

Table 1: Technology overview technology – Summary-Technical Details

Technology Provider	Technology	Scale +	Pest Comp. treated	Related comp treated	Validation project experience **	Applicability Ranking ++	Additional Remarks
Thermal and Chemical Soil Remediation Ltd, (TCSR), Czech Rep.	BCD + thermal desorption	PS + FS	HCB, Lindane	PCDDs and PCDFs		DA	Treatment of one of world most contaminated sites with dioxins, 2003 and 2004 under execution. Full scale operation started 2006. To date 29,000 t of 38,000 t contaminated soil and building rubble have been treated. Almost 200 t of waste chemicals and 300 t of concentrated contaminants from the soil treatment have been treated in the BCD reactors.
BCD Technologies	BCD	FS	??	PCB's		DA	Permanent treatment facility in Brisbane
Enterra (ADI)	ADOX/BCD	FS	Chlorinated benzenes, chlorophenols, Pesticides waste	dioxins, furans waste		DA	North Homebush Olympic site. Only made trials on chloro-organics (not pesticides). ADOX/BCD batch plant upgraded to 2 m ³ effective capacity to allow treatment of quantity of chlorinated benzene present
SoilTech ATP System	mobile anaerobic thermal processor (ATP) system in conjunction with alkaline polyethylene glycol (APEG) dechlorination	FS		PCB's /arachlor Soil		DA	Full Scale 42000 t Wide Beach, 1991 Superfund site in. 2 m3 cap. Plant
SoilTech ATP System		FS		PCB's in soil		DA	Outboard Marine Corp.(OMC), 1992, Superfund Site, Waukegan, Illinois, in 12,755 t contaminated soil & sedim.
ETG (Therm-O-Detox system)		FS		PCP in soil		DA	SITE demonstration at Koppers Company Superfund site in Morrisville, North Carolina
IT Corporation		FS		PCB-contaminated soil		DA	At U.S. Navy facilities in Guam 10,000 tons of soil (1994-96).
ETG		FS		Soil contaminat. with Dioxin and Pesticides		DA	New York State Dept of Environ. Conserv. cleanup site Binghamton, New York (1997) 2,500 tons



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ETG	BCD in conjunction with Therm-o-Detox® system	P		PCBs, dioxin/ furan in soil		DA	Warren Country Landfill. State of Carolina Dept. of Environment and Natural Resources
S.D. Myers de Mexico	BCD	FS		PCB's			Permanent treatment facility
Ebara Corporation	BCD	FS		Low concentrations PCB's, PCDD + PCDF, Dioxin-like PCBs		DA	
Ebara Corporation	BCD	B		PCB's pure			Ebara plant at Chubu Electric Power Company Recycling Center
+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			

**Table 2- Part 1:
Overview project experience per technology suppliers in Australia
BCD Technologies, Enterra-Australia**

Location/project	Contaminants	Amount treated in tons	Results incl DRE, Pre-treat, Post treat, Emissions, energy consumption, costs*	Client References Name, address, contactperson phone, Email , fax
BCD Technologies Treatment plant, Brisbane				
Thermal and Chemical Soil Remediation Ltd, (TCSR), Czech Republic	HCB, Lindane, PCDDs and PCDFs	To be treated 200 t of waste pesticide chemicals and 1200-1500 t of dioxin and pesticide concentrate from soil remediation	Tests DEs of 99.99–99.9999% for dioxins	Czech Ministry of Environment
ADI's St. Marys site (Sydney)				ADI (Australian Defence Industry)
ADI's Footscray site (Victoria)				ADI (Australian Defence Industry)
ADI Marybyrnong site (Victoria)				ADI (Australian Defence Industry)
North Homebush Olympic site	Chlorinated benzenes, chlorophenols, Pesticides, dioxins, furans waste	400 t test runs PCB treatment: 1,06 – 4.432 t/h	Performance tests DE>99.9999% for DDT, Dieldrin, Lindane and PCP	Olympic Co-ordination Authority (OCA) Enterra, Bala Kathiravelu bala.k@compuserve.com Ph: + 03 9819 0284

*In case of more details per project Table 3 should be used



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**Table 2 – Part 2:
Overview project experience per technology suppliers in US and Mexico
SoilTech ATP System, Therm-o-Detox system and S.D. Myers de Mexico**

