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Association of Australia

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Ash Development Association of Australia

Coal Combustion Product (CCP)

Environmental Testing Programme 2003/2004

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ATTACHMENTS

Attachment A – TCLP results 1993 to 2001 and 2003 including summary sheet
Attachment B – Determination of total metals results
Attachment C – PCDD's and PCDF's results
Attachment D – Sizing Distribution Analysis

Glossary

Term	Definition
AS	Australian Standard
CCP	coal combustion product
Chain of Custody (COC)	Documentation which accompanies samples to reduce the potential for loss or erroneous labelling or analysis reporting
DEC	Department of Environment and Conservation of New South Wales replaced the Environment Protection Authority (EPA) and National Parks and Wildlife Service (NPWS) and Resource NSW.
ISO	International Standards Organisation
I-TEQ	The total toxic equivalence relating to dioxins and furans in this report.
leachate	The water solution containing the released substance.
NATA	National Association of Testing Authorities
ng/g	nano grams per gram or 1×10^{-9}
pg/g	pico grams per gram or 1×10^{-12}
QA / QC	Quality Assurance. Quality Control
TCLP	Toxicity Characteristic Leaching Procedure – a method of determining the release of a substance via exposure to water solution.
USEPA	United States Environment Protection Agency
WHO	World Health Organisation

Executive Summary

As part of its Research and Development Programme for 2003/2004 the Ash Development Association of Australia (ADAA) requested the development and implementation of an environmental investigation programme into coal combustion products (CCPs). The aim of this investigation was to collate and interpret the analytical knowledge on its members' CCPs through a coordinated sampling, analysis and reporting programme.

The programme investigated the chemical characteristics of ash from several ash producer and handlers, which will assist the Association in identifying alternative uses to which ash products can be used as a secondary resource.

The methodology consisted of collecting fine, medium, coarse and bottom ash samples from ADAA members throughout Australia. The geographic distribution of members is shown in **Figure 1**.

After the programme had started the NSW Department of Environment and Conservation (DEC) - already consulting the ADAA on the use of ash in agriculture - provided further criteria for total metals, dioxins and furans. A selection of these samples was then subjected to the additional analytes.

The samples were analysed for a range of metals (total and leachate), dioxins and furans. Fifty four (54) samples were tested for leachate and thirteen (13) were selected for total metals analysis. Three (3) were analysed for dioxins and furans.

In summary,

- Total metal results for Cadmium (Cd), Lead (Pb) and Mercury (Hg) were within the proposed guidelines (Fertiliser Act 1985) nominated by DEC.
- All leachate results, under the worse case scenario, were either below or just above the laboratory detection limit for each analyte and so were well within the maximum acceptance criteria. Since many results were reported as the limit of detection, no statistical analysis would be useful.
- Leachate results from the previous investigations (1993 – 2001) were also low, either below or slightly above the detection limit, for the same range of analytes.
- All three samples tested for dioxins and furans met the 100 pg/g criterion.

These investigations are an important step towards demonstrating the responsible and environmentally sustainable use of CCPs for applications, but not limited to, civil engineering fills, raw materials for the cement and concrete industries and for agricultural and horticultural purposes.

These results coupled with agreed ongoing investigation methods will assist regulatory authorities and the ADAA with the scientific evidence required for the appropriate handling and application of CCPs as a secondary resource.

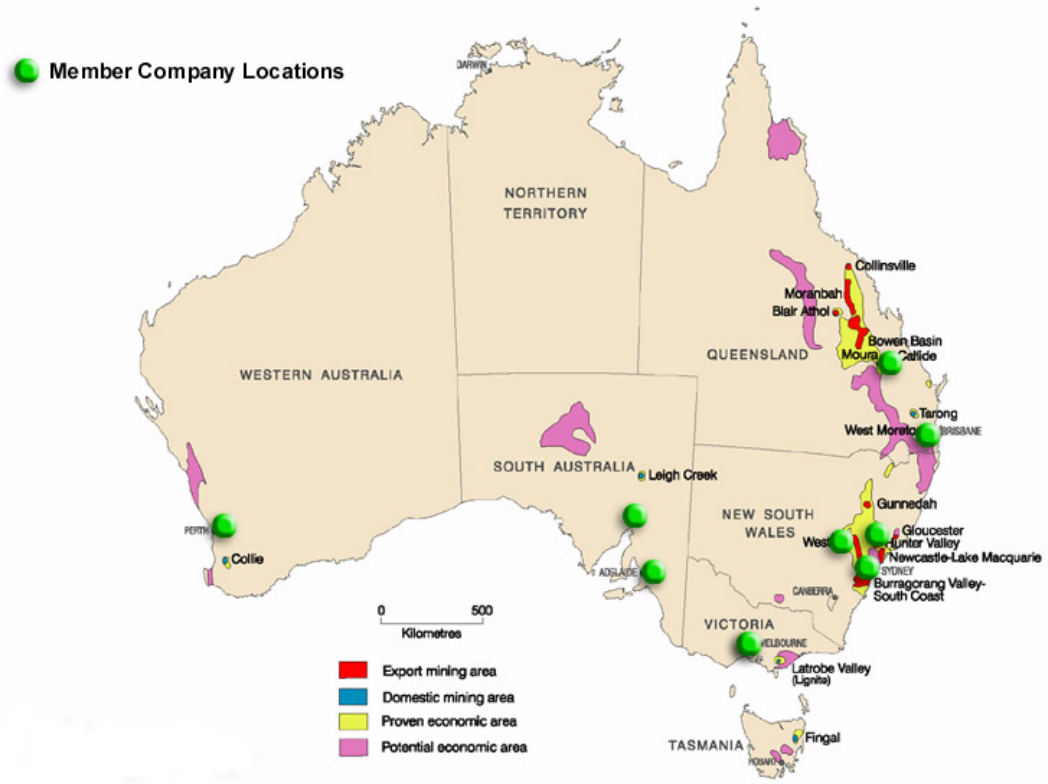

Figure 1 Distribution of Members

1 Introduction

The Ash Development Association of Australia (ADAA) has undertaken an extensive analysis investigation into the metal concentration and leachability of those metal species from coal combustion products (CCPs) using the USEPA TCLP and total methods[1]. The aim of this investigation is to collate and interpret the analytical knowledge on its members' CCPs through a co-ordinated sampling, analysis and reporting programme, building on information collected in previous years.

Moeyan Management Pty. Limited was commissioned to manage the sampling and analysis programme and prepare this report.

The findings will be used to produce important benchmarks to underpin ADAA's case for ash reuse in applications where significant environmental interactions may occur, e.g. agriculture.

All data has been treated with strict confidentiality and no published results identify individual participants. Participating members were provided with a unique identifier (client code) to assist with distinguishing their respective material/s for internal assessment purposes and for comparison against other ash sources from throughout Australia.

The participants in this sampling programme are listed below:

Generator	Ash Marketer
• **CS Energy (QLD)**	• **Flyash Australia (NSW, SA)**
• **NRG Flinders (SA)**	• **Pozzolanic Enterprises (QLD)**
• **Pacific Western (WA)**	• **Blue Circle Ash (NSW)**
• **Western Power (WA)**	• **Adelaide Brighton Cement Limited (SA, WA & NSW)**
• **Delta Electricity (NSW)**	• **Hyrock (NSW)**
• **Tarong Energy (QLD)**	
• **Eraring Energy (NSW)**	

[1] Method: USEPA method 200.2 (modified) for determination of total metals and TCLP method 1311 for leachate

2 Site Identification and Characteristics

Each site was allocated a unique client code known to only them, Moeyan Management and the ADAA CEO. This system allows each site to view their results and compare these to the complete data set.

The code consisted of a *two-digit number* for each participant and then a *sub-classification code* with fly ash samples coded according to fine (FAF), medium (FAM), coarse (FAC). Bottom ash is simply (BA).

In some cases individual producers used terms more meaningful to their site, or where the classification was unclear were tagged 'X'.

3 Objective of Scope of Work

This programme investigated the chemical characteristics of ash from the range of participants and locations, which will assist the Association in identifying alternative uses to which ash products can be used as a secondary resource.

The programme originally consisted of collecting fly ash of fine, medium, coarse grades[2] and bottom ash samples from as many ADAA members as possible. These samples were then to be analysed for a range of leachable metals.

However, after the programme had started the DEC who was already in discussion with the ADAA on ash use for agricultural application, nominated total metals, dioxins and furans criteria. A selection of the already collected samples was then subjected to the additional analyses.

Also stemming from the total metal analyses a further three (3) samples of bottom ash were analysed for the total metals, and seven (7) samples were analysed for fineness by mass passing 45 µm sieve to investigate whether metals (particularly Hg) had a tendency to move to bottom ash; and whether size fractions of fly ash influenced metal concentration.

All of these new results were compiled with leachate data previously gathered by the Association and assessed against current criteria.

[2] AS 3582.1—1998 has a table on page 8 describing ash grades.

4 Sampling and Analysis Procedures

4.1 Site Sampling Procedures

Each site was briefed on sampling procedures. Fly ash samples were to be taken in accordance with the following standards:

- AS 1199 Sampling procedures and tables for inspection by attributes
- AS 1399 Guide to AS 1199

Each sample was to be collected and segregated based on its grading according to AS 3582.1—1998 - *Supplementary cementitious materials for use with portland and blended cement Part* 1: Fly ash.

An extract from this Standard is provided from the Association's copy below.

