., 1996). The main components of incinerator feedstock that are responsible are common MHW items such as food remnants, certain plastics, paper, wood, and old clothes - largely what Entech-Rem states they would be processing if allowed to establish their plant (REM, 2013. Spiral-bound booklet). From incinerators, dioxins and other pollutants are carried in the air, and deposited to enter the soil locally (e.g. Franzblau et al., 2010) or carried far. Dioxins originating in Florida have been identified in the Great Lakes (Commoner et al., 1996). These authors state that "dioxin travels in the air thousands of miles, creating a toxic fallout that settles out everywhere - contaminating not only water, fish and wildlife in the Great lakes, but the farms where cattle are raised to produce milk, dairy products and beef as well" (Commoner et al., 1996).

More importantly, the dioxins do not merely settle, they are actually absorbed in to the vegetation and crops that become food and livestock feed, and they appear in the milk and meat that are destined for human consumption (McLachlan et al., 1990; Fries, 1995; Lorber et al., 1994; Huwe and Larsen, 2005; Franzblau et al., 2010). Most importantly, the poisons **ACCUMULATE** in the crops and in the livestock over time (e.g. WHO [World Health Organization], 2010; Commoner et al., 1996), further underscoring the point

that the claim that only "low levels" are emitted by an incinerator, "within Standards", is **totally meaningless**. As with other mutagens, there is no lower limit below which dioxins can not cause cancer (Energy Justice Network, 2012).

The World Health Organization Fact Sheet quoted above (WHO [World Health Organization], 2010), states: "In terms of dioxin release into the environment, uncontrolled waste incinerators (solid waste and hospital waste) are often the worst culprits, **due to incomplete burning**" [emphasis added]. Entech-Rem have emphasised that in their form of incineration ("gasification"), waste is converted to a mixture of gases called Syngas at **lower temperatures** than is used in other incinerators (Entech-Rem Website, 2013). The information in this WHO report might suggest that the incompleteness of the burning in the Entech process may render the risk of dioxin production and its resulting concentration in the syngas **even higher** than it would be with high temperature incineration.

Conclusion

The HHRE fails to address the very serious health concerns that are associated with the Entech-Rem proposal. In the above I have commented on errors of fact and of scientific validity in the content of the HHRE, and on omissions of extremely important information from the HHRE. The HHRE's conclusions that emissions from an Entech plant would not constitute health risks are patently erroneous.

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