Response to Consultation on the source segregation requirement in Paragraph 7A of Schedule 3 to the Waste Management Licensing Regulations 1994

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Introduction

The ArrowBio Process is a unique water-based MBT process developed by Arrow Ecology of Israel (www.oaktech-environmental.com)

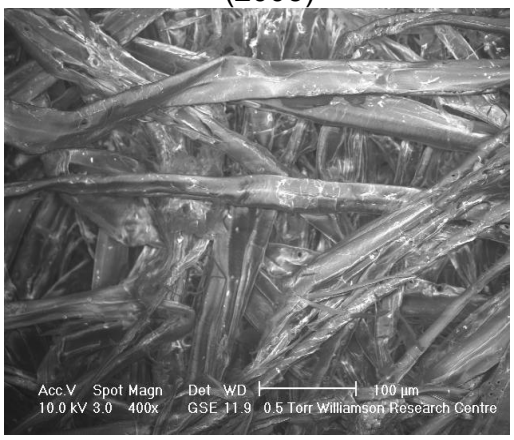
The ArrowBio Process has undergone 15 years of development. The system has a 35,000 tonne per annum commercial reference facility located at the Hiriya Waste Management Park outside Tel Aviv. This plant processes completely unsegregated mixed municipal wastes and creates high grade anaerobic digestate and is widely accepted and used beneficially on land in Israel.

Oaktech Environmental is based in Manchester. Oaktech promotes the ArrowBio system in the UK and Ireland. Oaktech has close links to the University of Manchester and has worked with a number of students who have analysed the digestates from the ArrowBio plant in Israel.

Acidogenic digestate, ArrowBio Tel Aviv

Growth trials on Acidogenic Digestate (2005)

Dried acidogenic digestate, ArrowBio Tel Aviv



ESEM investigation of digestate, Manchester University (Fearn 2004)

ArrowBio has recently been awarded a contract to treat waste originating from Macarthur Regional Councils close to Sydney, Australia (WSN Environmental Solutions, 2005). As part of this contract a due diligence study was conducted independently by Douglas Partners Consultants (2004), this included full comprehensive analysis of the digestates produced by the system.

Response to Questions

Q1: Should the source segregation requirement in paragraph 7A remain in place?

No, the source segregation requirement should not remain in place. It has been proven at a commercially operational facility that excellent soil improving material can be consistently produced by mixed wastes from advanced MBT technologies. It does not make sense to create a further barrier to entry into a market where environmentally sustainable and beneficial technologies are in great need.

Independent growth trials have been completed at seed farms in Israel illustrating the beneficial properties of digestates from mixed wastes. These studies are illustrated in the evidence section.

Studies conducted by the University of Manchester (Fearn 2004, Bandaru 2005, Veale 2005) and by Douglas Partners illustrate that the digestate produced from mixed wastes has properties equal to the physical and chemical standards of the BSI PAS 100 with no modification or purposeful system changes in the Israeli market.

If an accepted standard is produced for composts from mixed wastes and system manufacturers can prove that theses standards are constantly attained from unsegregated waste streams use of this material should be permitted on land.

Q2: Is it environmentally acceptable (in terms of the relevant objectives of Article 4 of the Waste Framework Directive) to treat agricultural land with non source segregated biodegradable outputs from MBT (or other similar processes)?

Technology providers should be made to consistently demonstrate that the highest standards for outputs from MBT facilities should be attained. Comprehensive testing of outputs from MBT facilities destined for land should be undertaken. The outputs from these processes should improve the quality of the agricultural land and not provide adverse side effects. These outputs should be in addition to the animal by-products legislation. It is suggested that they should be of comparable physical and chemical standards to the BSI PAS 100 for composted materials.

The prevention of the use of composts derived from mixed wastes has a negative environmental effect. The barrier to entry into the market for advanced MBT technologies will prevent the most beneficial environmental processes entry into the UK market in order to meet the EU landfill directive. In the wider environmental picture, the ability to capture carbon in soils derived from high quality MBT facility outputs far out weighs any associated negative impacts of these technologies.

Q3: Is it agriculturally acceptable to treat agricultural land with non source segregated biodegradable outputs from MBT (or other similar processes)?

It has been proven agriculturally that advanced waste treatment processes such as ArrowBio can consistently produce soil improver, or peat substitute to the highest standards.

Section 4.2 of the consultation document states:

"The Government is not aware of any country that permits the spreading to land of outputs where there are no controls on inputs and minimal controls on outputs"

Oaktech Environmental submits that there are no specific barriers for the use of digestate derived from mixed waste on land in Israel. Conversely the moisture retentive properties of the digestate are extremely beneficial on land with low moisture content or in hot countries.