TABLE 1

SPECIFIED REQUIREMENTS

Grade	Fineness, by mass passing 45 µm sieve, % minimum	Loss on ignition, % maximum	Moisture content % maximum	SO_3 content, % maximum
Fine	75	4.0	1.0	3.0
Medium	65	5.0	1.0	3.0
Coarse	55	6.0	1.0	3.0
Reference test method	AS 3583.1	AS 3583.3	AS 3583.2	AS 3583.8

Bottom ash samples were to be taken in accordance with the following standard:

- AS 1141.3.1 – Methods for Sampling and Testing Aggregates 1996 (Method 3.1- Sampling Aggregates: Section 6.9 - Sampling from Stockpiles)

An extract from the Standard is shown overleaf:

Generally samples from the surface of the stockpiles are not representative. Approximately 200mm of surface material should be removed and samples taken from the fresh exposed face. Increment sampling should be carried out in various locations and at various heights on the sides of the perimeter of the stockpile. This approach ensures the whole stockpile is being sampled and not one section only. Samples should then be placed in the supplied jars and labelled accordingly.

Samples of approximately 200 – 500g must be placed in unused clean containers and sealed with screw cap or equivalent to withstand transportation to the laboratory. Each container should be clearly labelled with the required information.

A Chain of Custody form was filled in and despatched with each set of samples.

4.2 Laboratory Procedures

Laboratory procedures for analysis of total metals and TCLP were conducted by ALS Environmental.

ALS operates a management system that complies with the requirements of ISO 9001:2000 for the provision of inorganic and organic environmental analysis services. Company wide quality procedures have been established to control and monitor all generic aspects of the company's operations and all laboratories operate according to the guidelines set out in ISO/IEC 17025.

ALS is NATA (National Association of Testing Authorities) accredited for a range of inorganic and organic analyses, including the procedures conducted for this programme.

The laboratory procedures used for each analysis are summarised below:

- *For total metals samples were digested by USEPA method 200.2 (modified) and the results reported on a dry weight basis.*
- *USEPA Method 1311 – Toxicity Characteristic Leaching Procedure (TCLP)*

This method is the most widely used leachate procedure. The buffering solutions (pH 4.93 and 2.88) used in the TCLP were designed specifically to simulate landfill conditions. This rather conservative approach was designed to accommodate the acidic conditions typically found in a putrescible waste landfill. If the analysed material is being used for any other application the results need to be considered carefully as they are

providing a worse case scenario. If the application does not involve an acidic environment or co-disposal with putrescible material these results may be not be adequately representative of what will occur once the material is applied.

The dioxin and furan analyses were conducted by AgriQuality. The analysis method is based on USEPA method 1613B (Isotope Dilution) for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).

The laboratory holds the following accreditations for these procedures

- *ISO 17025 through IANZ (International Accreditation New Zealand) for persistent organic pollutants, a wide range of other environmental contaminants and test types. This is recognised by NATA via a Mutual Recognition Agreement, and all reports carry both the NATA and IANZ logos.*
- *WHO Accreditation for the assessment of dioxins, furans and polychlorinated biphenyls in human serum, breast milk, cow's milk and fish.*
- *WHO recognized Centre of Expertise for dioxins, furans and polychlorinated biphenyls.*

4.3 Quality Control / Quality Assurance Procedures

Australian Laboratory Services (ALS) conducted the total metal and leachate analysis for this programme. The QA / QC programme implemented by ALS is summarised below.

ALS employ full time externally trained QA/QC Chemists to maintain the quality system, monitor results and conduct audits. The QA/QC Chemist has a line responsibility to the quality department and reports through to the company quality manager.

Quality Systems (ISO 9001) - ALS operates a management system that complies with the requirements of ISO 9001:2000 for the provision of inorganic and organic environmental analysis services. Company wide quality procedures have been established to control and monitor all generic aspects of the company's operations and all laboratories operate according to the guidelines set out in ISO/IEC 17025.

ALS Environmental (Sydney) laboratory is NATA (National Association of Testing Authorities) accredited for a comprehensive range of inorganic and organic analyses.

Laboratory Quality Control - Comprehensive QA/QC programs have been established to monitor and control every aspect of the operation and regulate all ALS laboratory procedures. QA/QC procedures are designed to provide reliable analytical results to our clients.

AgriQuality conducted the dioxin and furan analyses for this programme. The QA/QC programme was in accordance with USEPA methods. These include the following:

Use of laboratory blanks

Calculation of compound recovery rates

Strict requirements for sample storage and holding times.

The full breakdown of the analytical results for the QA/QC and NATA laboratory reports for the following analyses are available as follows;

Attachment A – TCLP results 1993 to 2001 and 2003 including summary sheet

Attachment B – Determination of total metals results

Attachment C – PCDD's and PCDF's results

5 Criteria

Coincident with the conduct of this biennial testing program of the ADAA, various discussions were ongoing with the DEC. This agency having consulted with the ADAA regarding proposed guidelines for the use of ash in agriculture, subsequently provided guidelines for a proposed criteria for nominated metals (total), dioxins and furans in correspondence dated 30 October 2003.

The proposed criteria are referenced and listed below:

(a) Fertilisers Act 1985 (Order No 2001/02 or 2001/07)

Table 1 Criteria for Total Metals (a)

Cadmium	
Phosphatic Fertiliser	300 mg/kg of phosphorus
Non-phosphatic Fertiliser	10 mg/kg of non-phosphatic fertiliser
Liming Material	*10 mg/kg of liming material*
Lead	
Fertiliser	100 mg/kg of fertiliser
Liming Material	*100 mg/kg of liming material*
Mercury	
Fertiliser	5 mg/kg of fertiliser
Liming Material	*5 mg/kg of liming material*

(b) Chlorinated dioxin and furan **TEQ limit of 100 ng/kg** as referenced for land application of biosolids in Europe.

6 Analytical Results

6.1 Total Metals (Cd, Pb, Hg)

The following table summarises the total metals (Cd, Pb, and Hg) for thirteen (13) randomly selected ash samples. NATA laboratory reports are included in **Attachment B**.

Table 2 Total Metals Results

Sample[3] Number→	05-FAF	05-ROS	05-FAC	06-FAF	06-FAM	06-FAC	06-BA	10-CS	10-FM	11-FAX	01-BA	12-BA	13-BA
Metal ↓	mg/kg												
Cd (10)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pb (100)	5	5	4	4	4	<1	<1	1	<1	6	8	7	<1
Hg (5)	0.2	0.4	0.5	<0.1	<0.1	<0.1	2.1*	<0.1	<0.1	0.4	<1	<1	<1
(Max Criterion mg/kg)													

* Refer to table 3 below.

Sample 06-BA was re-analysed four times to confirm elevated level for mercury. The results are presented below:

Table 3 Mercury Results for Sample 06-BA

Sample 06-BA	Hg (mg/kg)
Repeat 1	0.5
Repeat 2	0.2
Repeat 3	<0.1
Repeat 4	0.2

This sample displays a fairly large degree of physical heterogeneity with:

- a mean of 0.6 mg/kg, and
- standard deviation of 0.8 mg/kg, (largely due to the initial 2.1 result),

and serves as a caution - without inferring the sample was collected incorrectly (indeed the sample has a gritty appearance) - that interpretation of Bottom Ash samples may rely greatly on correct sample collection and particularly preparation procedure.

[3] Sample Nomenclature – the first two digits are the Participant, FA means Fly Ash, F/M/C means Fine/Medium/Coarse respectively, BA means Bottom Ash.

6.2 Leachate (TCLP) Results

A total of 54 samples were analysed for TCLP for the following analytes: The results have been collated and presented with NATA Laboratory Reports are included in **Attachment A**.

Silver	Cadmium	Lead	Zinc
Arsenic	Chromium	Antimony	Selenium
Barium	Copper	Thallium	Mercury
Beryllium	Nickel		

In addition to these results, historical data has also been incorporated. These analyses were conducted between 1993 and 2001 by AWT. This report cannot comment on the QA/QC for these analyses or sampling procedures but the results are included here for comparison purposes.

6.3 Dioxin and Furans

The following table summarises the dioxin and furan analyses for selected ash samples. NATA laboratory reports are included in **Attachment C**.

Table 4 Dioxin and Furan Results

Sample Number→	**4) ES 43607 (06-FAF)**	**5) ES 43607 (06-FAM)**	**10) ES 43607 (11-FAX)**
I-TEQ (100)	1.65	2.73	2.25
(Maximum Criterion ng/kg)			

6.4 Sizing Analysis

Ten (10) samples were analysed for size against the % passing 45 μm criterion to ascertain that the samples as labelled corresponded to the Australian Standard AS 3582.1—1998 grade classification. The results are shown below.

Table 5 Percent passing 45 μm

Sample Number→	05-FAF	05-ROS	05-FAC	06-FAF	06-FAM	06-FAC	06-BA	10-CS	10-FM	11-FAX	01-BA	12-BA	13-BA
% passing 45μm	N/A	**73.6**	N/A	N/A	N/A	N/A	**10.2**	**8.5**	N/A	**92.5**	**3.8**	**3.7**	**2.6**
Grade According to AS 3582.1—1998	**F**	**M**	**C**	**F**	**M**	**C**	**C**	**C**	**M**	**F**	**C**	**C**	**C**

As can be seen from the table the Bottom Ash Samples are clearly all Coarse (C). The two finer grade samples are Medium (M), and Fine (F). Though it should be noted that 05-ROS is only slightly outside of being graded show slightly higher Mercury levels though the Lead remains without trend against the size criterion in this data set.

7 Discussion of Results

7.1 Total Metals

Ash samples were analysed for nominated total metals from four separate process locations and consisted of fine, medium, coarse and bottom ash, coarse sand and filter material.

