In Flight Plasma Arc Waste Treatment Process (PLASCON) - Annex to Annex to POPs Technology Specification and Data Sheet

Table 1: Technology overview - Summary - Technical Details

Waste Treatment Facility	Technology	Test Date/s	Scale +	Pesticide Component Treated	Other Compound Treated	Validation Project Experience	Applicability Ranking	Additional Remarks	Others
Nufarm Limited	PLASCON Plasma Arc	01/03/1992	F	2,4-D waste products and Chlorophenols byproducts from herbicide manufacture.			DA	March 1992 the world first commercial plasma arc waste destruction unit commenced operation on-line at Nufarm Limited located in Melbourne	
SRL Plasma Pty. Ltd.	PLASCON Plasma Arc	28/01/1997 - 11/06/1997	F		Halons CFCs		DA	Commissioning and treatability trials conducted under Victorian Environmental Protection Agency's Research, Development and Demonstration Approval No: RD 28055 for the destruction of ozone depleting substances. In excess of 70 tonnes of Halon 1211 destroyed during this period. DE ranged from 99.9999% to 99.9981%. Commercial operation approved October 1997.	
SRL Plasma Pty. Ltd.	PLASCON Plasma Arc	24/05/1999 - 15/09/1999	F	HCB;α-HCB; Lindane; Heptachlor; Aldrin; β-BHC; δ-BHC; Heptachlorepoxide; DDT; DDD; DDE; Dieldrin; Chlordane; Endosulphan; Endrin aldehyde..				Treatability Trial - Victorian EPA Research, Development and Demonstration (RD&D) Approval, number RD 37847, on 22 March 1999. This approval is for the destruction of organochlorine based pesticide mixtures, both with and without arsenic compounds. The location of the trial program is at premises situated at Beachley St., Tottenham in accordance with EPA Licence EI 33267 issued on 28 October 1997. PCDDs & PCDFs I-TEQ 0.0212 ng/Nm3 including LOD values. All pesticides tested for were below detection limits. DEs of 99.9999% or better were achieved for all trials.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	13/10/1997 - 28/11/1997	F		PCBs		DA	Commissioning and treatability trials. Plant operating under a R&D licence issued by Queensland Environmental Protection Authority. 7500 Kg of Aroclors destroyed.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	02/03/1998	F		PCBs		DA	Validation trials conducted prior to granting of a commercial operating licence by the Queensland Environmental Protection Agency. Queensland EPA Licence SR674 endorsed for commercial PLASCON treatment of PCBs July 1998.	

BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	01/09/1998 - 01/12/1999		DDT,DDE, Methoxychlor, Endrin aldehyde, Dieldrin, Endosulfan, Chlordane, Heptachlor, BHC, HCB, Aldrin, Dichlorvos, Dimethoate, Diazinon, Chloropyrifos, Malathion,Fenthion, Parathion, Pyrimiphos, Chlorfenvinphos, Ethion, 2,4 D, 2,4,5 T, DCMA			DA	Treatability and validation trials conducted using PLASCON destroying a mixture of commercial OCPs. & OPPs. DE for all trials were 99.99997% or better. Queensland EPA Licence SR674 endorsed for the commercial destruction of OCPs & OPPs. During these trials 2500Kg of OCPs & OPPs were destroyed.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	04/10/2000	F		PCBs	Plascon DE Trials for Prospective Japanese Customer	DA	Feed Stock Aroclor 1254 (65% Aroclor 1254 35% TCB). Trials witnessed/validated by Mitsubishi Chemical Corporation Personnel. DEs of 99.99999% or better were achieved. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.05 ng/Nm3 including LOD values.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	18/10/2000	F		PCBs	Plascon DE Trials for Prospective Japanese Customer	DA	Feed Stock Aroclor 1254 (65% Aroclor 1254 35% TCB). Trials witnessed/validated by Mitsubishi Chemical Corporation Personnel. DEs of 99.99999% or better were achieved. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.03 ng/Nm3 including LOD values.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	19/10/2000	F		PCBs	Plascon DE Trials for Prospective Japanese Customer	DA	Feed Stock Aroclor 1242. Trials witnessed/validated by Mitsubishi Chemical Corporation Personnel. DEs of 99.99999% or better were achieved. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.03 ng/Nm3 including LOD values.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	10/10/2001- 11/10/2001	F		PCBs	Plascon DE Trials for Japanese Customer	DA	Feed Stock Aroclor 1242 50%w/w in Kerosene matrix. Three (3) trials conducted. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.0119 - 0.0205 ng/Nm3 including LOD values. DEs of greater than 99.99999%.	
BCD Technologies Pty. Ltd.	PLASCON Plasma Arc	9/1/2004 - 15/1/2004	F		TCBs	Plascon Plants commissioning trials prior to export to Japan	DA	Feed Stock Trichlorobenzene 50% in hydrocarbon matrix. Twelve (12) hour DE trials. DEs 99.999991 - 99.999992%	
DASCEM Europe Limited	PLASCON Plasma Arc	19/11/2003	F		Halons; CFCs	Technology Validation Trials	DA	Validation trials conducted prior to granting of a commercial UK operating licence. Commercial operating licence granted in February 2004. DEs greater than 99.9999% achieved. Total(PCDFs+PCDDs) I -TEQ < 0.0024 pg/L including LOD values.	