Q4: Is it environmentally acceptable to treat any land type with source segregated biodegradable outputs from MBT (or other similar processes)?

It is our belief that if outputs from MBT facilities can be shown to achieve high quality compost from mixed waste it is environmentally acceptable on all land. This should be with the strict provider that the soil improver shows environmental benefit and consistently achieves the highest standards.

Evidence

Douglas Partners Due Diligence Report for ANZ Bank- Australian MBT System Project Background

"Douglas Partners (was) engaged by Waste Service NSW and the ANZ Bank as the independent technical expert to undertake a due diligence evaluation of a selected MBT process to be utilised in Waste Service plant at Belrose"

"In carrying out the review of the results of laboratory analyses we have used a number of different guidelines and standards, as follows:

- Australian Standard AS4419-2003 "Soil for Landscaping and Garden use"
- Australian Standard "AS4454-2003 "Compost Soil Conditioner and Mulches"
- Use and disposal of Biosolids Products – EPA Guideline October, 1997
- Guideline on Investigation Levels for Soil and Groundwater – National Environment Protection Council 1999
- Solid Waste Guidelines – EPA

"Results of the analyses undertaken by Arrow Ecology and Douglas Partners indicate that… either material could be used as fertiliser"

"The material from the Tel Aviv plant meets the requirements (of the biosolids guidelines) for class B, C and D material and could therefore be used as landscaping material on top of existing landfill. The material is suitable because it has high nutrient value and very low leachability of heavy metals and could be required if blended to meet the Biosolids Guidelines for Class A material."

Summary table of Key Douglas Partners Findings

Table 1

SUMMARY OF SOIL ANALYSIS							GUIDELINE VALUES				
Analyte	Tested by Arrow (mg / kg)		Tested by DP SCC (mg / kg)		Tested by DP TCLP (mg / L)		H.I.L. (mg / kg)	Biosolids Grade A (mg / kg)	Background Range (mg / kg)	Waste Classification Inert Waste	
	A.R.	M.R.	A.R.	M.R.	A.R.	M.R.				SCC (mg / kg)	TCLP (mg / L)
AL	4,018	9,772	5,500	5,200	0.06	I.S.					
AS	<5		<3	<3	<0.05	I.S.	100	20	1 - 50	500	0.5
Ca	37,190	118,900	36,305	95,870							
Cd	1	2	<0.5	1.0	<0.006	I.S.	20	3	1	100	0.1
Cr	36	140	17	48	<0.005	I.S.	100	100		1,900	0.5
Cu	57	182	50	130	0.03	I.S.	1,000	100	2 - 100		
Fe	5,389	12,380	3,000	6,100	0.37	I.S.					
Hg	2	4	0.42	0.34	<0.0005	I.S.	15			50	0.02
K	2,742	5,119	2,100	4,900	42	I.S.					
Mg	2,808	6,950	1,700	5,800	18	I.S.		1	0.03		
Na	2,276	3,277	3,400	8,100	530	I.S.					
Ni	12	24	8	13	0.008	I.S.	600	60	5 - 500	0.2	1,050
P	5,888	25,310									
Pb	30	58	15	34	<0.04	I.S.	300	150	2 - 200	1,500	0.5
S	7,450	17,490	3,600	9,200							
Zn	335	1122	160	540	0.14	I.S.	7,000	200	10 - 300		

A.R. = Acidogenic Reactor
M.R. = Methanogenic Reactor
I.S. = Insufficient Sample
SCC = Specific contaminant concentration (Total Concentration)
TCLP = Toxicity Characteristics Leaching Procedure (Leachate Concentration)
H.I.L. = Health Investigation Limited

Israeli Growth Acidogenic Growth Trials Results

The report is not presently completed however pictures of plants grown on digestate in Israel are shown below. The results show that digestate can be used and have excellent properties as a peat substitute and a carbon sink.


שלשולים
במצע

APPENDIX

QUALITY OF DIGESTATE (COMPOST) FROM THE ARROWBIO PROCESS

Compiled by Professor M.S. Finstein

21 October 2005

The ArrowBio process recovers glass, metal, and plastic for recycling as secondary materials, and converts biodegradable materials such as food and vegetative wastes to biogas and digestate. The amount of digestate produced is smaller than in other anaerobic digestion processes, but is still appreciable. Its quality is thus an important issue. A poor quality digestate may be a liability, whereas a high quality one may be an asset salable as compost.