If the ash material was considered a liming agent in terms of agricultural application, the levels of cadmium, lead and mercury reported in these samples are well below the proposed criteria, as referenced in the Fertiliser Act 1985. Indeed the analytical results are below all proposed criteria in this Act.

The bottom ash sample (06-BA) produced the highest mercury level (2.1 mg/kg) on its initial analysis. It was unclear from this one sample whether mercury had a propensity to move to bottom ash, so the sample was re-analysed. The four new analyses showed mercury ranged from not detected (<0.1 mg/kg) to 0.5 mg/kg. These results are lower than the original level of 2.1 mg/kg, which may indicate

the sample was not completely homogenous. All results are below the proposed mercury criterion and therefore not considered an issue.

05-ROS and 11-FAX were both finer grades and do indicate slightly higher Mercury at 0.4mg/kg than the Bottom Ash Samples. Though overall *Participant 05* showed slightly higher levels than the other samples tested.

Lead (Pb) results are all low. Cadmium (Cd) was not detected.

7.2 Leachate Results

The majority of the analytical results are below the detection limit for each analyte. The remaining results are just over the detection limit.

There are no standout results which significantly exceed the detection limit.

Since many results were reported as the limit of detection, no statistical analysis would be useful.

The historical leachate data (1993 – 2001) shows a similar trend. The majority of analytical results are very low, being below or just above the detection limit. There are no significantly high results.

7.3 Dioxin and Furans

The three ash samples which were analysed for dioxins and furans produced results which equate to “not detected.” The low values in the relevant table above are conservative values representing the detection limit for each sample.

The NATA laboratory reports show a “not detected” result for each furan and dioxin.

In recent correspondence from the NSW EPA (now DEC) a chlorinated dioxin and furan TEQ limit of 100 ng/kg (100 pg/g) was referenced as proposed criterion for land application of biosolids in Europe. The results from this analysis programme are well below this proposed criterion.

7.4 Sizing Analysis

The sizing analysis indicates that of the seven (7) samples analysed, they fitted their labelled classification and no clear pattern could be ascertained from the concentration of metals and the fineness of the sample. Sizing analysis result are in **Attachment D**

8 Conclusions

8.1 Beneficial Use of CCPs in Agricultural Performance

This investigation aimed to examine some of the characteristics of CCPs as a reusable product. Other studies (notably in Western Australia) have described the beneficial effects of using CCPs to enhance agricultural performance.

8.2 Compliance with Acceptance Criteria

The analytical results presented here indicate that there may be a feasible opportunity to use CCPs as a secondary resource in agricultural applications.

- Not one acceptance criterion has been exceeded.
- No results of this investigation approach the maximum acceptable levels.

8.3 Sustainable Development

Where agricultural circumstances support the application of CCPs the environmental benefits of re-use as opposed to landfill containment, are significant.

Much of the literature for the beneficial use of CCPs in agricultural applications describes application rates with the soil in ratios of 5% to 20%. Application rates are modified according to soil type and the characteristic being modified (e.g. pH modification, drainage). Accordingly, these test results have been assessed against the liming material application as shown in Criteria for Total Metals (a) on p12.

9 Recommendations

These investigations demonstrate the potential for responsible and environmentally sustainable use of CCPs in the areas such as, civil engineering fills, raw materials for the cement and concrete production and for agricultural and horticultural purposes.

Importantly these results should be coupled with an appropriate ongoing monitoring program to assist regulatory authorities and the ADAA in building sound scientific evidence required for ongoing appropriate re-use of CCPs as a secondary resource.

To achieve this re-use benefit the following issues and recommendations require further clarification and development between the DEC and the ADAA:

- ADAA needs agreement with DEC and other authorities on the elements or species of concern, and their criteria.

- Environment authorities can – in conjunction with relevant Agriculture departments – review these results to:
  - Clarify what other investigations are required, and then
  - Devise (with ADAA) CCPs specifications/guidelines for agricultural use.
- ADAA can modify, if required, this monitoring programme to address issues raised by Environment authorities.
- A product application scenario should be developed for when and how to use CCPs, and an agreed chemical/physical specification developed and approved by Environment and/or Agriculture agencies.

ATTACHMENT A

NATA LABORATORY REPORTS

TCLP results 1993 to 2001 and 2003 including summary sheet

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR DAVID AYNSLEY	**BATCH:**	ES43339
CLIENT:	ASH DEVELOPMENT ASSOCIATION	**SUB BATCH:**	0
ADDRESS:	C/O ADAA SUITE 1,42 RAMAH AVE MT OUSLEY NSW 2519	**LABORATORY:**	SYDNEY
		DATE RECEIVED:	07/11/2003
		DATE COMPLETED:	20/11/2003
		SAMPLE TYPE:	TCLP LEACHATE
ORDER No.:		**No. of SAMPLES:**	54
PROJECT:			

COMMENTS

The concentrations reported are those determined on the TCLP leachate.

Extraction fluid #1 pH 4.88-4.98.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

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Signatory

Batch: ES43339
Sub Batch: 0
Date of Issue: 20/11/2003
Client: ASH DEVELOPMENT ASSOCIATION
Client Reference:

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
	Laboratory I.D.			1	2	3	4	5	6	7	8	9	10
	Date Sampled			05-FAF	05-ROS	05-FAC	05-FAFD	05-ROSD	05-FACD	06-FAF	06-FAM	06-FAC	06-BA
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR										
ALS1	Initial pH		0.1	5.9	5.6	5.6	5.6	5.8	5.7	8.9	9.0	10.9	6.7
ALS2	After HCl pH		0.1	1.7	1.7	1.7	1.7	1.8	1.7	1.7	1.7	1.9	1.7
ALS3	Extraction Fluid Number		1	1	1	1	1	1	1	1	1	1	1
ALS4	pH After Extract		0.1	5.2	5.2	5.2	5.2	5.2	5.2	5.3	5.5	6.9	5.2
EG-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Arsenic - TCLP	mg/L	0.1	0.3	0.2	0.2	0.2	0.2	0.2	<0.1	<0.1	<0.1	<0.1
EG-005C	Barium - TCLP	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Chromium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Copper - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Nickel - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Thallium - TCLP	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1
EG-005C	Zinc - TCLP	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EG-020C	Selenium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-035C	Mercury - TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Batch: ES43339
Sub Batch: 0
Date of Issue: 20/11/2003
Client: ASH DEVELOPMENT ASSOCIATION
Client Reference:

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		11	12	13	14	15	16	17	18	19	20
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	11-FAX	07-A-FAC	07-A-BA	07-B-FAM	07-B-BA	07-C-FAF	07-C-BA	07-D-FAC	07-D-BA	07-E-FAC
ALS1	Initial pH		0.1	10.1	9.9	4.6	4.0	4.4	9.6	8.7	4.1	4.4	9.5
ALS2	After HCl pH		0.1	2.0	1.6	----	----	----	1.8	1.6	----	----	----
ALS3	Extraction Fluid Number		1	1	1	1	1	1	1	1	1	1	1
ALS4	pH After Extract		0.1	6.4	5.1	5.1	5.1	5.1	5.7	5.4	5.1	5.1	5.1
EG-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Arsenic - TCLP	mg/L	0.1	0.7	<0.1	0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Barium - TCLP	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2
EG-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Chromium - TCLP	mg/L	0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Copper - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Nickel - TCLP	mg/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Thallium - TCLP	mg/L	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
EG-005C	Zinc - TCLP	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EG-020C	Selenium - TCLP	mg/L	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-035C	Mercury - TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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Client Reference:

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		21	22	23	24	25	26	27	28	29	30
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	07-E-BA	07-F-FAM	07-F-BA	07-G-BA	02-FAF	02-BA	10-CS	10-FM	03-BA	03-FAF
ALS1	Initial pH		0.1	7.4	9.8	8.5	8.7	8.4	8.1	7.6	7.8	3.0	5.1
ALS2	After HCl pH		0.1	1.5	1.5	1.5	1.6	1.5	1.5	1.5	1.4	----	1.4
ALS3	Extraction Fluid Number		1	1	1	1	1	1	1	1	1	1	1
ALS4	pH After Extract		0.1	5.1	5.3	5.2	5.4	5.1	5.1	5.1	5.1	5.0	5.1
EG-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Arsenic - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Barium - TCLP	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2
EG-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Chromium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Copper - TCLP	mg/L	0.1	<0.1	0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	0.1	<0.1
EG-005C	Nickel - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Thallium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
EG-005C	Zinc - TCLP	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EG-020C	Selenium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-035C	Mercury - TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		31	32	33	34	35	36	37	38	39	40
		Date Sampled		16/10/2003	16/10/2003	16/10/2003	15/10/2003	28/10/2003	22/10/2003	27/10/2003	30/10/2003	30/10/2003	30/10/2003
				13-FA1	13-FA2	13-FA3	13-BA	12-FAF	12-FAC	12-BA	02-FAC-Z1	02-FAM-Z2	02-FAM-Z3
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR										
ALS1	Initial pH		0.1	5.6	8.5	10.1	8.0	9.4	10.0	8.9	4.3	3.7	3.9
ALS2	After HCl pH		0.1	1.5	1.8	1.8	1.7	3.2	2.1	1.7	----	----	----
ALS3	Extraction Fluid Number		1	1	1	1	1	1	1	1	1	1	1
ALS4	pH After Extract		0.1	5.2	5.2	5.1	5.0	5.3	5.2	5.1	5.0	5.0	5.0
EG-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Arsenic - TCLP	mg/L	0.1	0.2	0.2	0.2	<0.1	0.4	0.2	<0.1	<0.1	<0.1	0.1
EG-005C	Barium - TCLP	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Chromium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Copper - TCLP	mg/L	0.1	<0.1	0.1	<0.1	<0.1	0.4	0.3	<0.1	<0.1	0.2	0.3
EG-005C	Nickel - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Thallium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Zinc - TCLP	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5
EG-020C	Selenium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-035C	Mercury - TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		41	42	43	44	45	46	47	48	49	50
		Date Sampled		30/10/2003	30/10/2003	31/10/2003	24/10/2003	24/10/2003					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	02-FAF-Z4	02-FAF-Z5	02-BA-AH	04-FAF	04-FAM	04-FAC	04-BA	01-FAF	01-FAM	01-FAC
ALS1	Initial pH		0.1	3.7	3.6	6.3	2.9	3.0	3.1	3.8	8.8	10.2	10.1
ALS2	After HCl pH		0.1	----	----	1.7	----	----	----	----	3.0	2.6	1.9
ALS3	Extraction Fluid Number		1	1	1	1	1	1	1	1	1	1	1
ALS4	pH After Extract		0.1	5.0	5.0	5.1	4.9	5.0	5.0	5.1	5.7	5.3	5.2
EG-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Arsenic - TCLP	mg/L	0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	0.2	<0.1
EG-005C	Barium - TCLP	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Chromium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
EG-005C	Copper - TCLP	mg/L	0.1	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1
EG-005C	Nickel - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	<0.1	<0.1	<0.1
EG-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Thallium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-005C	Zinc - TCLP	mg/L	0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EG-020C	Selenium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG-035C	Mercury - TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		51	52	53	54						
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	01-BA	12-FAFD	12-FACD	12-BAD						
ALS1	Initial pH		0.1	9.3	9.5	10.3	8.9						
ALS2	After HCl pH		0.1	1.8	3.1	2.9	1.8						
ALS3	Extraction Fluid Number		1	1	1	1	1						
ALS4	pH After Extract		0.1	5.2	5.4	5.3	5.1						
EG-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Arsenic - TCLP	mg/L	0.1	<0.1	0.4	0.2	<0.1						
EG-005C	Barium - TCLP	mg/L	1	<1	<1	<1	<1						
EG-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Chromium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Copper - TCLP	mg/L	0.1	<0.1	0.3	0.2	<0.1						
EG-005C	Nickel - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Thallium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-005C	Zinc - TCLP	mg/L	0.5	<0.5	<0.5	<0.5	0.6						
EG-020C	Selenium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1						
EG-035C	Mercury - TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01						

Batch: ES43339
Sub Batch: 0
Date of Issue: 20/11/2003
Client: ASH DEVELOPMENT ASSOCIATION
Client Reference:

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	1	11	11	21	21	31	31	41	41
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	05-FAF MS	05-FAF CHK	11-FAX MS	11-FAX CHK	07-E-BA MS	07-E-BA CHK	13-FA1 MS	13-FA1 CHK	02-FAF-Z4 MS	02-FAF-Z4 CHK
				CHECKS AND SPIKES									
ALS1	Initial pH		0.1	----	----	----	----	----	----	----	----	----	----
ALS2	After HCl pH		0.1	----	----	----	----	----	----	----	----	----	----
ALS3	Extraction Fluid Number		1	----	1	----	1	----	1	----	1	----	1
ALS4	pH After Extract		0.1	----	----	----	----	----	----	----	----	----	----
EG-005C	Silver - TCLP	mg/L	0.1	----	<0.1	----	<0.1	----	<0.1	----	<0.1	----	<0.1
EG-005C	Arsenic - TCLP	mg/L	0.1	114%	0.2	118%	0.7	109%	<0.1	115%	0.2	101%	0.1
EG-005C	Barium - TCLP	mg/L	1	99.0%	<1	102%	<1	97.0%	<1	99.0%	<1	91.0%	<1
EG-005C	Beryllium - TCLP	mg/L	0.1	113%	<0.1	114%	<0.1	109%	<0.1	114%	<0.1	105%	<0.1
EG-005C	Cadmium - TCLP	mg/L	0.1	107%	<0.1	102%	<0.1	104%	<0.1	107%	<0.1	99.0%	<0.1
EG-005C	Chromium - TCLP	mg/L	0.1	105%	<0.1	105%	0.5	102%	<0.1	105%	<0.1	95.0%	<0.1
EG-005C	Copper - TCLP	mg/L	0.1	101%	<0.1	98.0%	<0.1	96.0%	<0.1	96.0%	<0.1	86.0%	0.3
EG-005C	Nickel - TCLP	mg/L	0.1	104%	<0.1	102%	0.1	102%	<0.1	105%	<0.1	97.0%	<0.1
EG-005C	Lead - TCLP	mg/L	0.1	101%	<0.1	98.0%	<0.1	100%	<0.1	102%	<0.1	93.0%	<0.1
EG-005C	Antimony - TCLP	mg/L	0.1	----	<0.1	----	<0.1	----	<0.1	----	<0.1	----	<0.1
EG-005C	Thallium - TCLP	mg/L	0.1	----	<0.1	----	<0.1	----	<0.1	----	<0.1	----	<0.1
EG-005C	Zinc - TCLP	mg/L	0.5	104%	<0.5	100%	<0.5	104%	<0.5	106%	<0.5	96.0%	<0.5
EG-020C	Selenium - TCLP	mg/L	0.1	102%	<0.1	100%	0.2	100%	<0.1	102%	<0.1	106%	<0.1
EG-035C	Mercury - TCLP	mg/L	0.01	109%	<0.01	109%	----	105%	----	109%	----	105%	----

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QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		51	51	200	201	205	206	210	211		
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	01-BA MS	01-BA CHK	METHOD BLANK1	LCS1	METHOD BLANK2	LCS2	METHOD BLANK3	LCS3		
				CHECKS AND SPIKES									
ALS1	Initial pH		0.1	----	----	----	----	----	----	----	----		
ALS2	After HCl pH		0.1	----	----	----	----	----	----	----	----		
ALS3	Extraction Fluid Number		1	----	1	1	----	1	----	1	----		
ALS4	pH After Extract		0.1	----	----	----	----	----	----	----	----		
EG-005C	Silver - TCLP	mg/L	0.1	----	<0.1	<0.1	----	<0.1	----	<0.1	----		
EG-005C	Arsenic - TCLP	mg/L	0.1	110%	<0.1	<0.1	104%	<0.1	----	<0.1	103%		
EG-005C	Barium - TCLP	mg/L	1	96.0%	<1	<1	99.0%	<1	----	<1	99.0%		
EG-005C	Beryllium - TCLP	mg/L	0.1	111%	<0.1	<0.1	----	<0.1	----	<0.1	----		
EG-005C	Cadmium - TCLP	mg/L	0.1	101%	<0.1	<0.1	102%	<0.1	----	<0.1	102%		
EG-005C	Chromium - TCLP	mg/L	0.1	101%	<0.1	<0.1	100%	<0.1	----	<0.1	99.0%		
EG-005C	Copper - TCLP	mg/L	0.1	94.0%	<0.1	<0.1	101%	<0.1	----	<0.1	101%		
EG-005C	Nickel - TCLP	mg/L	0.1	101%	<0.1	<0.1	101%	<0.1	----	<0.1	100%		
EG-005C	Lead - TCLP	mg/L	0.1	95.0%	<0.1	<0.1	101%	<0.1	----	<0.1	100%		
EG-005C	Antimony - TCLP	mg/L	0.1	----	<0.1	<0.1	----	<0.1	----	<0.1	----		
EG-005C	Thallium - TCLP	mg/L	0.1	----	<0.1	<0.1	----	<0.1	----	<0.1	----		
EG-005C	Zinc - TCLP	mg/L	0.5	102%	<0.5	<0.5	101%	<0.5	----	<0.5	100%		
EG-020C	Selenium - TCLP	mg/L	0.1	102%	<0.1	<0.1	100%	----	----	----	----		
EG-035C	Mercury - TCLP	mg/L	0.01	93.0%	----	<0.01	105%	<0.01	103%	<0.01	104%		

RECEIVED
27 NOV 2003
BY:

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:		**BATCH:**	ES43460
CLIENT:		**SUB BATCH:**	0
ADDRESS:		**LABORATORY:**	SYDNEY
		DATE RECEIVED:	13/11/2003
		DATE COMPLETED:	25/11/2003
		SAMPLE TYPE:	TCLP LEACHATE
ORDER No.:	3917	**No. of SAMPLES:**	4
PROJECT:	TCLP		

COMMENTS

The concentrations reported are those determined on the TCLP leachate

Extraction fluid #1 pH 4.88-4.98.

