

Radicalplanet Technology (Mechanochemical Principle)
– Annex to POPs Technology Specification and Data Sheet
Provisional version

Table 1: Technology Overview – Summary Technical Details

Technology Provider	Technology	Scale +	Comp. treated	Related comp treated	Validation project experience**	Applicability Ranking++	Additional Remarks	Others
Radicalplanet Research Institute Co. Ltd.	Radicalplanet Technology	F	Fly ash and Incineration ash polluted by DXNs.		Over three years of experience	DA	Pilot Commercial Equipment Operation with 200kg/charge by the use of E-200 Type 1999-:Detoxification of Soil and Ash contaminated by DXNs.	
Radicalplanet Research Institute Co. Ltd.	Radicalplanet Technology	F	Mixture of Pesticides and related POPs wastes		Over three years of experience	DA	2000-: Detoxification of Pesticides and POPs wastes.	
Radicalplanet Research Institute Co. Ltd.	Radicalplanet Technology	F	Admixture (Soil, stones, concrete, glass, metal, plastics) polluted by PCB oils and POPs wastes		Over three years of experience	DA	2001-:Decomposition and detoxification of PCB oil, mixture and contaminated soil and stabilizers	
Radicalplanet Research Institute Co. Ltd.	Radicalplanet Technology	F	PCP, Chlordane, BHC, DDT, Endrin, PCNB, PCB, DXNs		Over three years of experience	DA	2000-:Detoxification of Pesticides and POPs Wastes	
Radicalplanet Research Institute Co. Ltd.	Radicalplanet Technology	F		PVC (Sheets, Chips)	Over three years of experience	DA	2000-:Dechlorination of PVC	
Radicalplanet Research Institute Co. Ltd.	Radicalplanet Technology	F		Asbestos (Fiber, Plate, Brick)	Over two years of experience	DA	2001-:Detoxification of asbestos (non-crystalization, amorphous, micro-particle shaped spherically)	
+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

Technology Provider	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
Radicalplanet Research Institute Co. Ltd.	<p>PCP, Chlordane, BHC, DDT, Endrin, PCB, DXNs</p> <p>Mixture of Pesticides and related POPs wastes</p> <p>Admixture (Soil, stones, concrete, glass, metal, plastics) polluted by PCB oils and POPs wastes.</p> <p>Fly ash and Incineration ash polluted by DXNs.</p>	0, 5 tons	<p>DE grater than 99.9998 % achieved. DREs grater than 99.999999% achieved. Total(PCDFs +PCDDs +Coplanar PCBs): *PCP;0.18 pg-TEQ/g, *Chlordane;0.034-6.2 pg-TEQ/g, *BHC:0.031-0.14 pg-TEQ/g, *DDT,Endrin:0.12 pg-TEQ/g, *PCNB:0.54 pg-TEQ/g, *PCB oil in glass bottles:0.004-0.0063 pg-TEQ/g, *Admixture Soil polluted by PCB:0.0045 pg-TEQ/g, *Admixture (Soil, stones, concrete, glass, metal, plastics) polluted by PCB:0.0018 pg-TEQ/g *Fluorescent Stabilizers containing PCB:0.00027 pg-TEQ/g, *Admixture Soil polluted by DXNs: lower than 0.012 pg-TEQ/g, *Fly ash and Incineration ash polluted by DXNs: lower than 0.012 pg-TEQ/g, Energy consumption: Electric Cost=3.6Mwh/ton,</p>	<p>Authorization by Government. The permission to apply the "Radicalplanet Technology" was officially granted by the Notification No.25 (April 1, 2004) of the Environment Ministry in the name of the "kikai kagaku bunkai hoho"</p> <p>References :</p> <p>'Guide Book on PCB Treatment Technology in Japan' : 2005 edited by WMF, published by Gyosei Co. Ltd: Mr. S. Izumisawa :Director of WMF, 3RD Floor, 6-1 Kajimachi 2-chome, Chiyoda-ku Tokyo 101-0044 Japan, e-mail :izumisawa@sanpainet.or.jp, Phone: +81-3-3526-0155</p> <p>Ministry of the Environment : 2-2 Kasumigaseki 1-chome, Chiyoda-ku Tokyo 100-8975 Japan.</p> <p>Institute of Environmental Toxicology (Ministry of Agriculture, Forest and Fisheries) :</p> <p>Mrs. E. Nagayoshi: Uchimoriya-machi 4321 Mitsukaido-city Ibaraki 303-0043 Japan, e-mail :e-naga@viola.ocn.ne.jp, Phone: +81-2987-27-4501, Fax:+81-2987-27-1225</p>

