

5	<p>Opinion box – PCB Management issues (Please describe briefly)</p> <p>What are your major concerns?</p> <p>Can you identify research and development needs in PCB management that would be beneficial for your region and waste managers worldwide?</p>
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Block II				Types of PCB wastes			
Part A: Treatment of PCB containing equipment/material							
Part A1: Metallic Parts							
A1.1	Types of metallic PCB equipment/material treated:			Limitation on waste accepted <i>(please specify, if appropriate)</i>			
				Concentration <i>(specify the unit)</i>		Quantity <i>(specify the unit)</i>	
				min	max		
	<input checked="" type="checkbox"/> Equipment containing 100% PCB			No limitations			
	<input checked="" type="checkbox"/> Equipment containing mineral oil contaminated by PCB			No limitations			
<input type="checkbox"/> Others:							
<i>Please specify any other limitation on waste accepted:</i>							
There is no limitation on the concentration of PCBs in material. The GPCR technology can treat 100% strength organic material, including 100% PCBs.							
A1.2	Preparation of metallic equipment/material						
	In what form must the metallic PCB equipment/material be presented:						
	<input checked="" type="checkbox"/> Drums						
	<input checked="" type="checkbox"/> Other packaging: Pallets, coffins, smaller containers, etc.						
	<input checked="" type="checkbox"/> Other constraints: There are no other constraints on the form of waste. The technology can handle PCB waste in any matrix. Integrity of the container must be sound (i.e. no leaking containers).						
A1.3	Treatment of metallic PCB equipment/material						
	Immediate destruction of metallic equipment/material containing PCB? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>						
	If "Yes", please specify the applied technology in Part III						
	Extraction of PCB? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>						
	If "Yes":						
	<ul style="list-style-type: none"> • Please specify the applied technology in Part III • Is the decontaminated metallic equipment/material subjected to reuse/recycling? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 						
	If "Yes", please specify in Block II Part C (Reuse and recycling)						

Part A: Treatment of PCB containing equipment/material				
Part A2: Non-metallic Parts				
A2.1	Types of non-metallic PCB equipment/material treated:	Limitation on waste accepted <i>(please specify, if appropriate)</i>		
		Concentration <i>(specify the unit)</i>		Quantity <i>(specify the unit)</i>
		min	max	
	<input checked="" type="checkbox"/> PCB-containing materials (clothes, cables, etc.)	0 %	100 %	1 drum/day
	<input checked="" type="checkbox"/> PCB-contaminated residues, sludges	0 %	100 %	1 drum/day
	<input checked="" type="checkbox"/> PCB-contaminated soils and sediments	0 %	100 %	1 drum/day
	<input checked="" type="checkbox"/> Packaged/drummed waste	0 %	100 %	1 drum/day
	<input checked="" type="checkbox"/> Others: Any PCB-contaminated solid	0 %	100 %	1 drum/day
<i>Please specify any other limitation on waste accepted:</i>				
None				
A2.2	Preparation of non-metallic equipment/material			
	In what form must the non-metallic PCB equipment/material be presented:			
	<input checked="" type="checkbox"/> Drums			
	<input checked="" type="checkbox"/> Other packaging: Pallets, coffins, smaller containers, etc.			
	<input type="checkbox"/> Other constraints: There are no other constraints on the form of waste. The technology can handle PCB waste in any matrix. Integrity of the container must be sound (i.e. no leaking containers).			
A2.3	Treatment of non-metallic PCB equipment/material			
	Immediate destruction of non-metallic equipment/material containing PCB? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>			
	If "Yes", please specify the applied technology in Part III			
	Extraction of PCB? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>			
	If "Yes":			
	<ul style="list-style-type: none"> • Please specify the applied technology in Part III • Is the decontaminated non-metallic equipment/material subjected to reuse/recycling? Yes <input type="checkbox"/> No <input type="checkbox"/> 			
	If "Yes", please specify in Block II Part C (Reuse and recycling)			