NOTES

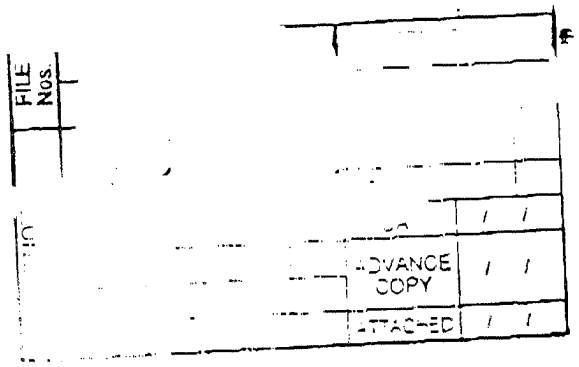
This is the Final Report and supersedes any preliminary reports with this batch number
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: SYDNEY

Address
277-289 Woodpark Road
SMITHFIELD NSW 2164

Phone: 61-2-8784 8555
Fax: 61-2-8784 8500
Email: cindy suen@alsenviro.com

Signatory



Batch: ES43460
Sub Batch: 0
Date of Issue: 25/11/2003
Client:
Client Reference: TCLP

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	1	200	201	202					
		Date Sampled				13/11/2003	13/11/2003	13/11/2003					
				OB-FAC MS	OB-FAC CHK	METHOD BLANK	LCS	MS					
				CHECKS AND SPIKES									
LS1	Initial pH		0.1	---	---	---	---	---					
LS2	After HCl pH		0.1	---	---	---	---	---					
LS3	Extraction Fluid Number		1	---	---	1	---	---					
LS4	pH After Extract		0.1	---	---	---	---	---					
G-005C	Silver - TCLP	mg/L	0.1	---	<0.1	<0.1	---	---					
G-005C	Arsenic - TCLP	mg/L	0.1	112%	<0.1	<0.1	101%	112%					
G-005C	Barium - TCLP	mg/L	1	101%	<1	<1	99.0%	101%					
G-005C	Beryllium - TCLP	mg/L	0.1	110%	<0.1	<0.1	---	110%					
G-005C	Cadmium - TCLP	mg/L	0.1	107%	<0.1	<0.1	103%	107%					
G-005C	Chromium - TCLP	mg/L	0.1	106%	<0.1	<0.1	101%	106%					
G-005C	Copper - TCLP	mg/L	0.1	99.0%	<0.1	<0.1	99.0%	99.0%					
G-005C	Nickel - TCLP	mg/L	0.1	105%	<0.1	<0.1	100%	105%					
G-005C	Lead - TCLP	mg/L	0.1	103%	<0.1	<0.1	102%	103%					
G-005C	Antimony - TCLP	mg/L	0.1	---	<0.1	<0.1	---	---					
G-005C	Zinc - TCLP	mg/L	0.5	106%	<0.5	<0.5	101%	106%					
G-020C	Selenium - TCLP	mg/L	0.1	106%	<0.1	<0.1	106%	106%					
G-020C	Thallium - TCLP	mg/L	0.1	---	<0.1	<0.1	99.0%	---					
G-035C	Mercury - TCLP	mg/L	0.01	---	---	<0.01	113%	114%					

Batch: ES43460
Sub Batch: 0
Date of Issue: 25/11/2003
Client:
Client Reference: TCLP

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION			
	Laboratory I.D.			1	2	3	4
	Date Sampled						
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	OB-FAC	OB-FAM	OB-FAF	OB-BA
LS1	Initial pH		0.1	4.0	3.6	3.9	5.9
LS2	After HCl pH		0.1	---	---	---	1.7
LS3	Extraction Fluid Number		1	1	1	1	1
LS4	pH After Extract		0.1	5.0	5.0	5.0	5.0
G-005C	Silver - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Arsenic TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Barium TCLP	mg/L	1	<1	<1	<1	<1
G-005C	Beryllium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Cadmium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Chromium - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Copper - TCLP	mg/L	0.1	<0.1	<0.1	0.6	<0.1
G-005C	Nickel - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Lead - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Antimony - TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-005C	Zinc TCLP	mg/L	0.5	<0.5	<0.5	1.0	<0.5
G-020C	Selenium TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-020C	Thallium TCLP	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
G-035C	Mercury TCLP	mg/L	0.01	<0.01	<0.01	<0.01	<0.01

99%

P.03

TCLP Results

Batch Number - ES43339				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sample Number				05-FAF	05-ROS	05-FAC	05-FAFD	05-ROSD	05-FACD	06-FAF	06-FAM	06-FAC	06-BA	11-FAX	07-A-FAC	07-A-BA	07-B-FAM	07-B-BA
Silver	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	mg/L	0.1		**0.3**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	<0.1	<0.1	<0.1	<0.1	**0.7**	<0.1	**0.1**	<0.1	**0.2**
Barium	mg/L	1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Beryllium	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.5**	<0.1	<0.1	<0.1	<0.1
Copper	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Lead	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1
Antimony	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Thallium	mg/L	0.1		**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	**0.1**	<0.1	<0.1
Zinc	mg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1
Mercury	mg/L	0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TCLP Results

Batch Number - ES43339			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Sample Number			07-C-FAF	07-C-BA	07-D-FAC	07-D-BA	07-E-FAC	07-E-BA	07-F-FAM	07-F-BA	07-G-BA	02-FAF	02-BA	10-CS	10-FM	03-BA	03-FAF	13-FA1
Silver	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.2**
Arsenic	mg/L	0.1	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**2**	<1
Barium	mg/L	1	<1	<1	<1	<1	**2**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1
Beryllium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	**0.3**	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1
Nickel	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Antimony	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Thallium	mg/L	0.1	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TCLP Results

Batch Number - ES43339																	
		32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Sample Number		13-FA2	13-FA3	13-BA	12-FAF	12-FAC	12-BA	02-FAC-Z1	02-FAM-Z2	02-FAM-Z3	02-FAF-Z4	02-FAF-Z5	02-BA-AH	04-FAF	04-FAM	04-FAC	04-BA
Silver	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	mg/L	0.1	**0.2**	**0.2**	<0.1	**0.4**	**0.2**	<0.1	<0.1	<0.1	**0.1**	**0.1**	**0.2**	<0.1	<0.1	<0.1	<0.1
Barium	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Beryllium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	mg/L	0.1	**0.1**	<0.1	<0.1	**0.4**	**0.3**	<0.1	<0.1	**0.2**	**0.3**	**0.3**	**0.3**	<0.1	<0.1	<0.1	<0.1
Nickel	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.2**	**0.2**	**0.1**	**0.1**
Lead	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Antimony	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Thallium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.6**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.6**	<0.5	<0.5	<0.5
Selenium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Batch Number - ES43339			48	49	50	51	52	53	54
Sample Number			01-FAF	01-FAM	01-FAC	01-BA	12-FAFD	12-FACD	12-BAD
Silver	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	mg/L	0.1	**0.7**	**0.2**	<0.1	<0.1	**0.4**	**0.2**	<0.1
Barium	mg/L	1	<1	<1	<1	<1	<1	<1	<1
Beryllium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/L	0.1	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	mg/L	0.1	**0.2**	**0.2**	<0.1	<0.1	**0.3**	**0.2**	<0.1
Nickel	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Antimony	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Thallium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.6**
Selenium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TCLP testing Results (1993-2001) conducted by AWT

1993-1997	3721THg **Mercury** TM01NS ug/L	3511TSb **Antimony** TM11WW mg/L	3521TAs **Arsenic** TM11WW mg/L	3531TBa **Barium** TM11WW mg/L	3571TCd **Cadmium** TM11WW mg/L	3601TCr **Chromium** TM11WW mg/L	3621TCu **Copper** TM11WW mg/L	3691TPb **Lead** TM11WW mg/L	3741TNi **Nickel** TM11WW mg/L	3751TSe **Selnium** TM11WW mg/L	3771TAg **Silver** TM11WW mg/L	3821TZn **Zinc** TM11WW mg/L	9004TTl **Thallium** TM11WW mg/L	9988TBe **Beryllium** TM11WW mg/L
Client Sample ID														
SCC	**<0.5**	**<15**	**<50**	**<1500**	**<0.5**	**<100**	**<250**	**<150**	**<100**	**<5**		**<500**	**<5**	**<15**
A	0.40	0.02	0.11	0.257	0.005	0.09	0.046	0.08	0.01	0.04	0.01	0.14	0.05	0.005
B	0.70	0.02	0.25	0	0.005	0.05	0.107	0.13	0.02	0.10	0.01	0.22	0.05	0.005
C	0.50	0.02	0.02	0	0.005	0.05	0.029	0.02	0.01	0.07	0.01	0.93	0.05	0.005
D	0.20	0.02	0.03	0	0.005	0.11	0.089	0.02	0.02	0.14	0.01	0.82	0.05	0.006
E	0.60	0.02	0.27	0	0.005	0.06	0.025	0.02	0.02	0.11	0.01	0.80	0.05	0.005
F	0.2	0.02	0.04	0	0.005	0.01	0.011	0.02	0.02	0.11	0.01	2.03	0.05	0.005
G	0.05	0.02	0.02	0	0.005	0.02	0.047	0.21	0.02	0.01	0.01	0.45	0.05	0.005
H	0.2	0.02	0.02	0	0.005	0.06	0.019	0.04	0.01	0.05	0.01	0.16	0.06	0.005
I	0.2	0.02	0.27	0	0.005	0.19	0.267	0.07	0.03	0.08	0.01	0.15	0.07	0.005
L	0.1	0	0.26	0.256	0.005	0.19	0.243	0.20	0.03	0.08	0.01	0.19	N/A	0.005
M	0.1	0	0.02	0.658	0.005	0.01	0.019	0.15	0.04	0.02	0.01	0.18	N/A	0.005
L	0.3	0.02	0.02	1.25	0.005	0.01	0.139	0.02	0.01	0.02	0.01	0.25	0.14	0.005
N	0.1	0.02	0.06	0.691	0.005	0.01	0.181	0.02	0.02	0.02	0.01	0.26	0.14	0.005
O	0.2	0.02	0.37	0.171	0.005	0.17	0.424	0.02	0.05	0.09	0.01	0.27	0.11	0.005
P	0.1	0.02	0.02	0.369	0.005	0.01	0.111	0.02	0.01	0.02	0.01	0.24	0.15	0.005
C	0.6	0.03	0.04	0.342	0.005	0.12	0.112	0.02	0.02	0.14	0.01	0.16	0.13	0.006
Q	0.4	0.02	0.04	0.456	0.009	0.01	0.237	0.02	0.24	0.11	0.01	0.57	0.21	0.006
H	0.3	0.02	0.02	0.865	0.005	0.10	0.085	0.02	0.03	0.10	0.01	0.17	0.13	0.005
A	1.1	0.02	0.03	0.475	0.005	0.13	0.070	0.02	0.02	0.12	0.01	0.17	0.12	0.005
A	0.2	0.02	0.02	0.290	0.005	0.01	0.055	0.02	0.01	0.01	0.01	0.14	0.10	0.005
B	0.1	0.02	0.02	0.191	0.005	0.01	0.016	0.02	0.01	0.01	0.01	0.14	0.09	0.005
F	0.1	0.03	0.02	0.265	0.005	0.01	0.040	0.02	0.01	0.01	0.01	0.15	0.10	0.005
E	0.1	0.02	0.02	0.722	0.005	0.01	0.010	0.06	0.02	0.01	0.01	0.55	0.05	0.005
E	0.7	0.02	1.28	0.529	0.005	0.12	0.051	0.02	0.07	0.18	0.01	0.29	0.05	0.005
E	1.1	0.02	1.99	0.314	0.005	0.16	0.019	0.02	0.08	0.13	0.01	0.19	0.05	0.005
R	0.2	0.03	0.02	0.394	0.005	0.07	0.181	0.02	0.03	0.02	0.01	0.36	0.06	0.005
S	0.2	0.02	0.19	0.828	0.005	0.02	0.057	0.02	0.03	0.08	0.01	0.23	0.05	0.005
G	0.1	0.02	0.04	0.226	0.006	0.03	0.072	0.02	0.02	0.02	0.01	0.45	0.06	0.005
T	1.9	0.02	0.09	0.996	0.005	0.01	0.134	0.02	0.02	0.06	0.01	0.21	0.05	0.005
E	0.001	0.18	0.51	0.291	0.005	0.28	0.018	0.08	0.05	0.09	0.01	0.32	0.08	0.005
E	0.001	0.10	0.41	0.623	0.005	0.01	0.048	0.06	0.02	0.10	0.01	0.28	0.09	0.005
L	0.1	0.02	0.03	0.868	0.005	0.01	0.005	0.08	0.01	0.02	0.01	0.29	0.10	0.005

