ASH Development
Association of Australia

Ash Development Association of Australia (ADAA)

Coal Combustion Product (CCP) Environmental Monitoring Program 2008/9

February 2009

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ATTACHMENTS

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
Composite Sample	A sample that combines 5 discrete subsamples into a single sample for the purpose of analysis
DECC	Department of Environment and Climate Change New South Wales
EQL	Estimated Quantitation Limit (EQL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The EQL is generally 2 to 5 times the Method of Detection Limit (MDL).
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
QLD EPA	Queensland Environmental Protection Agency
SCC	Specific Chemical Concentration
TCLP	Toxicity Characteristic Leaching Procedure – a method of determining the release of a substance via exposure to water solution
TM	Total metals analysis - absolute. Report as mg/kg dry weight
TM (Chara)	Maximum average total metals limit reported for characterisation or once-off tests as specified by DECC approval for a minimum of 20 separate composite samples
TM (Routine)	Maximum average total metals limit reported for routine testing as specified by DECC approval for a minimum of 5 composite samples each 6 months
TM (Max)	Maximum total metals limit reported for any single composite sample analysis result as specified by DECC approval.
USEPA	United States Environment Protection Agency
WHO	World Health Organisation

Executive Summary

Arising from the 2003/2004 Research and Development capstone study and the subsequent recommendations from the *Coal Combustion Product (CCP) - Environmental Testing Programme 2003/2004*[1] report, the Ash Development Association of Australia (ADAA) has implemented an ongoing "Environmental Monitoring Program" (EMP) into coal combustion products (CCPs).

Commencing in 2006, the ADAA has published two monitoring reports, one in 2006/7 and 2007/8 reporting on CCPs samples collected from its member companies from across Australia. This report summarises the results of the EMP for 2008/9, which assesses, discusses and compares the chemical characteristics and leaching behaviour of CCP from several Australian producers and suppliers.

The aim of the EMP is to collate and interpret the analytical knowledge on its members' CCPs through a coordinated annual sampling, analysis and reporting program.

The monitoring program is also intended to supplement/compliment Association members own testing and assessment requirements as mandated by various state regulations, for example "*The fly ash and bottom ash from burning NSW or Queensland coal exemption 2006* (NSW)" and Queensland EPA beneficial reuse approval issued in 2007 amongst others.

The methodology used involved the collection of fine fly ash, medium fly ash, run-of-station ash and furnace bottom ash samples from ADAA members throughout Australia. The geographic distribution of members is illustrated in **Figure 1**.

A total of 41 samples were analysed using total metals analysis for a range of specified elements. From these results, a selected number of samples [18] were also tested using TCLP methods.

In summary,

- All total metal results for M17 elements, in particular elements of concern - Nickel (Ni), Cadmium (Cd), Lead (Pb) and Mercury (Hg) were **below limits** specified by NSW & QLD agencies.
- All total metal results for specific elements nominated by QLD EPA were **below limits**.
- Results for both fly ash and furnace bottom ash from Victorian sources (brown coal ash) were **below limits** for total metals and leachate assessments specified by NSW & QLD agencies.
- All leachate results were either below or just above the laboratory **detection limits** for each analyte, and accordingly were **well within** the acceptance criteria adopted for each jurisdiction. It should be noted that numerous results reported were below the limit of detection, so no statistical analysis has been conducted.

These 2008/9 investigations represent another milestone in further confirming the benign (inert) nature of CCPs, thus demonstrating the potential reuse of CCPs for applications, including but not limited to civil engineering applications, raw materials for the cement and concrete industries and for agricultural and horticultural purposes.

