APPENDIX A

COPC Screening

1.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

Identification of COPC for a project that has yet to be constructed involves the review of several sources of information to determine what the relevant chemical emissions would be for the type of project under consideration. Thermal treatment technologies are well understood and there are numerous publications and government agencies that have reported on chemical emissions to air from thermal treatment. By using these sources, it was possible to develop a comprehensive COPC list for the Project, based on the overall design philosophy, specific process units, combustion fuel types, anticipated control technologies, and the methods of transportation. The COPC list also incorporated existing knowledge of the Durham and York Regions, including the results of air quality monitoring within the airshed and knowledge about emissions from existing industries located in the Regions. The following sources were consulted in compiling the COPC list.

- **Durham York Request for Proposals (RFP):**contaminants requested to have guaranteed emissions limits placed on them by the Regions of Durham/York in the project request for proposals (RFP) (Table 1);
- **Jacques Whitford, 2007, Generic Risk Assessment:** The COPC for the assessment were selected by screening ambient air monitoring data from the Durham and York Regions, KMS Peel emissions data, government documents and literature identifying emissions from other thermal treatment facilities. The COPC list for this site-specific HHERA is more comprehensive than the one used for the Generic Risk Assessment.
- **MOE 2004, Guideline A-7 Combustion and Air Pollution Control Requirements for New Municipal Waste Incinerators:** This guideline sets out the minimum requirements for emission control systems and the maximum allowable “in-stack” contaminant emission levels for municipal waste thermal treatment facilities in Ontario. It also sets out the minimum design and operating parameters for thermal treatment facilities utilizing conventional incineration technology.
- **Durham and York Regional ambient air quality monitoring:** Ambient air quality in Ontario has been monitored for over 30 years by the Ministry of the Environment. The chemicals included in the monitoring program represent the potential releases from a variety of industries and are not necessarily associated with thermal treatment facilities. Most recently site-specific ambient air monitoring programs were initiated in September 2007 at the short-listed sites. Baseline ambient air data was collected for SO_2, NO_X, CO, O_3, $PM_{2.5}$, Total Suspended Particulate Matter (TSP), metals, PAH’s, dioxins and furans, wind speed/direction and temperature.
- **EU 2000, Directive on the incineration of waste:** The EU Directive on the Incineration of waste covers both incineration and co-incineration plants (an incineration plant whose primary purpose is the generation of energy or the production of material products). It sets out the maximum allowable stack emission limits for environmental contaminants of concern. It also addresses the minimum operational standards and pollution abatement technologies to be installed at thermal treatment facilities in Europe.
- **US EPA 2005, Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities:** The HHRAP document provides risk assessors with

criteria for evaluating and screening COPCs from combustion facilities. The HHRAP document also describes in detail the Criteria Air Pollutants outlined under the *Clean Air Act*.

Table 1 COPC Requested by the Regions in the RFP

PARAMETER	TEST METHOD	OPERATING LIMIT
Dioxins	arithmetic average of three stack tests	60 pg/Rm^3 measured as TEQ
Cadmium	arithmetic average of three stack tests	7 µg/Rm^3
Cadmium + Thallium	arithmetic average of three stack tests	46 µg/Rm^3
Lead	arithmetic average of three stack tests	50 µg/Rm^3
Mercury	arithmetic average of three stack tests	15 µg/Rm^3
Sum of (As, Ni, Co, Pb, Cr, Cu, V, Mn, Sb)	arithmetic average of three stack tests	460 µg/Rm^3
Total Particulate Matter	arithmetic average of three stack tests	9 mg/Rm^3
Hydrogen Chloride	arithmetic average of 24 hours of data from a continuous emission monitoring system	9 mg/Rm^3
Sulfur Dioxide	arithmetic average of 24 hours of data from a continuous emission monitoring system	35 mg/Rm^3
Hydrogen Fluoride	arithmetic average of 24 hours of data from a continuous emission monitoring system	0.92 mg/Rm^3
Nitrogen Oxides	arithmetic average of 24 hours of data from a continuous emission monitoring system	180 mg/Rm^3
Carbon Monoxide	arithmetic average of 24 hours of data from a continuous emission monitoring system	45 mg/Rm^3
Organic Matter (as Methane)	arithmetic average of three stack tests	49 mg/Rm^3