Printed on : 04/10/03
Checked By: CH

N	0.1	0.03	0.24	0.254	0.005	0.02	0.210	0.34	0.0	0.05	0.01	0.28	0.14	0.005
O	0.3	0.09	0.44	0.091	0.005	0.06	0.426	0.18	0.04	0.09	0.01	0.22	0.16	0.005
B	0.2	0.04	0.17	0.315	0.005	0.03	0.098	0.09	0.02	0.15	0.01	0.19	0.19	0.005
F	0.6	0.18	0.07	0.916	0.005	0.01	0.026	0.02	0.05	0.11	0.01	0.40	0.23	0.005
SCC	**<0.5**	**<15**	**<50**	**<1500**	**<0.5**	**<100**	**<250**	**<150**	**<100**	**<5**		**<500**	**<5**	**<15**
Average	0.343	0.034	0.208	0.386	0.005	0.063	0.104	0.061	0.032	0.071	0.010	0.357	0.096	0.005
Mode	0.1	0.02	0.02	0	0.005	0.01	0.019	0.02	0.02	0.02	0.01	0.14	0.05	0.005
Std Dev	0.384	0.041	0.387	0.334	0.001	0.068	0.107	0.073	0.039	0.048	ERR	0.349	0.051	0.000

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Checke

ATTACHMENT B

NATA LABORATORY REPORTS

Determination of total metals results

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR CRAIG HIEDRICH	**BATCH:**	ES43607
CLIENT:	ASH DEVELOPMENT ASSOCIATION	**SUB BATCH:**	0
ADDRESS:	P O BOX 1194 WOLLONGONG NSW 2500	**LABORATORY:**	SYDNEY
		DATE RECEIVED:	24/11/2003
		DATE COMPLETED:	02/12/2003
		SAMPLE TYPE:	SOIL
ORDER No.:		**No. of SAMPLES:**	10
PROJECT:			

COMMENTS

Samples as received digested by USEPA method 200.2 (modified) prior to the determination of metals. Results reported on a dry weight basis.

All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999).

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: SYDNEY

Address
277-289 Woodpark Road
SMITHFIELD NSW 2164

Phone: 61-2-8784 8555
Fax: 61-2-8784 8500
Email: cindy.suen@alsenviro.com

Signatory

Batch: ES43607
Sub Batch: 0
Date of Issue: 02/12/2003
Client: ASH DEVELOPMENT ASSOCIATION
Client Reference:

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
		Date Sampled		05-FAF	05-ROS	05-FAC	06-FAF	06-FAM	06-FAC	06-BA	10-CS	10-FM	11-FAX
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR										
EA-055	Moisture Content (dried @ 103'C)	%	0.1	<0.1	<0.1	0.1	0.2	0.1	0.1	22.4	5.3	4.5	<0.1
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005T	Lead - Total	mg/kg	1	5	5	4	4	4	<1	<1	1	<1	6
EG-035T	Mercury - Total	mg/kg	0.1	0.2	0.4	0.5	<0.1	<0.1	<0.1	2.1	<0.1	<0.1	0.4

Batch: ES43607
Sub Batch: 0
Date of Issue: 02/12/2003
Client: ASH DEVELOPMENT ASSOCIATION
Client Reference:

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	1	200	201						
		Date Sampled				24/11/2003	24/11/2003						
				05-FAF	05-FAF	METHOD	LCS						
				MS	CHK	BLANK							
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	<0.1	----	----						
EG-005T	Cadmium - Total	mg/kg	1	103%	<1	<1	109%						
EG-005T	Lead - Total	mg/kg	1	102%	5	<1	102%						
EG-035T	Mercury - Total	mg/kg	0.1	103%	0.3	<0.1	103%						

ATTACHMENT C

NATA LABORATORY REPORTS

PCDD's and PCDF's results

AgriQuality New Zealand Limited
Huarangi Aotearoa

Wellington Office
P.O. Box 31 242
1B Bell Road, Lower Hutt

Phone: 64 4 5708800
Facsimile: 64 4 5708176

17 December 2003

Certificate of Analysis

Client:	ALS Pty Ltd Locked Bag 106 Wetherill Park VC NSW 1851 Australia
Attention:	Greg Vogel
Date Received:	25 Nov 2003
AgriQuality Lab. Reference:	2640
Sample Type:	Solid
Analysis:	**Polychlorinated dibenzo-p-dioxins (PCDDs)** **Polychlorinated dibenzofurans (PCDFs)**
Method:	Based on USEPA Method 1613B (Isotope Dilution)

Results are reported in picograms per gram (pg/g), equivalent to ppt, on an as received basis to two significant figures. The DL value is reported to one significant figure. Results have been corrected for recoveries. The sum of PCDDs and PCDFs is calculated and reported to three significant figures both including and excluding DL values.

The total toxic equivalence (I-TEQ) was calculated for each sample using international toxic equivalency factors (I-TEFs). The total I-TEQ level is reported both including and excluding the DL values.

Unless requested, samples will be disposed of three months from the date of this report.

Lawrence Porter
IANZ Signatory
AgriQuality

International Accreditation New Zealand (IANZ) has a Mutual Recognition Agreement (MRA) with the National Association of Testing Authorities (NATA), Australia, such that both organisations recognise accreditations by IANZ and NATA as being equivalent. Users of test reports/certificates are recommended to accept test reports/certificates in the name of either accrediting body.

Results: USEPA Method 1613B

Laboratory Reference: **2640-1**

Sample Identification: **4) ES 43607**

Date Received: 25 Nov 2003 Date Analysed U2: 12 Dec 2003

Date Extracted: 10 Dec 2003 Date Analysed SP2331: Not applicable

Analyte	Conc.† (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.7		88	24 - 169	
Total TCDF	ND	0.7				
2378 TCDD	ND	0.6		88	25 - 164	
Total TCDD	ND	7				
37Cl TCDD				87	35 - 197	
12378 PeCDF	ND	0.3		79	24 - 185	
23478 PeCDF	ND	0.3		82	21 - 178	
Total PeCDF	ND	0.3				
12378 PeCDD	ND	0.6		82	25 - 181	
Total PeCDD	ND	0.6				
123478 HxCDF	ND	0.5		99	26 - 152	
123678 HxCDF	ND	0.5		93	26 - 123	
234678 HxCDF	ND	0.5		105	28 - 136	
123789 HxCDF	ND	0.6		97	29 - 147	
Total HxCDF	ND	0.6				
123478 HxCDD	ND	0.7		114	32 - 141	
123678 HxCDD	ND	0.8		101	28 - 130	
123789 HxCDD	ND	0.7				
Total HxCDD	ND	0.8				
1234678 HpCDF	ND	1		85	28 - 143	
1234789 HpCDF	ND	1		90	26 - 138	
Total HpCDF	ND	3				
1234678 HpCDD	ND	4		88	23 - 140	
Total HpCDD	ND	7				
OCDF	ND	3				
OCDD	ND	30		62	17 - 157	

	Minimum	Maximum	Units
Sum of PCDD and PCDF congeners:	0	51.8	pg/g
Total I-TEQ:	0	1.65	pg/g

† = Results are reported on an as received basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