Part B: Treatment of PCB oils and PCB waste oils				
B1	Types of PCB oils and PCB waste oils treated:	Limitation on waste accepted <i>(please specify, if appropriate)</i>		
		Concentration <i>(specify the unit)</i>		Quantity <i>(specify the unit)</i>
		min	max	
	<input checked="" type="checkbox"/> 100% PCB oils	0 %	100 %	1 drum/day
	<input checked="" type="checkbox"/> Mineral oils contaminated by PCB	0 %	100 %	1 drum/day
<input checked="" type="checkbox"/> Waste oils contaminated by PCB	0 %	100 %	1 drum/day	
<input checked="" type="checkbox"/> Others: Any oil	0 %	100 %	1 drum/day	
<i>Please specify any other limitation on waste accepted:</i>				
None				
B2	Preparation of PCB oil and PCB waste oil In what form must the PCB oil and PCB waste oil be presented: <input checked="" type="checkbox"/> Drums <input checked="" type="checkbox"/> Other packaging: Pallets, coffins, smaller containers, etc. <input type="checkbox"/> Other constraints: There are no other constraints on the form of waste. The technology can handle PCB waste in any matrix. Integrity of the container must be sound (i.e. no leaking containers).			
B3	Treatment of PCB oils and PCB waste oils Please specify the applied technology for the destruction of PCB oils and PCB waste oils in Part III			

Part C: Reuse & Recycling of decontaminated PCB equipment/material																				
C1	<table border="1"> <thead> <tr> <th rowspan="2">Types of decontaminated PCB equipment/material treated:</th> <th>Limitation on waste accepted <i>(please specify, if appropriate)</i></th> </tr> <tr> <th>Quantity <i>(specify the unit)</i></th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/> Transformers</td> <td>1 drum/day</td> </tr> <tr> <td><input checked="" type="checkbox"/> Capacitors</td> <td>1 drum/day</td> </tr> <tr> <td><input checked="" type="checkbox"/> Materials (clothes, cables, etc.)</td> <td>1 drum/day</td> </tr> <tr> <td><input checked="" type="checkbox"/> Residues, sludges</td> <td>1 drum/day</td> </tr> <tr> <td><input checked="" type="checkbox"/> Soils and sediments</td> <td>1 drum/day</td> </tr> <tr> <td><input checked="" type="checkbox"/> Others: Activated Carbon</td> <td>1 drum/day</td> </tr> <tr> <td colspan="2"><i>Please specify any other limitation on waste accepted:</i></td> </tr> <tr> <td colspan="2">None</td> </tr> </tbody> </table>	Types of decontaminated PCB equipment/material treated:	Limitation on waste accepted <i>(please specify, if appropriate)</i>	Quantity <i>(specify the unit)</i>	<input checked="" type="checkbox"/> Transformers	1 drum/day	<input checked="" type="checkbox"/> Capacitors	1 drum/day	<input checked="" type="checkbox"/> Materials (clothes, cables, etc.)	1 drum/day	<input checked="" type="checkbox"/> Residues, sludges	1 drum/day	<input checked="" type="checkbox"/> Soils and sediments	1 drum/day	<input checked="" type="checkbox"/> Others: Activated Carbon	1 drum/day	<i>Please specify any other limitation on waste accepted:</i>		None	
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None																				
C2	<p>Presentation of decontaminated PCB equipment/material</p> <p>In what form must the decontaminated PCB equipment/material be presented:</p> <p><input checked="" type="checkbox"/> Drums</p> <p><input checked="" type="checkbox"/> Other packaging: Pallets, coffins, small containers, bags, etc.</p> <p><input type="checkbox"/> Other constraints: None</p>																			
C3	<p>Treatment of decontaminated PCB equipment/material</p> <p>Reuse and Recycling of decontaminated PCB equipment/material? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If "Yes", please specify the applied technology in Part III</p> <p>Is the decontaminated PCB equipment/material disposed of? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>If "Yes", please specify:</p> <p>Transport to the disposal site? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If "Yes": <input checked="" type="checkbox"/> International transport <input checked="" type="checkbox"/> National transport</p> <p>Location of disposal site: Cleaned PCB equipment/material goes to whatever site the client selects.</p> <p>Please provide a short description of disposal site:</p>																			