Not all COPC were considered relevant to the multi-pathway risk assessment because not all COPC released from the Project will persist or accumulate in the environment. The characterization of persistence and bio-accumulation are provided in detail in Environment Canada's Existing Substances Program, and the Health Canada and Environment Canada Domestic Substances List Categorization, under the *Canadian Environmental Protection* Act (CEPA 1999).

Persistence refers to the length of time a chemical resides in the environment and is measured its half-life. This is the time required for the quantity of a chemical to diminish or degrade to half its original amount in a particular environment. Bio-accumulation is a general term used to describe the process by which chemicals are accumulated in an organism directly from

exposure to water or soil; for example, the extent to which a chemical in soil has the ability to accumulate into vegetation.

COPC that were considered in the multi-pathway risk assessment were selected based on their physical and chemical properties and compared to accepted national and international criteria for the classification of persistent (half-life greater than or equal to (≥) six months (182 days)) and bio-accumulative substances (Log K_{ow} ≥ to 5). The principle of this exercise is that if a COPC that is emitted to the air does not meet either of these aforementioned criteria, the potential for the COPC to persist or accumulate in the environment is negligible, and only limited opportunity for exposure via secondary exposure pathways (*i.e.,* all those assessed pathways other than inhalation). Conversely, if a COPC meets either of these criteria, sufficient opportunity may be present for exposure via secondary pathways.

During the peer review process, a question was posed about the exclusion of acrolein and 1,3-butadiene from the COPC list. Acrolein is released to the environment through the incomplete combustion of organic matter. The main combustion source of acrolein is from gas and diesel motor vehicle emissions (CEPA, 1999). It is likely that acrolein would be emitted from a Thermal Treatment Facility; however, the Air Quality Team was unable to locate any emission factors for acrolein for incineration facilities during their review of Canadian, US EPA or CalEPA data sources. Given that motor vehicle emissions to the environment far exceed those that would be expected from a Thermal Treatment Facility (CEPA, 1999), it is not anticipated that its exclusion from the HHRA would alter the overall conclusions of the report.

Although 1,3-butadiene was identified as a COPC in the *Air Quality Assessment Technical Study Report* (Jacques Whitford, 2009e), no credible sources of emissions data for this contaminant were found during the extensive literature review performed for the assessment. Therefore, 1,3-butadiene was considered, but not modelled by the Air Quality Team.

The COPC selection/screening process is presented in Table 2.