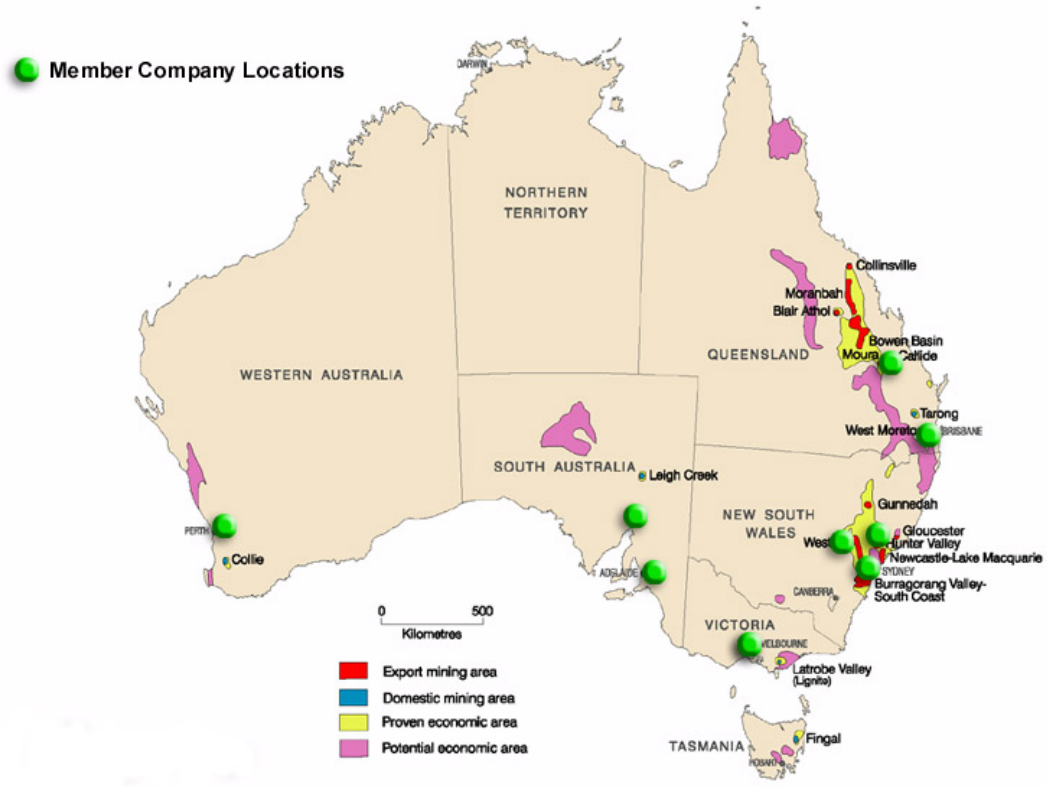

Figure 1- Distribution of Members

1 Introduction

The Ash Development Association of Australia (ADAA) has undertaken an extensive analysis investigation into the element concentration and leachability of selected metal species from coal combustion products (CCPs) using the USEPA, DECC and QLD EPA total and TCLP methods.[2] 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 program, building on information collected in previous years.

The results over the past ten (10) years have been instrumental in underpinning the ADAA's position when – seeking, on behalf of its members, approval of CCPs as a resource for beneficial reuse. For example as granted under the *Environmental Protection (Waste Management) Regulation 2000*

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

(QLD). The application was approved and given effect from December 10, 2007.

All data has been treated with strict confidentiality and no published results identify individual participants.

Participating members are however provided with a unique identifier (member code) to assist with distinguishing their respective materials results for internal assessment purposes and for comparison against other CCP sources from throughout Australia. The participants in the 2008/9 sampling program are listed below:

Table 1 – Environmental Testing Program 2008/9 – Participants

Generator	CCP Marketer
• **CS Energy (QLD)**	• **Blue Circle Ash**
• **Delta Electricity (NSW)**	• **Cement Australia**
• **Eraring Energy (NSW)**	• **Flyash Australia**
• **Flinders Power (SA)**	• **Independent Fly Ash Brokers**
• **Intergen (QLD)**	• **Pozzolanic Enterprises**
• **International Power (VIC)**	
• **Loy Yang Power (VIC)**	
• **MacGen (NSW)**	
• **Stanwell Corporation (QLD**	
• **Tarong Energy (QLD)**	
• **Tarong North (QLD**	
• **TRUenergy (VIC)**	
• **Verve Energy (WA)**	

2 Site Identification and Characteristics

Each sample was allocated a unique code known to only the member and the ADAA. This system allows each site to view their results and compare these to the complete data set. The code consisted of a three-digit number for each sample, with samples coded according each site/client and the type of CCP (i.e. Fine Fly Ash, Medium Fly Ash, Run-of-station and Furnace Bottom Ash).