Mitsubishi Chemical Corporation Yokkaichi Japan	PLASCON Plasma Arc	May 2004 - July 2004	F		PCBs		DA	Destruction of stockpiled PCBs 50% in hydrocarbon matrix. 100 tonnes mixture destroyed from May 2004 - 15 July 2004. DE better than 99.999999%.After flare, total (PCDFs+PCDDs+Coplanar PCBs) I -TEQ < 0.01 ng/Nm3 including LOD values. Total(PCDFs+PCDDs+Coplanar PCBs) in aqueous effuent I -TEQ < 0.01 pg/L including LOD values.	

+ Key: F - Full Scale Application completed	"++Key: Applicability ranking for pesticides
P - Pilot/Demonstration scale completed; no F-applications	DA - Directly 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: Overview project experience per technology supplier

Location/Project	Contaminants	Amount Treated in Tonnes	Results Including DE, Pre-treatment, Post Treatment, Emissions, Energy Consumptions & Costs	Client References Name, Address, Contact Person, Phone, E-mail, Facsimile
Nufarm Limited Laverton Victoria Australia - Routine Operations and Regulatory Testing	Dichlorophenols;Dichlorophenoxy acetic acids in a hydrocarbon matrix	>1000 tonnes chlorophenols & chlorophenoxy acetic acids	DE greater than 99.9999% achieved. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.006 - 0.009 ng/Nm3 including LOD values.	Refer Table 4
SRL Plasma Ply. Ltd. Tottenham Victoria Australia - Routine Operations and Regulatory Testing	Halon & CFCs	> 1200 tonnes Halons & CFCs	DE ranged from 99.9999% to 99.9981%. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.06 ng/Nm3 including LOD values.	Refer Table 4
BCD Technologies Pty. Ltd. Narangba Queensland Australia - Routine Operations and Regulatory Testing	PCBs; POPs; Chlorinated Solvents; Mercaptans; ODS materials	> 600 tonnes of liquid PCBs, OCPs & OPPs	DE greater than 99.99999% achieved. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ 0.01 - 0.019 ng/Nm3 including LOD values.	Refer Table 4
DASCEM Europe Limited Peterlee County Durham UK - Routine Operations and Regulatory Testing	Halons & CFCs		DE greater than 99.9999%. Total(PCDFs+PCDDs+Coplanar PCBs) I -TEQ < 0.0024 ng/Nm3 including LOD values.	Refer Table 4
Mitsubishi Chemical Corporation Yokkaichi Japan	PCBs in Hydrocarbon Matrix	> 100 tonnes	DE better than 99.999999%.After flare, total (PCDFs+PCDDs+Coplanar PCBs) I -TEQ < 0.01 ng/Nm3 including LOD values. Total(PCDFs+PCDDs+Coplanar PCBs) in aqueous effuent I -TEQ < 0.01 pg/L including LOD values.	Refer Table 4

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

Location/Project	Pre Treatment mg/kg	Post Treatment mg/kg	DEs	Emissions 1. Air (HCl, Dioxins & Furans etc.) 2. Water 3. Waste (slags)	Client References Name, Address.	Energy Consumption	Costs (Capital, Operating Costs)
BCD Technologies Pty. Ltd. Narangba Queensland Australia - Routine Operations and Regulatory Testing	(2001) 50% w/w PCBs in Hydrocarbon matrix containing 564900 ng/g Dioxins (2002) PCB/Kerosene Mixture containing 441000000ng/g PCBs 61000 ng/g Dioxins	(2001) Aqueous Effluent Total PCBs I-TEQ 10.5 pg/L including LOD values. Total(PCDFs+PCDDs) I-TEQ 39.1pg/L including LOD values. (2002) Aqueous Effluent	DEs greater than 99.99999%	DE greater than 99.99999% achieved. (2001) Total(PCDFs+PCDDs) I-TEQ 0.010 - 0.019 ng/Nm3 including LOD values. (2002) Total (PCDFs+PCDDs) I-TEQ 0.00 - 0.05 ng/Nm3 including LOD values No slag produced Particulate Matter 0.013 - 0.021 g/min HCl <1mg/m3 at NTP	Refer Table 4		Standard 150KW PLASCON Plant approx. $USD 1 million. Operating & Maintenance Costs $USD 1.50 per Kg for Schedule Wastes
BCD Technologies Pty. Ltd. Narangba Queensland Australia - 12 Hour Commissioning Trials Japanese Plants	January 2004 TCB in Kerosene Mixture ***Plant 1- 4*** 590 - 670g/L 1,2,4 Trichlorobenzene	Aqueous - all plants < 1.0 µg/L	***DEs:*** ***Plant1 99.999991%*** ***Plant2 99.999992%*** ***Plant3 99.999992%*** ***Plant4 99.999991%***		Refer Table 4		
Mitsubishi Chemical Corporation Yokkaichi Plant Japan	May - July 2004 Feed Stock PCBs 50%w/w. In excess of 100 tonnes destroyed during this period	Aqueous - all plants typically Total (PCDFs+PCDDs+Coplanar PCBs) I-TEQ < 0.01pg/L	DEs greater than 99.999999%	After flare Total (PCDDs+PCDFs+Coplanar PCBs) I-TEQ < 0.01 ng/Nm3	Refer Table 4		
SRL Plasma Pty. Ltd. Tottenham Victoria Australia	January - June 1997 Feed Stock Halons & CFCs 70 tonnes destroyed		DEs 99.9999% - 99.9981%	Typical Total (PCDDS+PCDFs) I-TEQ 0.006 ng/Nm3 including LOD values	Refer Table 4		
Dascem Europe Peterlee County Durham United Kingdom	November 2003 Feed Stock Halon 1211		DEs greater than 99.9999%	Total (PCDDS+PCDFs) I-TEQ 0.0024 ng/Nm3 HCl < 0.12 mg/Nm3	Refer Table 4		