$^{37}CL_4$ TCDD: Clean-up recovery spike

Lab Analyst: MP Data Analyst: AS Authorised: Lawrence Porter

Results: USEPA Method 1613B

Laboratory Reference: **2640-2**

Sample Identification: **5) ES 43607**

Date Received: 25 Nov 2003 Date Analysed U2: 09 Dec 2003

Date Extracted: 08 Dec 2003 Date Analysed SP2331: Not applicable

Analyte	Conc.† (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.8		51	24 - 169	
Total TCDF	ND	0.8				
2378 TCDD	ND	1		60	25 - 164	
Total TCDD	ND	2				
37Cl TCDD				92	35 - 197	
12378 PeCDF	ND	0.9		51	24 - 185	
23478 PeCDF	ND	0.4		54	21 - 178	
Total PeCDF	ND	0.9				
12378 PeCDD	ND	0.6		57	25 - 181	
Total PeCDD	ND	0.6				
123478 HxCDF	ND	0.7		60	26 - 152	
123678 HxCDF	ND	0.8		52	26 - 123	
234678 HxCDF	ND	1		43	28 - 136	
123789 HxCDF	ND	1		40	29 - 147	
Total HxCDF	ND	1				
123478 HxCDD	ND	0.7		70	32 - 141	
123678 HxCDD	ND	0.8		58	28 - 130	
123789 HxCDD	ND	0.7				
Total HxCDD	ND	0.8				
1234678 HpCDF	ND	0.9		45	28 - 143	
1234789 HpCDF	ND	1		46	26 - 138	
Total HpCDF	ND	1				
1234678 HpCDD	ND	2		48	23 - 140	
Total HpCDD	ND	2				
OCDF	ND	2				
OCDD	ND	20		34	17 - 157	

	Minimum	Maximum	Units
Sum of PCDD and PCDF congeners:	0	28.8	pg/g
Total I-TEQ:	0	2.73	pg/g

† = Results are reported on an as received basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

$^{37}CL_4$ TCDD: Clean-up recovery spike

Lab Analyst: TG Data Analyst: AS Authorised: Lawrence Porter

Results: USEPA Method 1613B

Laboratory Reference: **2640-3**

Sample Identification: **10) ES43607**

Date Received: 25 Nov 2003 | Date Analysed U2: 09 Dec 2003

Date Extracted: 08 Dec 2003 | Date Analysed SP2331: Not applicable

Analyte	Conc.† (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.7		92	24 - 169	
Total TCDF	ND	0.7				
2378 TCDD	ND	0.8		93	25 - 164	
Total TCDD	ND	0.8				
37Cl TCDD				94	35 - 197	
12378 PeCDF	ND	0.4		87	24 - 185	
23478 PeCDF	ND	0.4		88	21 - 178	
Total PeCDF	ND	0.4				
12378 PeCDD	ND	0.8		87	25 - 181	
Total PeCDD	ND	0.8				
123478 HxCDF	ND	0.8		98	26 - 152	
123678 HxCDF	ND	0.8		89	26 - 123	
234678 HxCDF	ND	0.8		102	28 - 136	
123789 HxCDF	ND	1		91	29 - 147	
Total HxCDF	ND	1				
123478 HxCDD	ND	1		105	32 - 141	
123678 HxCDD	ND	1		91	28 - 130	
123789 HxCDD	ND	1				
Total HxCDD	ND	1				
1234678 HpCDF	ND	1		90	28 - 143	
1234789 HpCDF	ND	1		91	26 - 138	
Total HpCDF	ND	1				
1234678 HpCDD	ND	2		89	23 - 140	
Total HpCDD	ND	2				
OCDF	ND	2				
OCDD	ND	50		80	17 - 157	

	Minimum	Maximum	Units
Sum of PCDD and PCDF congeners:	0	59.1	pg/g
Total I-TEQ:	0	2.25	pg/g

† = Results are reported on an as received basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

$^{37}CL_4$ TCDD: Clean-up recovery spike

Lab Analyst: TG Data Analyst: AS Authorised: Lawrence Porter

Results: USEPA Method 1613B

Laboratory Reference: **2640 BLANK**

Sample Identification: **Laboratory Blank**

Date Received: Not applicable
Date Extracted: 08 Dec 2003
Date Analysed U2: 09 Dec 2003
Date Analysed SP2331: Not applicable

Analyte	Conc.† (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.5		93	24 - 169	
Total TCDF	ND	0.5				
2378 TCDD	ND	0.7		92	25 - 164	
Total TCDD	ND	0.7				
37Cl TCDD				88	35 - 197	
12378 PeCDF	ND	0.6		102	24 - 185	
23478 PeCDF	ND	0.6		102	21 - 178	
Total PeCDF	ND	1				
12378 PeCDD	ND	0.6		101	25 - 181	
Total PeCDD	ND	0.6				
123478 HxCDF	ND	0.6		101	26 - 152	
123678 HxCDF	ND	0.6		94	26 - 123	
234678 HxCDF	ND	0.6		104	28 - 136	
123789 HxCDF	ND	0.8		93	29 - 147	
Total HxCDF	ND	3				
123478 HxCDD	ND	1		109	32 - 141	
123678 HxCDD	ND	1		91	28 - 130	
123789 HxCDD	ND	1				
Total HxCDD	ND	6				
1234678 HpCDF	ND	0.7		94	28 - 143	
1234789 HpCDF	ND	1		88	26 - 138	
Total HpCDF	ND	3				
1234678 HpCDD	ND	6		95	23 - 140	
Total HpCDD	ND	9				
OCDF	ND	2				
OCDD	ND	50		62	17 - 157	

	Minimum	Maximum	Units
Sum of PCDD and PCDF congeners:	0	72.1	pg/g
Total I-TEQ:	0	2.07	pg/g

† = Results are calculated using the average weight of samples in this batch

ND = Not Detected

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit
$^{37}CL_4$ TCDD: Clean-up recovery spike

Lab Analyst: TG Data Analyst: AS Authorised: Lawrence Porter

I-TEFs: USEPA Method 1613B

Analyte	I-TEFs
2378 TCDF	0.1
Total TCDF	0
2378 TCDD	1
Total TCDD	0
12378 PeCDF	0.05
23478 PeCDF	0.5
Total PeCDF	0
12378 PeCDD	0.5
Total PeCDD	0
123478 HxCDF	0.1
123678 HxCDF	0.1
234678 HxCDF	0.1
123789 HxCDF	0.1
Total HxCDF	0
123478 HxCDD	0.1
123678 HxCDD	0.1
123789 HxCDD	0.1
Total HxCDD	0
1234678 HpCDF	0.01
1234789 HpCDF	0.01
Total HpCDF	0
1234678 HpCDD	0.01
Total HpCDD	0
OCDF	0.001
OCDD	0.001

I-TEFs	= International toxic equivalency factors
I-TEQ	= Total toxic equivalence

ATTACHMENT D

Sizing Distribution Analysis

Construction
Materials

ABN 51 000 756 507
MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY. LTD.
Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone (02) 9624 9900
Facsimile (02) 9624 9999

www.boral.com.au

Client: Ash Development Association of Australia

File No.: 135 / 04

PARTICLE SIZE ANALYSIS REPORT

Request No.: **16315**
Laboratory Sample Numbers: 45106, 45107, 45108, 45109, 45110, 45111, 45112

Job description:
Particle size analysis
Sample description:
05-ROS; 11-FAX; 06-BA; 10-CS; 01-BA; 12-BA; 13-BA

RESULTS

Seven ash samples have been submitted for particle size analysis and tested using a Mastersizer 2000 particle size analyzer.
The fly ash samples 05-ROS and 11-FAX have been analysed in “as received” conditions, while the coarser grade bottom ash samples have been screened and the pass on the 1.7mm sieve was analysed for particle size distribution.

The results obtained for the characteristic diameters of the samples are summarized in the table below, and plotted in **Figure 1**.

	Sample 05-ROS (as received)	Sample 11-FAX (as received)	Sample 06-BA (screened to <1.7mm)	Sample 10-CS (screened to <1.7mm)	Sample 01-BA (screened to <1.7mm)	Sample 12-BA (screened to <1.7mm)	Sample 13-BA (screened to <1.7mm)
D (10%), µm	5.1	1.8	44.6	52.8	79.7	84.7	132.1
D (50%), µm	24.0	11.1	301.2	314.7	266.6	379.0	634.9
D (90%), µm	85.0	40.0	987.9	1007.3	790.9	999.1	1330.3
Mean diameter, µm	37.8	17.1	422.0	433.9	363.1	469.1	691.9