The following table sets out the sample identification coding system used to sort the specific fly ash and furnace bottom ash into their various categories:

Table 2 – Key of Sample Types

Product Description	Sample Identifications
Run-of-Station Fine Fly Ash – Black Coal	201, 301, 401, 601, 701, 901, 1301, 1401, 1501, 1701, 1801 (n= 11)
Run-of-Station Fine Fly Ash – Brown Coal	1001, 1101, 1601 (n= 3)
Run-of-Station Medium Fly Ash – Black Coal	202, 302, 402, 602, 702, 902, 1302, 1402, 1502, 1702, 1802 (n= 11)
Run-of-Station Medium Fly Ash – Brown Coal	1002, 1102 (n= 2)
Run-of-Station Furnace Bottom Ash – Black Coal	211, 311, 411, 611, 711, 911, 1311, 1411, 1511, 1711, 1811 (n= 11)
Run-of-Station Furnace Bottom Ash – Brown Coal	1011, 1111, 1611 (n= 3)

3 Objective and Scope of Work

This EMP investigated the chemical characteristics of CCPs from the range of members and locations. The testing program was conducted not only to assist the Association in identifying potential uses for CCPs as a secondary resource, but also to supplement ADAA's members in meeting various acceptance criteria and methodologies used to assess the suitability of CCPs prior to use in agricultural, horticultural and forest ecosystems.

The program consisted of collecting fine and medium fly ash, run-of-station ash and furnace bottom ash samples. These samples were then analysed for a range of total and leachable metals, consistent with the existing legislative requirements expounded in NSW legislation (*Fertilisers Act 1985; Environmental Guidelines: Assessment Classification and Management of Liquid and Non-liquid Wastes 1999* (NSW)) and the QLD EPA requirements for the use of CCP as a resource for beneficial reuse, as outlined in the *Environmental Protection (Waste Management) Regulation 2000* (QLD).

4 Sampling and Analysis Procedures

4.1 Site Sampling Procedures

Each site was provided with information about the testing program, as well as an analysis request and chain of custody form, which provided appropriate guidance on sampling procedures.

Consistent with the information and guidelines provided, fly ash samples were to be taken in accordance with the requirements of the following Australian Standards:

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

Furnace bottom ash samples were to be taken in accordance with the requirements of the following Australian 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 as follows:

> *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 despatched and completed with each set of samples.

4.2 Laboratory Procedures

Laboratory procedures for analysis of total metals were conducted by LabMark - a NATA (National Association of Testing Authorities) accredited laboratory.

> *LabMark Environmental Laboratories are Australasia's leading provider of quality laboratory and technical services for the Environmental*

markets. All test methods are independently evaluated and accredited by the NATA to ISO 17025 across all LabMark Environmental Laboratories. LabMark's team of Quality Managers and Document Controllers work with Laboratory Managers and Area Supervisors to ensure that all test procedures are certified, documented, followed, and reviewed at defined periods.

The laboratory procedures used for each analysis are summarised below:

- Total metals samples were digested by *USEPA method 200.2 (modified)* and the results were 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.

4.3 Quality Control / Quality Assurance Procedures

LabMark conducted the total metal and leachate analysis for this program. The QA / QC program implemented by LabMark is summarised below:

Laboratory QA/QC consists of:

• Matrix Spiked Samples: frequency 1 in first 5 samples, then 1 in 20 samples thereafter.

• Discrete Sample Duplicates: frequency 1 in first 5 samples, then 1 in 10 samples thereafter.

• Method Blanks: frequency 1 per analytical batch, per sample type.

• Surrogate Standards: all target organic determinations, where appropriate.

• Internal Standards: selected target organic determinations, where appropriate.

• In-House Reference Samples (RS): determined on a regular basis over long term.

• External U.S. & Canadian Certified Reference Samples (CRS): determined on an irregular basis over long term. Exceptionally high

costs and difficulties associated with CRS availability prevent regular determinations.

- *Proficiency Trials: Regular NATA & NRL inter-laboratory proficiency trials for analytical determinations conducted.*

- *LabMark welcomes customer audits every 2-year period, and encourages all users of analytical data to become more familiar with laboratory practices.*

- *Sample QA/QC preparation involves spiking sample matrices prior to extraction process, and performing discrete sample duplicate and triplicate determinations.*

5 5 Criteria

5.1 New South Wales

The table below outlines the relevant criteria, procedure and frequency required for each of the test procedures conducted in this program, consistent with NSW legislation and regulations for application to land.

