

Gas-Phase Chemical Reduction (GPCR) – Annex to Pesticides Treatment Technology Fact Sheet

Table 1: Technology overview Alternative Waste technologies – Summary-Technical Details

Technology Provider	Technology	Scale+	Pest Comp. treated	Related comp treated	Validation project experience**	Applicability Ranking++	Additional Remarks	Others
Eco Logic	GPCR	F	DDT and mixed	PCBs		DA	Commercial operation of full-scale GPCR plant treating DDT, PCBs and other organochlorine pesticides	
Eco Logic	GPCR	F	HCB			DA	Commercial-scale engineering trial treating increasing quantities of HCB	
Eco Logic	GPCR	F		PCBs		DA	Treatment of PCB-contaminated material including electrical equipment, oil (askarel), concrete, personal protective equipment, and other dunnage.	
Eco Logic	GPCR		DDT, DDD, DDE soil			DA	Treatability testing on pesticide-contaminated soil from the Naval Air Station Patuxent River Site, MD.	
+Key: F - Full-scale applications completed						++Key: Applicability ranking for pesticides		
P - Pilot/Demonstration scale completed; no F-applications						DA – Direct applicable		
B - Bench/Laboratory scale completed; no P or F-applications						FS 1 – Full scale within reasonable period possible 0-2 years		
T - Theoretical applicable, no B, P, F applications						FS 2 – Full scale within considerable period possible 2-5 years		
* Vendor claims performance of demonstration, but no data provided						**Validation on the basis of info provided in Table 2 and 3		

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Table 2: Overview project experience per technology supplier

Location/project	Contaminants	Amount treated in tons	Results incl. DRE, Pre-treat, Post treat Emissions, energy consumption, costs*	Client References Name, address, contact person phone, Email, fax
Kwinana, Western Australia - Routine Operations and Regulatory Testing	DDT (in a toluene mixture); other organochlorine pesticides; PCBs	Approximately 500 tons pesticides, 1500 tons PCBs	Regulatory Testing Results: Destruction Efficiencies of 99.999984% and 99.999968 % for DDT and 99.999998% for PCBs (takes into account gaseous, liquid and solid outputs); no PCBs or DDT detected in outputs.	Please see list at end of tables.
Kwinana, Western Australia – Pilot- and Commercial-scale treatability testing	Pilot testing – Laboratory-scale study treating pure HCB solid and mixed hexachlorinated solid	Pilot Testing: Treatment of 2 sample types: pure HCB and solid containing 66% HCB, 17% HCBd, 2% HCE, 15% unknown Engineering Trials: Total of 8 tons of HCB waste	Pilot Testing Results: ` Destruction Efficiencies for both waste samples was 99.9999% for HCB; no analysed hexachlorinated compounds were detected in post-test scrubber water. Commercial-Scale Engineering Trial: Destruction and Removal Efficiencies for HCB in Tests 1, 2, and 3 respectively are 99.9999974%, 99.9999938%, and 99.9999922%	
General Motors of Canada Limited, Commercial-scale testing	Regulatory Testing - High-strength PCB oil Routine Operations - PCBs	89 tons PCB oil and water waste, 576 tons electrical equipment and misc. bulk solids, 191 tons soil, concrete, and asphalt, 70 tons soil	Regulatory Testing Results: Destruction Efficiencies of 99.9999996%, 99.9999985%, and 99.9999808% for PCBs, 99.9999836%, 99.9999972%, and 99.9999971% for chlorobenzenes, and 99.999 to 99.9999% for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (takes into account gaseous, liquid and solid outputs).	
Brown & Root Environmental – testing conducted at Eco Logic’s test facility, Rockwood, Ontario	Treatability testing – pesticide-contaminated soil	Conducted 2 test runs treating 7.5 pounds per hour of soil for over 2.5 hours. Soil contained 690 and 440 ppm DDT for Runs 1 and 2, respectively.	Destruction and Removal Efficiency for DDT in the soil was 99.999987% and 99.999985% for Runs 1 and 2, respectively. No DDT was detected in the process outputs except for Run 2 treated soil, which contained 0.004 ppm DDT.	