The issue of compost quality revolves around the concentration of certain potentially harmful elements. In the United States, the permissible levels of such elements are regulated according to standards for the application of sewage sludge to land. The standards were developed by the U.S. Environmental Protection Agency. A product derived from municipal solid waste (MSW) rather than sewage sludge would nonetheless be judged according to those standards.

The basic regulatory document is the Code of Federal Regulations Title 40 Section 503.13. Two sets of levels are indicated: "Ceiling Concentration" and "Pollutant Concentration." The latter is the stricter set and is often referred to as the "Exceptional Quality Limits." The individual states generally follow the Federal regulations, though may have stricter requirements with respect to certain elements. What follows is a compilation of the Federal (USEPA), New York, and New Jersey standards for "Exceptional Quality Products," and the levels found in ArrowBio digestates (Table 1).

On 08 August 2004, samples from the ArrowBio acidogenic and the methanogenic digesters were split for analyses in separate laboratories, one in Israel and one in Australia. The results are in reasonably good agreement (compare columns 6 and 7, and columns 8 and 9).

More importantly, with respect to the elements of concern (first ten listed) both digestates easily pass the standards for "Exceptional Quality" as defined by USEPA (Federal level), the state of New York, and the state of New Jersey (compare columns 5-9 with columns 1-3 in any combination). With respect to beneficial elements (Ca, Mg, Fe, P, K, S), their presence in an organic soil amendment, or compost, is desirable. These results suggest that the digestates from an ArrowBio plant in New York City would find utility in the area.

Table 1. Exceptional Quality Standards and Concentrations in ArrowBio Digestates analyzed in Israel or Australia (mg/kg oven dry weight). Standards have been set only for the first ten elements listed.

1	2	3	4	5	6	7	8	9
Element	Federal USEPA[1]	New York NYSDEC[2]	New Jersey RCE[3]	Acidogenic digestate 22 Dec 03 (analyzed in Israel)[4]	Acidogenic Digestate 08 Aug 04 (analyzed in Israel)[4]	Acidogenic Digestate 08 Aug 04 (analyzed in Australia)[5]	ArrowBio methanogenic digestate 08 Aug 04 (analyzed in Israel)[4]	ArrowBio methanogenic digestate 08 Aug 04 (analyzed in Australia)[5]
As	41	-	41	<5	<5	<3	<5	<3
Cd	39	10	21	<2	1	<5	2	1
Cr	-	1000	1200	24	36	17	140	48
Cu	1500	1500	1500	57	57	50	182	130
Pb	300	300	300	9	30	15	58	34
Hg	17	10	17	<2	2	0.42	4	0.34
Mo	-	-	18	6	3	Not done	5	Not done
Ni	420	200	420	7	12	8	24	13
Se	100	-	28	<5	<5	Not done	<5	Not done
Zn	2800	2500	2800	273	335	160	1122	540
Ag	-	-	-	<5	<5	Not done	<5	Not done
Al	-	-	-	4100	4018	5500	9772	5200
B	-	-	-	10	<5	Not done	<5	Not done
Ba	-	-	-	85	119	Not done	364	Not done
Be	-	-	-	<2	<2	Not done	<2	Not done
Ca	-	-	-	36630	37190	36305	118900	95870
Co	-	-	-	2	5	Not done	10	Not done
Fe	-	-	-	4606	5389	3000	12380	6100
K	-	-	-	1138	2742	2100	5119	4900
Li	-	-	-	<5	<6	Not done	<6	Not done
Mg	-	-	-	2389	2808	1700	6950	5800
Mn	-	-	-	67	151	Not done	325	Not done
Na	-	-	-	1533	2276	3400	3277	8100
P	-	-	-	2815	5888	Not done	25310	Not done
S	-	-	-	4250	7450	3600	17490	9200
Sr	-	-	-	120	?	Not done	312	Not done
Ti	-	-	-	32	46	Not done	66	Not done
V	-	-	-	5	9	Not done		Not done

[1] 40 CFR 503.13

[2] 6NYCRR 360-4

[3] The New Jersey Department of Environmental Protection follows the Federal standards. However, the New Jersey Agricultural Experiment Station, Rutgers Cooperative Research and

Extension (RCE) recommendations are more restrictive (Fact Sheet 954). The more restrictive RCE limits are listed here.
[4] AminoLab, Ness Tziona, Israel
[5] SGS Environmental, Matraville, New South Wales, Australia.

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