Table 3 – Assessment Criteria and Procedure

Elements	Procedure	Criteria	Reference	Frequency
Total Metals (Cd, Pb, Hg)	**USEPA 200.2**	**Cd (10mg/kg) Pb (100mg/kg) Hg (5mg/kg)**	**Fertilisers Act 1985 (NSW)**	**Annually**
Leachable TCLP Metals	**USEPA 1311**	**Various**	**Environmental Guidelines: Assessment Classification and Management of Liquid and Non-liquid Wastes, NSWDEC 1999**	**Annually**

For compliance to be achieved, the analytical results for all total metals and TCLP tests must be below the threshold limits specified in the above table and referenced guidelines and legislation.

Special conditions for NSW suppliers, processors and consumers which are outlined in the exemption, *The fly ash and bottom ash from burning NSW or Queensland coal exemption 2006* (NSW), must also be met in conjunction with the above criteria.

Consistent with legislative guidelines, individual sites are also required to conduct boron and electrical conductivity tests three times a year, dioxin and furan tests annually, and chemical oxide tests every three years. Sites should refer to the ADAA's Reference Data Sheet No. 8: *Assessment Criteria for Use in Agricultural Applications,* for further guidance and information on the required process. Specified limits from the draft approvals *Table 2* are included in Tables 4, 5, 6 and 7.

5.2 Queensland

Coincident with the EMP 2007/8, QLD EPA granted ADAA and its members a general approval for CCP as a resource for beneficial reuse. This agency approval includes guidance on maximum acceptance criteria for nominated total metals and TCLP analyses. The approval took effect from 10 December 2007. Specified limits from the approvals *Table 1 & 2* are included in Tables 4, 5, 6 and 7.

6 Analytical Results

Tables 4, 5, 6 and 7 summarise the results for total metals analyses conducted on each group of samples. Consistent with the first round of testing conducted in 2004, analyses for cadmium (Cd), Lead (Pb) and Mercury (Hg) were requested, include M17 metals for all 41 samples. Selected samples, 18 were also analysed using TCLP procedures for the analytes listed below. Again, some extra results were listed in the LabMark reports and have been included in the below tables where provided.

Arsenic	Cadmium	Manganese	Tin
Barium	Chromium	Molybdenum	Zinc
Beryllium	Cobalt	Nickel	Mercury
Boron	Copper	Selenium	
	Lead	Silver	

The LabMark reports detailing the results for each site are included in **Attachment A.**

Table 4 – Run-of-Station Fly Ash (Black Coal) Assessment

Run-of-station Fly Ash - Black Coal								
ADAA Results[3]			Queensland EPA Limits[4]		NSW Limits[5]			
Element	Average TM	95% UCI TCLP	TM SCC	TCLP SCC[2]	Table 2 values			
					TM(Chara)	TM(Routine)	TM(Max)	TCLP(Max)
	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/L
Ag	N/S	0.00087	N/S	0.5	N/S	N/S	N/S	N/A
As	7.36	0.02458	100	0.5	10	N/A	20	N/A
B	49.5	N/A	N/A	N/S	75	N/A	150	N/A
Ba	271.5	0.85417	N/S	10	N/S	N/S	N/S	N/A
Be	2.07	N/A	20	N/S	N/S	N/S	N/S	N/A
Cd	0.25	0.00367	20	0.05	0.5	0.5	1	N/A
Co	6.7	N/A	100	N/S	N/S	N/S	N/S	N/A
Cr	10.55	0.04667	N/S	0.5	25	25	50	N/A
Cu	18.45	0.05583	1000	10	20	N/A	40	N/A
Hg	0.15	N/A	15	0.01	0.5	N/A	1	N/A
Mn	161.77	N/A	1500	N/S	N/S	N/S	N/S	N/A
Mo	6.95	N/A	N/S	N/S	10	N/A	20	N/A
Ni	11.34	0.02708	600	0.5	25	25	50	N/A
Pb	10.18	C	300	0.5	25	25	50	N/A
Sb	N/A	0.00667	N/A	0.5	N/A	N/A	N/A	N/A
Se	4.05	C	N/S	0.1	10	10	20	N/A
Sn	2.34	N/A	N/S	N/S	N/S	N/S	N/S	N/A
Tl	N/A	C	N/A	0.1	N/A	N/A	N/A	N/A
Zn	44.55	0.1875	7000	50	35	35	70	N/A