Block III		Detailed information on applied technologies
1	The following description refers to Block II, Part:	Type of PCB waste or decontaminated equipment/material:
	<input checked="" type="checkbox"/> A1 (Treatment of metallic PCB equipment/material)	
	<input checked="" type="checkbox"/> A2 (Treatment of non-metallic PCB equipment/material)	
	<input checked="" type="checkbox"/> B (Treatment of PCB oil and PCB waste oil)	
	<input checked="" type="checkbox"/> C (Reuse and recycling of decontaminated PCB equipment/material)	
2	<p>Applied Technologies</p> <p><input type="checkbox"/> Pyrolysis/gasification</p> <p><input checked="" type="checkbox"/> Gas Phase Chemical Reduction (GPCR)</p> <p><input type="checkbox"/> Base Catalysed Decomposition (BCD)</p> <p><input type="checkbox"/> Sodium Reduction</p> <p><input type="checkbox"/> Super-Critical Water Oxidation (SCWO)</p> <p><input type="checkbox"/> Plasma Arc</p> <p><input type="checkbox"/> Molten Salt Oxidation</p> <p><input type="checkbox"/> Solvated Electron Technology</p> <p><input type="checkbox"/> Retrofilling</p> <p><input type="checkbox"/> Other:</p> <p>Type of technology (1-sentence description):</p> <p>Gas-Phase Chemical Reduction is a non-incineration technology whereby hydrogen and heat are used to reduce PCBs to methane and HCl.</p> <p>Description of the technology Please provide additional information as appropriate (<i>summarize here and, if necessary, attachment documentation</i>)</p> <p>Gas-Phase Chemical Reduction (GPCR) involves the reduction of organic compounds by hydrogen at temperatures of 850°C or greater. Organic compounds are ultimately reduced to methane, hydrogen chloride or hydrogen fluoride (if the waste is chlorinated or fluorinated, respectively), and minor amounts of low molecular weight hydrocarbons (benzene and ethylene). The hydrochloric acid and/or hydrobromic acid is neutralized by addition of caustic soda during initial cooling of the process gas, or can be taken off in acid form for reuse, if desired. Cooled, scrubbed gas from the reactor ("Product Gas") is compressed and analyzed. Product gas can then be reused as a fuel for plant components, or consumed in a burner.</p> <p>Eco Logic's GPCR™ technology can be broken down into three basic unit operations: the front-end system (where the contaminants are rendered into a suitable form for destruction in the reactor), the reactor (which reduces the contaminants, now in gas phase, using hydrogen and steam), and the gas scrubbing and compression system. The front-end units will differ depending on the waste matrix. For example, bulk solids such as drummed chemicals, electrical equipment, spent carbon, etc., are placed into a Thermal Reduction Batch Processor (TRBP), which desorbs the contaminants from the solid material, and then conveys them to the reactor for destruction. Watery wastes and high-</p>	

strength oily wastes are injected into a preheater that vaporises the liquids in an indirectly fired heat exchanger. The gases are mixed with hydrogen and steam to a temperature of 600°C prior to introduction to the GPCR™ reactor.

In the case of soil and sediment treatment, contaminants are first desorbed from the solids using a thermal desorption device (of which there are many proven and available worldwide). The gas containing the contaminants is then condensed, the water removed, and the remaining concentrated contaminant liquid fed to the preheater and GPCR™ reactor as a liquid waste feed.

See attached documentation for more detail.