Table 2 Selection and Screening of COPCs

COPC	Selected log K_{ow}	Reference	Selected $t_{1/2}$ in Soil (days)	Reference	Carried Forward Based on Phys/Chem?	Final COPC List
Chlorinated Polycyclic Aromatics						
Dioxins and Furans (as TEQ Toxic Equivalents)	**6.80E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Dioxins (as TEQ Toxic Equivalents)
Total PCBs (as Aroclor 1254)	**6.80E+00**	Mackay et al. (2000)	**9.40E+02**	CalEPA (2000)	**YES**	Total PCBs (as Aroclor 1254)
Metals						
Antimony	7.30E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Antimony
Arsenic	6.80E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Arsenic
Barium	1.70E+00	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Barium
Beryllium	-5.70E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Beryllium
Boron	2.30E-01	US EPA (2008)	**1.00E+08**	CalEPA (2000)	**YES**	Boron
Cadmium (Cd)	-7.00E-02	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Cadmium (Cd)
Chromium (hexavalent)	0.00E+00	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Chromium (hexavalent)
Total Chromium (and compounds)	2.30E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Total Chromium (and compounds)
Cobalt	2.29E-01	US EPA (2008)	**1.00E+08**	CalEPA (2000)	**YES**	Cobalt
Lead (Pb)	7.30E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Lead (Pb)
Mercury (Hg)	6.20E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Mercury (Hg)
Nickel	-5.70E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Nickel
Phosphorus	-2.70E-01	US EPA (2008)	**1.00E+08**	CalEPA (2000)	**YES**	Phosphorus
Silver	2.30E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Silver
Selenium	2.40E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Selenium
Thallium	2.30E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Thallium
Tin	1.29E+00	US EPA (2008)	**1.00E+08**	CalEPA (2000)	**YES**	Tin
Vanadium	2.30E-01	ChemID, 2006	**1.00E+08**	CalEPA (2000)	**YES**	Vanadium
Zinc	-4.70E-01	US EPA (2005)	**1.00E+08**	CalEPA (2000)	**YES**	Zinc
Chlorinated Monocyclic Aromatics						
1,2-Dichlorobenzene	3.40E+00	Mackay et al. (2000)	**2.29E+02**	Mackay et al. (2000)	**YES**	1,2-Dichlorobenzene

COPC	Selected log K_{ow}	Reference	Selected $t_{1/2}$ in Soil (days)	Reference	Carried Forward Based on Phys/Chem?	Final COPC List
1,2,4,5-Tetrachlorobenzene	4.50E+00	Mackay et al. (2000)	**2.29E+02**	Mackay et al. (2000)	**YES**	1,2,4,5-Tetrachlorobenzene
1,2,4 – Trichlorobenzene	4.10E+00	Mackay et al. (2000)	**2.29E+02**	Mackay et al. (2000)	**YES**	1,2,4 – Trichlorobenzene
2,3,4,6-Tetrachlorophenol	4.45E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
2,4,6-Trichlorophenol	3.69E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
2,4-Dichlorophenol	3.20E+00	Mackay et al. (2000)	2.29E+01	Mackay et al. (2000)	NO	
Pentachlorophenol	**5.05E+00**	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	**YES**	Pentachlorophenol
Hexachlorobenzene	**5.50E+00**	Mackay et al. (2000)	**2.29E+03**	Mackay et al. (2000)	**YES**	Hexachlorobenzene
Pentachlorobenzene	**5.00E+00**	Mackay et al. (2000)	**7.08E+02**	Mackay et al. (2000)	**YES**	Pentachlorobenzene
Polycyclic Organic Matter						
Acenaphthylene	4.00E+00	Mackay et al. (2000)	**2.29E+02**	Mackay et al. (2000)	**YES**	Acenaphthylene
Acenaphthene	3.90E+00	US EPA (2005)	5.80E+01	Mackay et al. (2000)	NO	
Anthracene	4.50E+00	US EPA (2005)	**2.29E+02**	Mackay et al. (2000)	**YES**	Anthracene
Benzo(a)anthracene	**5.70E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Benzo(a)anthracene
Benzo(b)fluoranthene	**6.12E+00**	US EPA (2005)	**3.30E+02**	Mackay et al. (2000)	**YES**	Benzo(b)fluoranthene
Benzo(k)fluoranthene	**6.10E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Benzo(k)fluoranthene
Benzo(a)fluorene	**5.40E+00**	Mackay et al. (2000)	7.50E+01	US EPA (2008)	**YES**	Benzo(a)fluorene
Benzo(b)fluorene	**5.75E+00**	Mackay et al. (2000)	7.50E+01	US EPA (2008)	**YES**	Benzo(b)fluorene
Benzo(ghi)perylene	**6.50E+00**	Mackay et al. (2000)	**6.20E+02**	Mackay et al. (2000)	**YES**	Benzo(ghi)perylene
Benzo(a)pyrene	**6.00E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Benzo(a)pyrene
Benzo(e)pyrene	**6.44E+00**	US EPA (2008)	**5.70E+02**	CalEPA (2000)	**YES**	Benzo(e)pyrene
Biphenyl	3.90E+00	Mackay et al. (2000)	2.29E+01	Mackay et al. (2000)	NO	
Chrysene	**5.70E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Chrysene
Dibenzo(a,c)anthracene	**6.70E+00**	US EPA (2008)	1.20E+02	US EPA (2008)	**YES**	Dibenzo(a,c)anthracene