[3] Results in *Attachment A – LabMark Reports* where given as ug/L have been converted to mg/L
[4] QLD EPA Limits specified in Table 1 & 2 - Soil Investigation Levels
[5] DECC Draft Limits set out in Table 2 "Notice of Approval" (Subject to change)

Table 5 – Run-of-Station Fly Ash (Brown Coal) Assessment

Run-of-station Fly Ash - Brown Coal								
ADAA Results[6]			Queensland EPA Limits[7]		NSW Limits[8]			
Element	Average TM	95% UCI TCLP	TM SCC	TCLP SCC[2]	Table 2 values			
					TM(Chara)	TM(Routine)	TM(Max)	TCLP(Max)
	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/L
Ag	0.26	N/A	N/S	0.5	N/S	N/S	N/S	N/A
As	13.2	N/A	100	0.5	10	N/A	20	N/A
B	210	N/A	N/A	N/S	75	N/A	150	N/A
Ba	181	N/A	N/S	10	N/S	N/S	N/S	N/A
Be	2	N/A	20	N/S	N/S	N/S	N/S	N/A
Cd	0.12	N/A	20	0.05	0.5	0.5	1	N/A
Co	11.2	N/A	100	N/S	N/S	N/S	N/S	N/A
Cr	32	N/A	N/S	0.5	25	25	50	N/A
Cu	31.6	N/A	1000	10	20	N/A	40	N/A
Hg	1.54	N/A	15	0.01	0.5	N/A	1	N/A
Mn	1393.8	N/A	1500	N/S	N/S	N/S	N/S	N/A
Mo	5.2	N/A	N/S	N/S	10	N/A	20	N/A
Ni	62.4	N/A	600	0.5	25	25	50	N/A
Pb	8.2	N/A	300	0.5	25	25	50	N/A
Sb	N/A	N/A	N/A	0.5	N/A	N/A	N/A	N/A
Se	20.4	N/A	N/S	0.1	10	10	20	N/A
Sn	2.1	N/A	N/S	N/S	N/S	N/S	N/S	N/A
Tl	N/A	N/A	N/S	0.1	N/A	N/A	N/A	N/A
Zn	149.4	N/A	7000	50	35	35	70	N/A

[6] Results in *Attachment A – LabMark Reports* where given as ug/L have been converted to mg/L
[7] QLD EPA Limits specified in Table 1 & 2 - Soil Investigation Levels
[8] DECC Draft Limits set out in Table 2 "Notice of Approval" (Subject to change)

Table 6 – Run-of-Station Furnace Bottom Ash (Black Coal) Assessment

Run-of-station Furnace Bottom Ash - Black Coal								
ADAA Results[9]			Queensland EPA Limits[10]		NSW Limits[11]			
Element	Average TM	95% UCI TCLP	TM SCC	TCLP SCC	Table 2 values			
					TM(Chara)	TM(Routine)	TM(Max)	TCLP(Max)
	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/L
Ag	C	0.00058	N/S	0.5	N/S	N/S	N/S	N/A
As	0.59	C	100	0.5	10	N/A	20	N/A
B	9.36	N/A	N/A	N/S	75	N/A	150	N/A
Ba	111.36	0.73833	N/S	10	N/S	N/S	N/S	N/A
Be	0.55	N/A	20	N/S	N/S	N/S	N/S	N/A
Cd	C	C	20	0.05	0.5	0.5	1	N/A
Co	0.91	N/A	100	N/S	N/S	N/S	N/S	N/A
Cr	2.36	C	N/S	0.5	25	25	50	N/A
Cu	4.18	C	1000	10	20	N/A	40	N/A
Hg	0.027	N/A	15	0.01	0.5	N/A	1	N/A
Mn	192.68	N/A	1500	N/S	N/S	N/S	N/S	N/A
Mo	0.64	N/A	N/S	N/S	10	N/A	20	N/A
Ni	1.73	C	600	0.5	25	25	50	N/A
Pb	1.36	0.0075	300	0.5	25	25	50	N/A
Sb	N/A	N/A	N/A	0.5	N/A	N/A	N/A	N/A
Se	C	C	N/S	0.1	10	10	20	N/A
Sn	C	N/A	N/S	N/S	N/S	N/S	N/S	N/A
Tl	N/A	C	N/A	0.1	N/A	N/A	N/A	N/A
Zn	4.86	0.04333	7000	50	35	35	70	N/A