Commissioned? Yes No Year: Various since 1995 (GPCR Demonstration Unit since 2000)

Can the technology be used in a mobile facility? Yes No

3 State of Development

Does the technology exist as an industrial unit? Yes No:

If "No", please indicate when it will become operational:

If "Yes", please indicate how many units exist: 2 (3rd in progress)

In what countries: Canada, Japan, pending for Slovakia

4 Pretreatment

Does the technology require any pretreatment procedures? Yes No

If "Yes", please specify required pretreatment procedures:

Thermal Desorption only for soil/sediment treatment

Dilution

Low Temperature Rinsing

Electro-osmosis

Draining/Solvent Washing

Dismantling/Shredding

Other:

5 Byproducts

What byproducts does the technology produce? (please specify below)

Byproduct	Kind	Amount
Liquids:	Scrubber Effluent	40 - 120 L per tonnes of waste treated
Solids:	Clean Treated Solids (no slag or fly ash are produced)	See note below
Air:	Stack emissions from burning clean product gas	120 - 400 m ³ per tonnes of waste treated

	<p>Does the technology allow all byproducts to be monitored for POPs/PTS before release? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If POPs/PTS are discovered, can the byproducts be returned to the process for further treatment? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Are any of the byproducts classified as other sorts of hazardous wastes? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>If "Yes", please specify:</p> <p>What volumes of such byproducts are generated by handling a unit volume of PCB wastes:</p> <p>Can third party monitoring data be provided? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <i>If "Yes", please attach to this questionnaire</i></p>
	<p>How are byproducts disposed of? <i>(please describe briefly)</i></p> <p>Byproducts are non-hazardous, nevertheless a licensed hazardous waste disposal company is used to take away byproducts.</p> <p>Solids: Contaminated solids are treated and the contaminants are destroyed. The cleaned solids may be landfilled or be sent to a metals recycler.</p> <p>Liquid: Effluent from the scrubber is water with dissolved solids. In the past we have received permits for municipal sewer disposal and for open water discharges.</p> <p>Air: The product gas is a clean gas containing methane that can be used as a fuel. Air emissions from the methane combustion are normal products of combustion.</p>
6	<p>Efficiency <i>(please specify, if appropriate)</i></p> <p>Destruction efficiencies (DEs): > 99.9999 %</p>

9	<p>Treatment capacities and scaling (<i>tonnes per year for main waste & equipment types</i>)</p> <p>Capability of existing facilities: 1000 – 3000 Tonnes per year (PCB oil and electrical equipment – soil capacity is significantly higher) (multiple units can be used at a single site to increase capacity)</p> <p>Can the technology be adapted to higher or lower capacities? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If "Yes":</p> <p>(i) What is the capacity of the smallest commercially viable facility: 40 – 80 Tonnes per year</p> <p>(ii) What is the capacity of the largest commercially viable facility: 1000 – 3000 Tonnes per year (PCB oil and electrical equipment – soil capacity is significantly higher) (multiple units can be used at a single site to increase capacity)</p> <p>Does the adaptation cause additional costs? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If "Yes", specify the increase in costs for the adaptation (%) of the initial costs:</p> <p>(i) For smaller plants: 50 % increase in cost for 100% increase in capacity</p> <p>(ii) For larger plants: 50 % increase in cost for 100% increase in capacity</p>
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Block IV**Facility: Address and Service Information**

1	<p>Facility Name</p> <p>Address: Eco Logic, 143 Dennis Street City/Town: Rockwood P.O. Box: District/State: Ontario Country: Canada Telephone: 519-856-9591 Fax: 519-956-9235 Email: beth.kummling@ecologic.ca Web site: www.ecologic.ca</p> <p>Person completing form</p> <p>Name: Beth Kümmling, M.Sc. Position: Director of Business Development</p> <p>Parent Company (if different)</p> <p>Address: City/Town: P.O. Box: District/State: Country: Telephone: Fax: Email: Web site:</p>
2	<p>Other Services offered by the company</p> <p><input type="checkbox"/> Laboratory analysis/testing</p> <p><input type="checkbox"/> PCB waste packaging for shipment</p> <p><input type="checkbox"/> PCB classification/labelling</p> <p><input type="checkbox"/> Clean-up of PCB contaminated sites</p> <p><input type="checkbox"/> PCB waste transport</p> <p><input type="checkbox"/> Other PCB-related services:</p>
3	<p>Further information</p> <p>Identify any company information (brochures, notes, etc.) provided separately and if you wish provide additional comments on your services in not more than 50 words:</p>

Additional material:

- General technology information
- Third-party data