Location/project	Contaminants	Amount treated in tons	Results incl DRE, Pre-treat, Post treat, Emissions, energy consumption, costs*	Client References Name, address, contactperson phone, Email , fax
Wide Beach Superfund site	PCB's in soil	42,000		
Outboard Marine Corporation (OMC), Superfund Site	PCB's in soil and sediment	12,755		
SITE demonstration at the Koppers Company Superfund Site	PCP		Treated soil met the cleanup goal of 95 ppm PCP and 7 ug/ kg 2,3,7,8-tetrachlorodibenzo-p-dioxin equivalents in all test runs LTR batch tests reduced PCP concentrations by 96.89% or better, and total dioxin and total furan concentrations by 99.97% or better	
Smith Farm, Louisville, Kentucky	PCBs, pesticides and solvents in soil	30,000		
U.S. Navy facilities in Guam	PCBs in soil	10,000		US Navy
Site in Binghamton, New York (1997)	Dioxin and Pesticides in soil	1500 cubic yards		New York State Department of Environmental Conservation
Inactive Wood Preserving Facility, Kalamazoo, Michigan	PCP	220 cubic yards		
Warren County PCB Landfill	PCB, dioxin/furan in soil	Pilot scale test Full scale Under execution 40,000 tons at present	PCB levels in soil were reduced from 259-853 ppm to 0-2.55 ppb. Dioxin levels were reduced from 147-238 ppt TEQ to 0-3 ppt TEQ. No data yet	State of Carolina Dept. of Environment and Natural Resources
S.D. Myers de Mexico	PCB's	2,500-3,000 t to date of PCB contaminated Oil and pure PCB's		Permanent treatment Facility 2,600 gallon BCD plant

*In case of more details per project Table 3 should be used

**Table 2 – Part 3:
Overview project experience per technology suppliers in Japan
Ebara Corporation**

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
Chubu Electric Power Company Recycling Center	PCB's	22 t/day 4906.2 kL (end of June 2006)		
Chubu Electric Power Company Recycling Center	PCDD+PCDF, Dioxin-like PCB's	22 t/day		
Ebara Corporation Fujisawa plant	Pure PCB's	10 kg/4 hrs (Batch of 10 kg)		
Ebara Corporation Fujisawa plant	High concentrated PCB's	10 kg/4 hrs		



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Table 3: Overview detailed project information per project – Project name (from Table 2):

Locat project	Pre-treat mg/kg	Post-treat mg/kg	DRE's	Emissions			Energy Consumption.	Costs(Capital , operating costs)	Others, remarks
				1. Air (HCL, Diox/furans etc)	2. Water,	3. Waste (slags)			
Wide Beach Superfund site	10 to 5,000 mg/kg PCB	< 0.5 mg/kg	NR	PCB's 1x10 ⁻⁵ (Requir. 3.3x10 ⁻⁵) lb/hr PEG 4.0x10 ⁻⁵ (Requir. 4.16x10 ⁻⁵ lb/hr Particulates 0.04 (Requir 0.05gr/dscf)					
Outboard Marine Corporation (OMC), Superfund Site	Soil and sediment 2,400 to 23,000 mg/kg PCBs	Soil and sediment 0.4 mg/kg to 8.9 mg/kg PCB's	soil and sediment; average PCB removal efficiency of 99.98% most samples less than 2 mg/kg	Regulatory Requirements Air - PCBs: Destruction and Removal Efficiency (DRE) of 99.9999%, Dioxins/Furans: 30 ng/dscm met for dioxins/furans after system modifications			109 US /t + 900.000 US costs before treatment (incl. mobilisation etc)		
SITE demonstration at the Koppers Company Superfund Site	OCDD and total HpCDD 15000 mg/kg and 2000 mg/kg resp. (1)	PCP's 0.14 - 1.06 mg/kg (0.49mg/kg average); OCDD and total HpCDD concentrations to below detection limits (approx. 20 mg/kg) (1)	PCP> 8000 mg/kg and lesser concentration of dioxins and furans in the soil.(1) Removal efficiencies of 99.97% or better for PCP and 99.56% or better for total dioxins and total furans						
Smith Farm, Louisville, Kentucky									
U.S. Navy facilities, Guam									
Binghamton, New York									
Warren County PCB Landfill	PCB levels in soil from 259-853 ppm Dioxin levels from 147-238 ppt TEQ	PCB 0-2.55 ppb Dioxin 0-3 ppt TEQ		Air emission standards (a the property line) of 8x10 ⁻⁴ ug/dscm for PCBs and 5x10 ⁻⁸ ug/dsm for dioxins were met					
S.D. Myers de Mexico	Up to100% PCB								
Chubu Electric Power	Low	Treated oil:		Exhaust gas: <0.00001 mg/m ³				Jan 2005	



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Company Recycling, Japan Center	concentrated PCB's 31 mg/kg	<0.003 mg/kg		Waste water (separated by condenser): <0.003 mg/l			
Chubu Electric Power Company Recycling, Japan Center	Low concentrated PCB's: -			Exhaust gas: <0.0001 mg/m ³			May 2006
Chubu Electric Power Company Recycling, Japan Center	<i>PCDD+PCDF, Dioxin-like PCB's</i> Input PCB conc: 31 mg/kg PCDD+PCDF: - Dioxin-like PCBs: - PCDD/Fs+ Dioxin-like PCBs: -			Waste water (separated by condenser): <0.005 mg/l			Disposal amount 0.95 kL/h Jan 2005
Ebara Corporation Fujisawa plant				Exhaust gas (PCDD+PCDF, Dioxin-like PCB's): 0.000032 ng-TEQ/m ³ N			Jan-Dec 2000
Ebara Corporation Fujisawa plant	PCB's 100%	Supernatant oil: 0.050 mg/kg Waste oil (containing salt) 0.022 mg/kg		Exhaust gas (PCDD+PCDF, Dioxin-like PCB's): 0.000083 ng-TEQ/m ³ N			10 kg/batch as 100% PCB Jan-Dec 2000
Ebara Corporation Fujisawa plant	<i>High concent PCB treatment:</i> PCDD+PCDF: 80 ng-TEQ/g			Exhaust gas: <0.01 ng-TEQ/m ³ N Waste water: - Supernatant oil: N.D. Waste oil (containing salt): N.D.			Jan-Dec 2000
	Dioxin-like PCBs: 4100 ng-TEQ/g			Exhaust gas: <0.02 ng-TEQ/m ³ N Waste water: - Supernatant oil: N.D. Waste oil (containing salt): N.D.			
	PCDD/Fs+			Exhaust gas: <0.03 ng-TEQ/m ³ N			