John Vijgen, International HCH and Pesticides Association and Dr.Ir. Ron McDowall, Auckland New Zealand for Secretariat of the Basel Convention
Tables in the Annex have been supplied by BCD Technologies Pty Ltd

Table 4: Client References for Plascon Plants in Australia

Organisation	Contact	Description / Notes
Queensland EPA	**Dr. Faiz Khan - Env. Policy & Economic Division** 12th Floor 160 Ann Street Brisbane Queensland 4002 Australia Telephone: +61 7 3227 7349 Facsimile: +61 7 3227 8341 E-mail: faiz.khan@env.qld.gov.au **Mr. Gary O'Connor** **Chief Scientific Advisor, Hazardous Wastes** 12th Floor 160 Ann Street Brisbane Queensland 4002 Australia Telephone: +61 7 3225 1455 Facsimile: +61 7 3227 7677 E-mail: gary.oconnor@env.qld.gov.au	- General knowledge of BCD Technologies' operations and licencing - Queensland EPA Licencing for Environmental Operations
Victorian EPA	**Mr. Bruce Dawson - Manager** West Metropolitan Region Environment Protection Authority GPO Box 4395QQ Melbourne Victoria Australia 3001 Telephone: +61 3 9628 5766 Facsimile: +61 3 9628 5053	
BCD Technologies Pty. Ltd.	**Mr. Martin Krynen - General Manager** BCD Technologies Pty. Ltd. PO Box 119 Narangba Queensland 4504 Australia Telephone: +61 7 3203 3400 Facsimile: +61 7 3203 3450 E-mail: bcdt@gil.com.au	- POPs and ODS destruction facilities
Mitsubishi Chemical Corporation	**Mr. Kohei Sarumaru - Associate Director** **Mitsubishi Chemical Corporation** 5-2, Marunouchi 2-chrome, Chiyoda-ku Tokyo 100-0005 Japan E-mail: sarumaru.kohei@mb.m-kagaku.co.jp Telephone: 81-3-3283-6770 Facsimile: 81-3-3283-6459 **Mr. Teruyuki Ono General Manager** **PCB Treatment Planning Department** Mitsubishi Chemical Corporation Yokkaichi Plant 1 Toho-cho Yokkaichi, Mie 510-8530 Japan Telephone: 0593-45-7098 Facsimile: 0593-45-7046	- Chemical Manufacturer Mitsubishi Chemical Corporation operates four (4) PLASCON plants at Yokkaichi Japan. The PLASCON plants, following successful commissioning and the granting of granting of operational approval by the Provincial Government and Technical Committee under the Ministry of Environment Japan, are destroying stockpiled PCB wastes PCB wastes. Since operational approval was granted in late April 2004 until the present time (July 2004) in excess of 100 tonnes of PCB mixture - (50%w/w PCBs in a hydrocarbon matrix) have been successfully destroyed.
DASCEM Europe Limited	**Mr. David Honeyman Plant Manager** DASCEM Europe Limited Pease Road North West Industrial Estate Peterlee County Durham SR8 2RD E-mail: dave.honeyman@dascemeurope.com Telephone: +44 191 587 4600 Facsimile: +44 191 518 4210	- Removal, Collection and Destruction of redundant ODS materials from United Kingdom and Europe DASCEM Europe Limited operates one (1) PLASCON Plant at Peterlee County Durhan United Kingdom. Commissioned in February 2004, the plant operation is for the destruction of Halons and CFCs
Nufarm Limited	**Mr. M. Wallace - Senior Process Engineer** Nufarm Limited PO Box 103 North Laverton Victoria Australia 3028 Telephone: +61 3 9282 1008 Facsimile: +61 3 9282 1000	- Manufacturer of agricultural chemicals including 2,4-D The first commercial use of the PLASCON technology involved the onsite destruction of a chlorophenol mixture at Nufarm Limited's 2,4-D herbicide manufacturing manufacturing plant. The plant was commissioned in March 1992 and was subsequently licenced by the Victorian EPA in October 1993. The successful destruction of the chlorinated waste streams has allowed Nufarm to improve efficiency of the whole production unit. Nufarm's on-site waste treatment was been further enhanced by the installation of a second unit commissioned in May 1995.