[9] Results in *Attachment A – LabMark Reports* where given as ug/L have been converted to mg/L
[10] QLD EPA Limits specified in Table 1 & 2 - Soil Investigation Levels
[11] DECC Draft Limits set out in Table 2 "Notice of Approval" (Subject to change)

Table 7 – Run-of-Station Furnace Bottom Ash (Brown Coal) Assessment

Run-of-station Furnace Bottom Ash - Brown Coal								
ADAA Results[12]			Queensland EPA Limits[13]		NSW Limits[14]			
Element	Average TM	95% UCI TCLP	TM SCC	TCLP SCC[2]	Table 2 values			
					TM(Chara)	TM(Routine)	TM(Max)	TCLP(Max)
	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/L
Ag	0.12	N/A	N/S	0.5	N/S	N/S	N/S	N/A
As	4.16	N/A	100	0.5	10	N/A	20	N/A
B	79	N/A	N/A	N/S	75	N/A	150	N/A
Ba	147.67	N/A	N/S	10	N/S	N/S	N/S	N/A
Be	1.83	N/A	20	N/S	N/S	N/S	N/S	N/A
Cd	C	N/A	20	0.05	0.5	0.5	1	N/A
Co	16.17	N/A	100	N/S	N/S	N/S	N/S	N/A
Cr	9.67	N/A	N/S	0.5	25	25	50	N/A
Cu	7.33	N/A	1000	10	20	N/A	40	N/A
Hg	0.41	N/A	15	0.01	0.5	N/A	1	N/A
Mn	1045.67	N/A	1500	N/S	N/S	N/S	N/S	N/A
Mo	3.83	N/A	N/S	N/S	10	N/A	20	N/A
Ni	46.67	N/A	600	0.5	25	25	50	N/A
Pb	1.67	N/A	300	0.5	25	25	50	N/A
Sb	N/A	N/A	N/S	0.5	N/A	N/A	N/A	N/A
Se	2	N/A	N/S	0.1	10	10	20	N/A
Sn	C	N/A	N/S	N/S	N/S	N/S	N/S	N/A
Tl	N/A	N/A	N/S	0.1	N/A	N/A	N/A	N/A
Zn	28.67	N/A	7000	50	35	35	70	N/A

[12] Results in *Attachment A – LabMark Reports* where given as ug/L have been converted to mg/L
[13] QLD EPA Limits specified in Table 1 & 2 - Soil Investigation Levels
[14] DECC Draft Limits set out in Table 2 "Notice of Approval" (Subject to change)

7 Discussion of Results

7.1 Total Metals Results

As demonstrated by the results recorded in Tables 4, 5, 6 and 7 using the 95% Upper Confidence Interval (UCI), all elements were below the specified limits for total metals analysis or were not detected.

7.2 TCLP Results

As demonstrated by the results recorded in Tables 4, 5, 6 and 7 using the 95% Upper Confidence Interval (UCI) the majority of all elements were below the specified limits for TCLP analysis or were below the detection limit for each analyte.

Results from *Table 5 – Run-of-Station Fly Ash (Brown Coal) Assessment*, Nickel (Ni) exceeded the specified limits nominated for NSW, but were below the specified limits nominated for Queensland.

It should be noted that given n<30 (2), using a 95% UCI, significant statistical error will be over represented in the result. It should be noted that **NO** individual point results was above the NSW specified limits.

No TCLP results for furnace bottom ash (black and brown coal) exceeded specified limits nominated for NSW and Queensland.

8 Conclusions

This investigation aimed to examine key characteristics of CCPs, with particular focus on agricultural applications. The analytical results presented indicate that CCPs, given their benign nature, have considerable potential as secondary resources.

All results from this investigation correlate well with previous reports, classifying CCPs as **“inert”**.

The consistency between results over time demonstrates the potential beneficial use of CCPs, and the reliability of CCPs in being a material to utilise, most notably in agriculture and land use applications.