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Table3: Overview detailed project information per project – Project name (from Table 2):

Location project	Pre-treat mg/kg	Post-treat mg/kg	DREs	Emissions 1. Air (HCl, Dioxins & furans etc) 2. Water, 3. Waste (slags)	Energy consumption	Costs(Capital, operating costs)	Others, remarks
Kwinana, Regulatory Testing	July 1995: 30.3% DDT February 1996: 5.6% DDT	Stack Gas: < 1.7 µg/m ³ (1995); < 0.80 µg/m ³ (1996)	99.999984 % (1995) 99.999968 % (1996) Note: includes all outputs, not just stack gas	Waste-specific compounds non-detect in air, solid and liquid outputs; no slag created; detailed data no longer available		Prototype plant - cost data not valid; current estimates are approximately US\$2500 - \$3000 per tonne for bulk solid and liquid waste feeds; approximately US\$200 and up (depending on quantity) for soil and sediment feeds	
Kwinana, – Pilot- and Commercial-scale treatability testing	Waste Input: 514kg–Test 1 1584kg–Test 2, 4610kg–Test 3	Treated Solids: 2kg–Test 1 23kg–Test 2 94kg–Test 3	HCB: 99.9999974% 99.9999938% 99.9999922% Chlorobenzene: 99.9999897% 99.9999863% 99.9999869%			See above	
General Motors of Canada Limited, Regulatory testing	50% PCBs 30% Chlorobenzenes		PCBs: 99.9999996%, 99.9999985%, 99.9999997% for Tests 1, 2, and 3, respectively. Chlorobenzenes 99.9999842% 99.9999985% 99.9999977% for Tests 1, 2, and 3, respectively.			Demonstration plant only, and so cost data not applicable to commercial operations. See information on Kwinana site above.	
Brown & Root Environmental – testing conducted at Eco Logic’s test facility, Rockwood, Ontario	Untreated Soil: 690 and 440 ppm DDT for Runs 1 and 2, respectively.	Treated Soil: <0.006 and 0.004 ppm DDT for Runs 1 and 2, respectively.	DRE DDT: 99.999987% and 99.999985% for Runs 1 and 2, respectively.			Demonstration plant only, and so cost data not applicable to commercial operations. See information on Kwinana site above.	

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Table 4: Client References for GPCR Plant in Australia

<i>Organization</i>	<i>Contact</i>	<i>Description/Notes</i>
Western Australia Department of Environmental Protection (DEP)	Local Rep - Paul Byrnes, Manager Kwinana Branch Tel 61-8-9419-5500 Perth Rep - Adam Parker, Director Waste Management Division Tel 61-8-9222-7160	<ul style="list-style-type: none"> - General knowledge of our Kwinana operation - in 1999/2000 oversaw the processing of several hundred tonnes of Chemical Collection pesticide waste from Western Australia
CSPB	Nathan Dixon - Manager Laboratory Tel 61-8-9411-8221	<ul style="list-style-type: none"> - Chemical manufacturer - Supplied PCB waste for destruction
Nufarm	Chris Lee - Plant Manager Tel 61-8-9411-4000	<ul style="list-style-type: none"> - Agricultural chemical manufacturer - Supplied over 100 tonnes of 2,4-D, other phenoxy acetic acids, and other miscellaneous pesticides, including DPE, rubbish, soils, old drums, etc., for destruction
Western Power	Roman Mandyczewsky - Principal Scientific Officer Tel 61-8-9326-4895	<ul style="list-style-type: none"> - Western Australia's electricity generation and distribution company - supplied mostly PCBs, but also roughly 40 tonnes of Dieldrin contaminated sludge, oil, residue from old tanks of 'pole-mix' (power pole insecticide) - Mr. Mandyczewsky is also aware of the original DDT work performed for the Dept. of Agriculture -
HATLAR Environmental	George Hatzimihalis - Managing Director Tel 61-3-9629-5300	<ul style="list-style-type: none"> - HATLAR Environmental managed many of Western Australia's used pesticide collection and redrumming operations - Used the GPCR plant exclusively for destruction -
ESI	Trevor Bridle - Technical director Tel 61-8-9473-3302.	<ul style="list-style-type: none"> - Member of Australia's National Advisory Board

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**Estimated Utility Requirements for Semi-Mobile GPCR Plant
Treating 70 Tonnes Pesticides per Month**

Utility	Units	Quantity
Nitrogen	m ³ /month	3,800
Carbon Dioxide	kg/month	2,260
Caustic (50%)	tonnes/month	38
Fresh Water (for scrubbing system)	L/month	48,000
Cooling Water (recirculating volume)	L/min	1,600
Power (peak demand)	kW	1,000
Natural Gas (normal usage)	tonnes/month	20
Natural Gas (maximum)	tonnes/month	122
Hydrogen	m ³ /month	122,600