COPC	Selected log K_{ow}	Reference	Selected $t_{1/2}$ in Soil (days)	Reference	Carried Forward Based on Phys/Chem?	Final COPC List
Dibenzo(a,h)anthracene	**6.50E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Dibenzo(a,h)anthracene
Fluoranthene	**5.00E+00**	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Fluoranthene
Fluorene	4.20E+00	US EPA (2005)	**2.29E+02**	Mackay et al. (2000)	**YES**	Fluorene
Indeno(1,2,3 – cd)pyrene	**6.60E+00**	US EPA (2005)	**5.70E+02**	CalEPA (2000)	**YES**	Indeno(1,2,3 – cd)pyrene
1 – methylnaphthalene	3.87E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
2 – methylnaphthalene	3.86E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
Naphthalene	3.30E+00	US EPA (2005)	7.08E+01	Mackay et al. (2000)	NO	
Perylene	**6.25E+00**	Mackay et al. (2000)	**7.08E+02**	Mackay et al. (2000)	**YES**	Perylene
Phenanthrene	4.50E+00	US EPA (2005)	**2.29E+02**	Mackay et al. (2000)	**YES**	Phenanthrene
Pyrene	4.90E+00	US EPA (2005)	**7.08E+02**	Mackay et al. (2000)	**YES**	Pyrene
Tetralin	3.96E+00	US EPA (2008)	3.00E+01	US EPA (2008)	NO	
O-terphenyl	**5.52E+00**	US EPA (2008)	7.50E+01	US EPA (2008)	**YES**	O-terphenyl
Volatile Organic Chemicals (VOC)						
Acetaldehyde	-2.20E-01	US EPA (2005)	2.29E+00	Mackay et al. (2000)	NO	
Benzene	2.10E+00	US EPA (2005)	2.29E+01	Mackay et al. (2000)	NO	
Bromodichloromethane	2.10E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
Bromoform (tribromomethane)	2.38E+00	Mackay et al. (2000)	**2.29E+02**	Mackay et al. (2000)	**YES**	Bromoform (tribromomethane)
Bromomethane	1.19E+00	Mackay et al. (2000)	3.00E+01	US EPA (2008)	NO	
Carbon tetrachloride	2.80E+00	US EPA (2005)	**2.29E+02**	Mackay et al. (2000)	**YES**	Carbon tetrachloride
Chloroform	2.00E+00	US EPA (2005)	**2.29E+02**	Mackay et al. (2000)	**YES**	Chloroform
Dichlorodifluoromethane	2.16E+00	Mackay et al. (2000)	7.50E+01	US EPA (2008)	NO	
Dichloroethene, 1,1 -	2.13E+00	Mackay et al. (2000)	7.50E+01	US EPA (2008)	NO	
Dichloromethane	1.30E+00	US EPA (2005)	**2.29E+02**	Mackay et al. (2000)	**YES**	Dichloromethane