Attachment A – LabMark reports

Laboratory Identification		**175506**	**175507**	**175508**	**175509**	**175510**	**175511**	**175512**	**175513**	**175514**	**175515**
Sample Identification		201	202	211	301	302	311	401	402	411	601
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	0.09	0.08	<0.05	0.13	0.13	<0.05	0.17	0.08	<0.05	0.22

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**175516**	**175517**	**175518**	**175519**	**175520**	**175521**	**175522**	**175523**	**175524**	**175525**
Sample Identification		602	611	701	702	711	901	902	911	1001	1002
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	0.1	<0.05	0.25	0.27	<0.05	0.10	0.09	<0.05	2.07	1.35

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**175526**	**175527**	**175528**	**175529**	**175530**	**175531**	**175532**	**175533**	**175534**	**175535**
Sample Identification		1011	1301	1302	1311	1401	1402	1411	1501	1502	1511
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		16/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	0.25	0.20	0.10	0.05	0.08	<0.05	<0.05	0.06	0.05	<0.05

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**175536**	**175537**	**175538**	**175539**	**175540**	**175541**	**175542**	**175543**	**175506d**	**175506r**
Sample Identification		1601	1611	1701	1702	1711	1801	1802	1811	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	--
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	--
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	0.57	0.18	0.48	0.32	<0.05	0.09	0.09	<0.05	0.1	11%

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**175517d**	**175517r**	**175527d**	**175527r**	**175537d**	**175537r**	**175507s**	**175528s**	**crm**	**lcs**
Sample Identification		QC	QC	QC	QC	QC	QC	QC	QC	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		--	--	--	--	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		12/9/08	--	12/9/08	--	12/9/08	--	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	--	15/9/08	--	15/9/08	--	15/9/08	15/9/08	12/9/08	12/9/08
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	<0.05	--	0.16	22%	0.17	6%	70%	68%	103%	82%

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**mb**									
Sample Identification		QC									
Depth (m)		--									
Sampling Date recorded on COC		--									
Laboratory Extraction (Preparation) Date		12/9/08									
Laboratory Analysis Date		12/9/08									
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	<0.05									

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**175506**	**175507**	**175508**	**175509**	**175510**	**175511**	**175512**	**175513**	**175514**	**175515**
Sample Identification		201	202	211	301	302	311	401	402	411	601
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	2	2	<1	7	7	<1	10	4	<1	10
Barium	5	69	59	95	277	292	87	34	12	<5	237
Beryllium	1	<1	<1	<1	<1	<1	<1	3	<1	<1	3
Boron	5	11	11	5	46	48	5	54	21	5	133
Cadmium	0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	0.4	0.1	<0.1	0.2
Chromium	1	4	2	1	5	5	<1	17	7	1	16
Cobalt	1	1	1	<1	3	3	<1	3	<1	<1	5
Copper	2	8	8	7	5	6	<2	17	4	<2	59
Lead	2	2	2	<2	6	7	<2	18	4	<2	28
Manganese	5	24	24	14	72	82	17	219	30	12	167
Molybdenum	1	7	6	<1	4	4	<1	7	5	<1	5
Nickel	1	<1	<1	<1	2	3	<1	10	1	1	12
Selenium	2	<2	<2	<2	<2	<2	<2	51	4	<2	<2
Silver	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.3
Tin	1	<1	<1	<1	1	1	<1	6	2	<1	5
Zinc	5	5	5	<5	23	25	<5	37	8	<5	35

Results expressed in mg/kg dry weight unless otherwise specified

Comments: - # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**175516**	**175517**	**175518**	**175519**	**175520**	**175521**	**175522**	**175523**	**175524**	**175525**
Sample Identification		602	611	701	702	711	901	902	911	1001	1002
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	5	<1	6	7	<1	7	6	<1	8	6
Barium	5	239	295	62	58	27	198	251	183	397	96
Beryllium	1	3	1	1	1	<1	<1	<1	<1	<1	<1
Boron	5	101	35	80	126	16	86	95	16	302	313
Cadmium	0.1	0.1	<0.1	0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1
Chromium	1	11	11	11	16	3	2	2	<1	9	8
Cobalt	1	4	2	1	2	<1	1	2	1	3	3
Copper	2	38	14	6	7	4	6	7	4	34	21
Lead	2	16	5	6	6	<2	4	5	<2	2	<2
Manganese	5	182	244	143	171	288	92	148	104	1350	1560
Molybdenum	1	3	2	4	5	<1	4	4	<1	3	2
Nickel	1	8	5	4	3	1	<1	1	<1	27	31
Selenium	2	<2	<2	3	3	<2	<2	<2	<2	37	26
Silver	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2
Tin	1	3	<1	2	3	<1	1	1	<1	1	<1
Zinc	5	21	18	18	19	5	21	20	6	227	137