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	Dioxin-like PCBs: 4180 ng-TEQ/g			Waste water: - Supernatant oil: - Waste oil (containing salt): -		
Ebara Corporation Fujisawa plant	BHC: 3 200000 ng/g		DEs: 99.99930 -99.99955 DREs: <99.99999973 (See, OEWG,2004)	Exhaust gas: 2.7 ng/m ³ N Waste water: 28.9 ng/L Sludge: 0.28 ng/g Dust: 120000 ng/g		2004
	Chlordane: 5 300000 ng/g		DEs: 99.99930 -99.99955 DREs: <99.99999973 (See, OEWG,2004)	Exhaust gas: 7.5 ng/m ³ N Waste water: 7.3 ng/L Sludge: 26 ng/g Dust: 560 ng/g		

* "-" in the table shows "non-measurement" or "non-recording".

* Conformity to emission standards shows as follows. (emission standard; exhaust gas (0.1 ng-TEQ/m³N), waste water (10 pg-TEQ/L):

* N.D criteria for Treated oil are not clear.

Table 4: Emissions Summary, BCD Plant in Basque Country, June 1999 – February 2001

	HCH Store Emissions				Process Plant Emissions				Number of samples
	HCH Concentration mg/Nm ³		TCB Concentration mg/Nm ³		HCH Concentration mg/Nm ³		TCB Concentration mg/Nm ³		
	Medium	Maximum	Medium	Maximum	Medium	Maximum	Medium	Maximum	
1999	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2,5	5,1	6
July	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	4,5	8,9	42
August	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		44
September	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		42
October	N.D.	N.D.	N.D.	1,3	N.D.	N.D.	<1	5,0	38
November	N.D.	N.D.	N.D.	N.D2,3.	N.D.	N.D.	1,5	8,7	42
December	N.D.	N.D.	N.D.	1,1	N.D.	N.D.	N.D.	1,0	28
January 2000	N.D.	N.D.	N.D.	2,5	N.D.	N.D.	N.D.	2,4	40
February	N.D.	N.D.	<1	2,0	N.D.	N.D.	1	3,0	42
March	N.D.	N.D.	1,8	3,6	N.D.	N.D.	2	3,8	46
April	N.D.	N.D.	<1	1,9	N.D.	N.D.	1,2	2,0	16
May	N.D.	N.D.	N.D.	1,4	N.D.	N.D.	1,1	1,2	6
June	N.D.	N.D.	1,5	1,8	N.D.	N.D.	1,2	1,3	4
July	N.D.	N.D.	1,1	1,2	N.D.	N.D.	1,9	2,7	4
August	Plant stop for maintenance								
September	N.D.	N.D.	1,3	1,5	N.D.	N.D.	1,5	1,5	4
October	N.D.	N.D.	0,7	1,3	N.D.	N.D.	0,7	1,4	4
November	N.D.	N.D.	1,4	2,4	N.D.	N.D.	0,7	1,1	6
December	N.D.	N.D.	1,8	1,9	N.D.	N.D.	3,7	5,9	4
January 2001	N.D.	N.D.	0,7	1,4	N.D.	N.D.	1,7	2	4
February	N.D.	N.D.	1,2	2,4	N.D.	N.D.	1,2	2,3	4
Emission limits for TCB = 20 mg/Nm ³ ; HCH = 20 mg/Nm ³									426

Table 5: Brine control summary – BCD plant in Basque Country June 1999 – February 2001

Brine Control Summary

TCB	
Data >0	154
Data = N.D.	178
Total data	332
Maximum value (mg/l)	1,4
15% of maximum value	0,21
81 % from total data <0,21	

HCH	
Data >0	1
Data = N.D.	353
Total data	354
Maximum value (mg/l)	0,15
99,7 from total data = N.D.	

ECOTOX	
Total data	158
Minimum value (mg/l)	127 000
Maximum value (mg/l)	450 000
45% of maximum value	202 500
70 % from total data >202.500	

pH	6,5-9,5
PCB (mg/l)	N.D.
% Salinity	15-26%

Table 6: Limits set by authorities as per European Directive (90/415/EEC)

European Directive (90/415/EEC)

Medium value	TCB	HCH
Monthly (g/ Tm)	10	5
Monthly (mg/l)	1	2
Daily (g/ Tm)	20	10
Daily (mg/l)	2	4