COPC	Selected log K_{ow}	Reference	Selected $t_{1/2}$ in Soil (days)	Reference	Carried Forward Based on Phys/Chem?	Final COPC List
Ethylbenzene	3.10E+00	US EPA (2005)	7.08E+01	Mackay et al. (2000)	NO	
Ethylene Dibromide (1,2-dibromoethane)	2.00E+00	US EPA (2005)	3.00E+01	US EPA (2008)	NO	
Formaldehyde	3.50E-01	US EPA (2005)	2.29E+00	Mackay et al. (2000)	NO	
Tetrachloroethene	3.40E+00	US EPA (2005)	7.08E+01	Mackay et al. (2000)	NO	
Tetrachloroethylene	3.40E+00	US EPA (2005)	7.08E+01	Mackay et al. (2000)	NO	
Toluene	2.70E+00	US EPA (2005)	7.08E+01	Mackay et al. (2000)	NO	
Trichloroethane, 1,1,1 -	2.50E+00	US EPA (2005)	**2.86E+02**	Mackay et al. (2000)	**YES**	Trichloroethane, 1,1,1 -
Trichloroethene	2.53E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
Trichlorofluoromethane	2.50E+00	US EPA (2005)	**1.25E+03**	Mackay et al. (2000)	**YES**	Trichlorofluoromethane
Vinyl chloride (chloroethene)	1.38E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	
Xylenes, m-, p- and o-	3.20E+00	Mackay et al. (2000)	7.08E+01	Mackay et al. (2000)	NO	

The list of COPCs included in the inhalation assessment and the multi-pathway risk assessment are displayed in Table 3. While it is recognized that HCl and HF are not commonly referred to as Criteria Air Contaminants, the study team feels that this category is the best placement for these substances.

Table 3 COPCs used in Inhalation and Multi-pathway Risk Assessment

COPC	Human Health Risk Assessment		Ecological Risk Assessment
	Inhalation	Multi-Pathway	
Criteria Air Contaminants			
Sulphur Dioxide (SO_2)	✓		✓
Hydrogen Chloride (HCl)	✓		
Hydrogen Fluoride (HF)	✓		✓
Nitrogen Dioxide (NO_2)	✓		✓
Particulate Matter (PM_{10})	✓		
Particulate Matter ($PM_{2.5}$)	✓		
Total Particulate Matter (TSP)	✓		
Ammonia (Slip at Stack)	✓		
Chlorinated Polycyclic Aromatics			
Dioxins and Furans as Toxic Equivalents (TEQs)	✓	✓	✓
Total PCBs (as Aroclor 1254)	✓	✓	✓
Metals			
Antimony	✓	✓	✓
Arsenic [b]	✓	✓	✓
Barium	✓	✓	✓
Beryllium [b]	✓	✓	✓
Boron	✓	✓	✓
Cadmium (Cd) [b]	✓	✓	✓
Chromium (hexavalent) [b]	✓	✓	✓
Total Chromium (and compounds) [b]	✓	✓	✓
Cobalt	✓	✓	✓
Lead (Pb)	✓	✓	✓
Mercury (Hg)[a]	✓	✓	✓
Nickel	✓	✓	✓
Phosphorus	✓	✓	✓
Silver	✓	✓	✓
Selenium	✓	✓	✓
Thallium	✓	✓	✓
Tin	✓	✓	✓

COPC	Human Health Risk Assessment		Ecological Risk Assessment
	Inhalation	Multi-Pathway	
Vanadium	✓	✓	✓
Zinc	✓	✓	✓
Chlorinated Monocyclic Aromatics			
1,2-Dichlorobenzene	✓	✓	✓
1,2,4,5-Tetrachlorobenzene	✓	✓	✓
1,2,4 – Trichlorobenzene	✓	✓	✓
2,3,4,6-Tetrachlorophenol	✓		
2,4,6-Trichlorophenol [b]	✓		
2,4-Dichlorophenol	✓		
Pentachlorophenol [b]	✓	✓	✓
Hexachlorobenzene [b]	✓	✓	✓
Pentachlorobenzene	✓	✓	✓
Poly Aromatic Hydrocarbons			
Acenaphthylene [b]	✓	✓	✓
Acenaphthene [b]	✓	✓	✓
Anthracene	✓	✓	✓
Benzo(a)anthracene [b]	✓	✓	✓
Benzo(b)fluoranthene [b]	✓	✓	✓
Benzo(k)fluoranthene [b]	✓	✓	✓
Benzo(a)fluorene	✓	✓	✓
Benzo(b)fluorene	✓	✓	✓
Benzo(ghi)perylene [b]	✓	✓	✓
Benzo(a)pyrene [b]	✓	✓	✓
Benzo(e)pyrene [b]	✓	✓	✓
Chrysene [b]	✓	✓	✓
Dibenzo(a,c)anthracene [b]	✓	✓	✓
Dibenzo(a,h)anthracene [b]	✓	✓	✓
Fluoranthene [b]	✓	✓	✓
Fluorene	✓	✓	✓
Indeno(1,2,3 – cd)pyrene [b]	✓	✓	✓
1 – methylnaphthalene	✓		
2 – methylnaphthalene	✓		
Naphthalene	✓		
Perylene [b]	✓	✓	✓
Phenanthrene [b]	✓	✓	✓
Pyrene [b]	✓	✓	✓