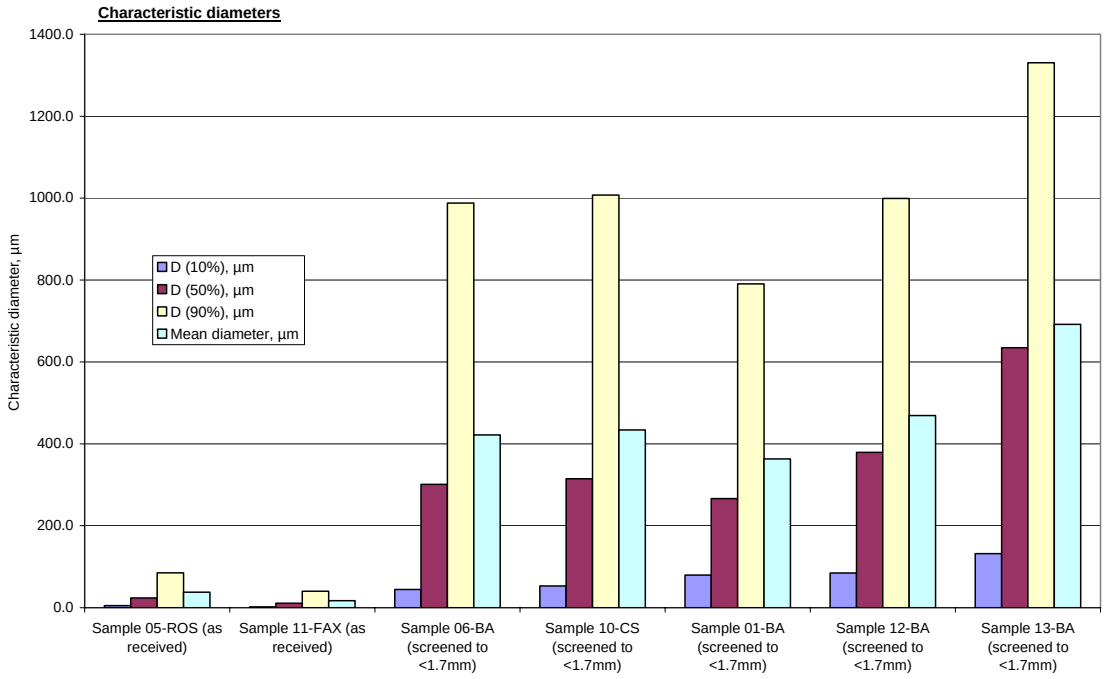

Figure 1: Characteristic diameters

The particle size distribution of the samples is presented in **Figure 2**, while the cumulated pass curves are presented in **Figure 3**. The cumulated pass trends of the original samples are plotted in **Figure 4**, with the results being obtained by correcting the cumulated pass results post-sieving with the >1.7mm residue figures (Note: this correction is based on an assumed uniform-density distribution).

The processed Excel source data file is also provided electronically.

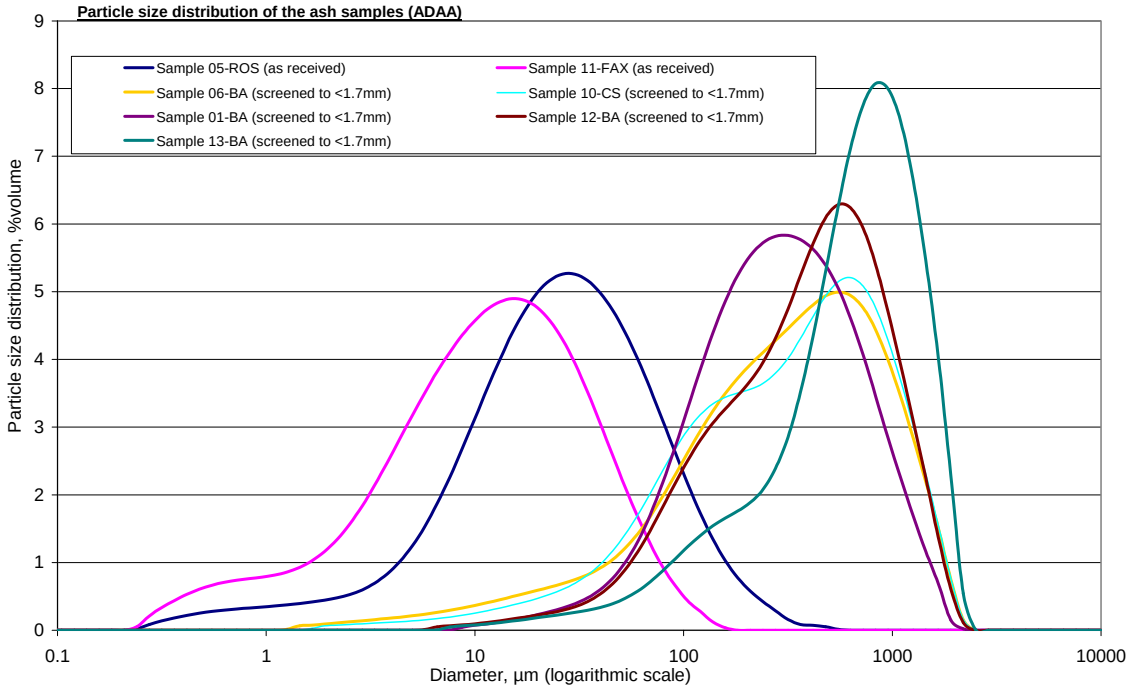

Figure 2: Particle size distribution

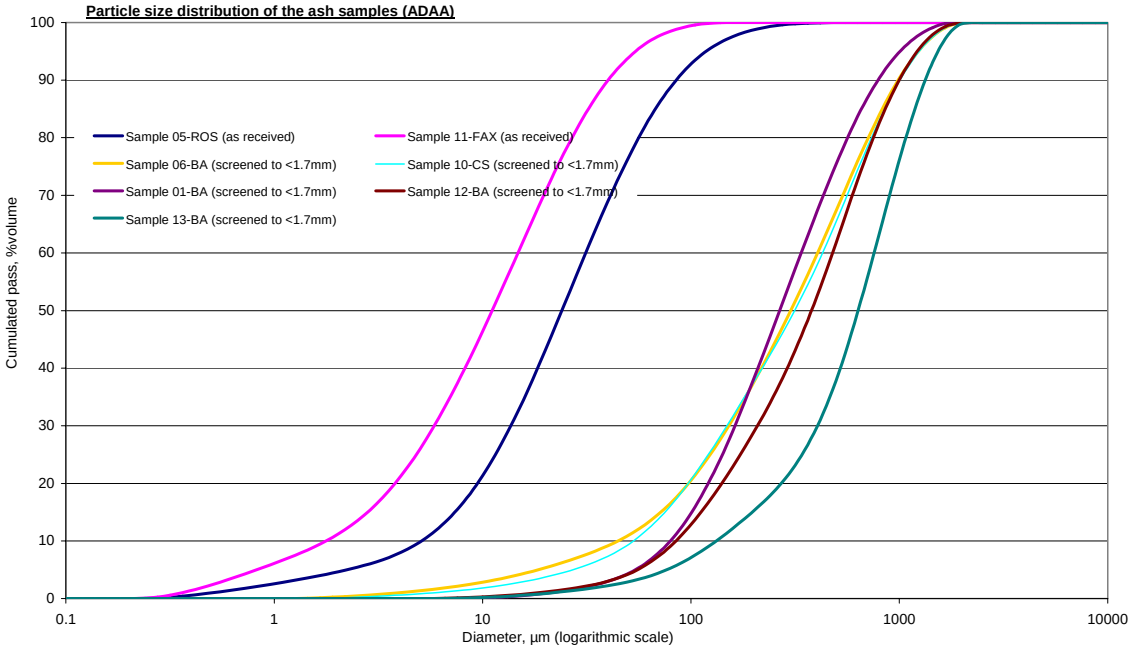

Figure 3: Cumulated pass

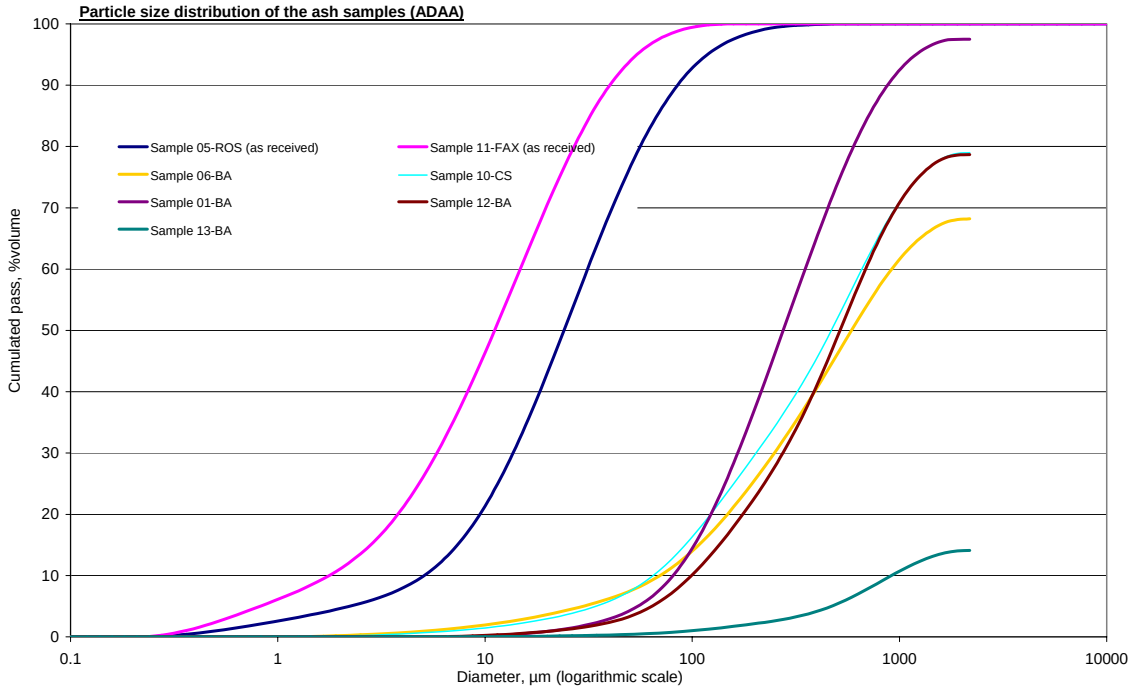

Figure 4: Cumulated pass curves, corrected for >1.7mm residue

Valentina Paraschiv
Senior Development Engineer
27.02.2004

C.Heidrich, File R&D, File