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

Location project	Pre-treat Amounts and conc pg-TEQ/g or %	Post-treat mg/kg or (pg-TEQ/g) Dioxin[+PCB]*	DREs and DEs	Emissions 1. Air (HCl, Dioxins & furans etc) 2. Water, 3. Waste (slags)	Energy consumption (kwh/ton)	Costs(Capital, operating costs)	Detoxification Agent
At Radical Plant site: Ibaraki 1999 tests	Dioxin soil (200kg): 8,200 pg-TEQ/g	<0.012 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents 3. Powder based on CaO	800		CaO
At Radical Plant site: Ibaraki 2000 tests	Dioxin burnt ash (180kg): 6,900 pg-TEQ/g	<0.012 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	800		CaO
At Radical Plant site: Ibaraki 2000 tests	PVC-sheet: 380 kg Poly-vinyl-chloride	De-Cl ratio=100%		1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	1,800		Detoxification agent All Cl → CaCl ₂
At Radical Plant site: 2001 tests	PCB Oil (5 g): 100%PCB(KC300)	0.031 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	15,500		CaO
At Radical Plant site: Ibaraki 2000 tests	PCB Oil (36 kg): Pure-Oil(51.3%PCB +38.4%Trichloro Benzene	0.081 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	14,400		CaO
At Radical Plant site: Ibaraki 2000 tests	PCB Oil (39kg): 8.6%Pure-Oil +91.4%Isolation-oil	0.066 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	11,000		CaO
At Radical Plant site: Ibaraki 2000 tests	PCB Oil (45 kg): 0.7%Pure-Oil +99.3%Isolation-oil	0.004 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	7,200		CaO
At Radical Plant site: Ibaraki 2001 tests	PCB (Soil) (125kg): 4.28%Pure-Oil +95.72%Soil	0.004 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	1,400		CaO
At Radical Plant site: Ibaraki 2001 tests	PCB (stabilizer)(10kg): 2%Pure-PCB	0.00027 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO
At Radical Plant site: Ibaraki 2001 tests	PCB (clothes)(12kg): 0.2%Pure-Oil	0.0038 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO
At Radical Plant site: Ibaraki 2002 tests	PCB (Mixed) (90kg): 0.2%Pure-Oil	0.0018 pg-TEQ/g	DREs ≥ 99.999999%, DEs ≥ 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO

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At Radical Plant site: Ibaraki 2003 tests	PCNB(2kg): 20%PCNB	0.54 pg-TEQ/g	DREs \geq 99.999999%, DEs \geq 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO
At Radical Plant site: 2000 tests	BHC (12kg): 97% γ -BHC	0.031 pg-TEQ/g	DREs \geq 99.9999996%, DEs \geq 99.999891%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO, Slag
At Radical Plant site: Ibaraki 2000 tests	BHC (28kg): 5%BHC	0.14 pg-TEQ/g	DREs \geq 99.9999981%, DEs \geq 99.999490%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO
At Radical Plant site: Ibaraki 2000 tests	BHC (15.6kg): 3%BHC	0.38 pg-TEQ/g	DREs \geq 99.999999%, DEs \geq 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	2,500		CaO
At Radical Plant site: Ibaraki 2001 tests	DDT (18.5kg): 5%DDT(powder)	0.08 pg-TEQ/g	DREs \geq 99.999999%, DEs \geq 99.9999%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	2,500		CaO
At Radical Plant site: Ibaraki 2001 tests	DDT (5.2kg): 2.5%DDT(ED-Powder)	0.18 pg-TEQ/g	DREs \geq 99.99999898%, DEs \geq 99.999342%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	2,500		CaO
At Radical Plant site: Ibaraki 2001 tests	Endrin (2kg): 2%Endrin	0.28 pg-TEQ/g	DREs \geq 99.99999681%, DEs \geq 99.997943%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	2,500		CaO.
At Radical Plant site: Ibaraki 2001 tests	DDT+Endrin+BHC (7kg): 5%DDT,97%BHC,2%Endrin	0.12 pg-TEQ/g	DREs \geq 99.9999983%, DEs \geq 99.998903%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	2,500		CaO
At Radical Plant site: Ibaraki 2000 tests	PCP(Solution) (12.6kg): 91%PCP	0.18 pg-TEQ/g	DREs \geq 99.9999998%, DEs \geq 99.997949%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO, Slag
At Radical Plant site: Ibaraki 2000 tests	Chlordane(Emulsion) (12.6kg): 95%Chlordane	0.034 pg-TEQ/g	DREs \geq 99.99999628%, DEs \geq 99.997530%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	3,600		CaO
At Radical Plant site: Ibaraki 2000 tests	Chlordane(Emulsion) (3.5kg): 95%Chlordane	6.2 pg-TEQ/g	DREs \geq 99.99999954%, DEs \geq 99.999521%	1. No exhaust gas 2. No Effluents, 3. Powder based on CaO	2,700		BF-Slag

* total values of PCDDs + PCDFs + Co-PCB. The values of PCDDs + PCDFs are equal to Dioxin values. PCB means Co-PCB values.

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Table 4: Utilities Required for E-200 and A500
(Example of Japanese plants)

Utility	Units	Quantity required per tonne of waste input	Quantity required per month (E-200-mobile plant)	Quantity required per month (A-500 mobile plant)
Electricity	MWh	*3.6	32.5	65.0
Nitrogen	Nm ³	0	0	0
CO2	Kg	0	0	0
Natural Gas	Nm ³	0	0	0
Dry Air	Nm ³	5.0	45.0	90.0
Processing Rate (Pesticides: 97% γ BHC), (Powder in card box)				
	Tonnes/month (Work time:8 hours/day, 28days/month)		9 Tonnes/month	18 Tonnes/month
	Tonnes/yr (Work time:8 hours/day, 341days/year)		109 Tonnes/yr	219 Tonnes/yr

* Depend on the Pesticides contents (3.6 is estimated by the contents, 5%BHC (97% γ BHC) powder in card box.)