COPC	Human Health Risk Assessment		Ecological Risk Assessment
	Inhalation	Multi-Pathway	
Volatile Organic Chemicals (VOC)			
Acetaldehyde [b]	✓		
Benzene [b]	✓		
Biphenyl	✓		
Bromodichloromethane	✓		
Bromoform (tribromomethane)	✓	✓	✓
Bromomethane	✓		
Carbon tetrachloride [b]	✓	✓	✓
Chloroform [b]	✓	✓	✓
Dichlorodifluoromethane	✓		
Dichloroethene, 1,1 -	✓		
Dichloromethane [b]	✓	✓	✓
Ethylbenzene	✓		
Ethylene Dibromide (1,2-dibromoethane) [b]	✓		
Formaldehyde [b]	✓		
O-terphenyl	✓	✓	✓
Tetrachloroethylene [b]	✓		
Toluene	✓		
Trichloroethane, 1,1,1 -	✓	✓	✓
Trichloroethylene, 1,1,2 [b]	✓		
Trichlorofluoromethane	✓	✓	✓
Vinyl chloride (chloroethene) [b]	✓		
Xylenes, m-, p- and o-	✓		

Notes:
[a] – Inorganic and methylmercury
[b] – This chemical was evaluated as a non-carcinogen and a carcinogen

2.0 REFERENCES

Canadian Environmental Protection Agency (CEPA). 1999. Priority Substances List Assessment Report. Acrolein. CEPA and Health Canada.

Environment Canada 2006. Priority Substance List Assessment Reports. Canadian Environmental Protection Act (CEPA) Environmental Registry. Environment Canada. Existing Substances Branch. Available at http://www.ec.gc.ca/CEPARegistry/subs_list/Priority.cfm

European Union. 2000. Directive 2000/76/EC of the European parliament and of the council of 4 December 2000 on the incineration of waste.

Jacques Whitford Limited, 2008. Draft Air Quality Technical Report for the Durham York Residual Waste Study.

Jacques Whitford Limited & Genivar, 2007. Generic Risk Assessment Report for the Durham York Residual Waste Study.

Mackay D., Shiu W-Y., Ma K-C. 2000. Physical Chemical Properties and Environmental Fate Handbook. Chapman & Hall/CRCnetBASE. Compact Disc.

MOE, 2004. Guideline A-7: Combustion and Air Pollution Control Requirements for New Municipal Waste Incinerators. Ontario Ministry of the Environment. Accessed in 2009 from http://www.ene.gov.on.ca/envision/gp/1746e.pdf

US EPA, 2005. Human Health Risk Assessment Protocols for Hazardous Waste Combustion Facilities. Office of Solid Waste and Emergency Response, United States Environmental Protection Agency. Accessed in 2009 from http://www.epa.gov/epawaste/hazard/tsd/td/combust/riskvol.htm#volume1

US EPA. 2008. Estimation Programs Interface (Epi) Suite™. Office of Pollution Prevention Toxics and Syracuse Research Corporation (SRC).