Results expressed in mg/kg dry weight unless otherwise specified

Comments: - # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**175526**	**175527**	**175528**	**175529**	**175530**	**175531**	**175532**	**175533**	**175534**	**175535**
Sample Identification		1011	1301	1302	1311	1401	1402	1411	1501	1502	1511
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	<1	5	5	1	10	3	1	15	11	<1
Barium	5	63	516	684	469	11	9	6	10	8	<5
Beryllium	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Boron	5	11	37	35	11	12	7	<5	8	7	<5
Cadmium	0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.4	0.3	<0.1
Chromium	1	2	17	23	6	11	4	1	5	4	<1
Cobalt	1	<1	4	5	3	3	1	<1	4	3	1
Copper	2	3	23	24	11	9	4	<2	12	8	<2
Lead	2	<2	4	6	<2	5	<2	<2	5	3	<2
Manganese	5	49	1090	403	1340	67	68	17	<5	<5	11
Molybdenum	1	<1	3	2	<1	7	3	<1	6	5	<1
Nickel	1	1	11	8	6	3	1	<1	3	2	1
Selenium	2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2
Silver	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	1	1	2	3	<1	2	<1	<1	2	1	<1
Zinc	5	7	23	20	7	37	11	<5	59	40	<5

Results expressed in mg/kg dry weight unless otherwise specified

Comments: - # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**175536**	**175537**	**175538**	**175539**	**175540**	**175541**	**175542**	**175543**	**175506d**	**175506r**
Sample Identification		1601	1611	1701	1702	1711	1801	1802	1811	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	--
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	--
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	15	9	9	7	<1	15	9	<1	2	0%
Barium	5	219	236	821	1850	22	90	186	36	69	0%
Beryllium	1	3	4	16	11	<1	<1	<1	<1	<1	--
Boron	5	184	184	19	22	<5	51	79	<5	11	0%
Cadmium	0.1	0.1	<0.1	1.3	1	<0.1	0.1	<0.1	<0.1	<0.1	--
Chromium	1	31	18	20	21	<1	10	19	1	4	0%
Cobalt	1	21	36	56	41	<1	2	2	<1	1	0%
Copper	2	32	12	84	59	<2	7	5	<2	8	0%
Lead	2	4	<2	58	34	<2	3	<2	<2	2	0%
Manganese	5	3700	3050	192	247	<5	79	54	70	26	8%
Molybdenum	1	8	10	33	23	<1	8	5	<1	7	0%
Nickel	1	175	120	91	75	1	3	7	2	<1	--
Selenium	2	21	3	3	3	<2	3	4	<2	<2	--
Silver	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--
Tin	1	2	<1	7	4	<1	2	2	<1	<1	--
Zinc	5	238	69	289	238	<5	16	10	<5	5	0%

Results expressed in mg/kg dry weight unless otherwise specified

Comments: - # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**175517d**	**175517r**	**175527d**	**175527r**	**175537d**	**175537r**	**175537t**	**175507s**	**175528s**	**crm**
Sample Identification		QC	QC	QC	QC	QC	QC	QC	QC	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		--	--	--	--	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		12/9/08	--	12/9/08	--	12/9/08	--	16/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	--	15/9/08	--	15/9/08	--	17/9/08	15/9/08	15/9/08	12/9/08
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	<1	--	5	0%	9	0%	--	86%	97%	100%
Barium	5	259	13%	474	8%	251	6%	--	#	#	--
Beryllium	1	1	0%	<1	--	10	86%	--	91%	103%	88%
Boron	5	31	12%	35	6%	138	29%	--	106%	104%	--
Cadmium	0.1	<0.1	--	<0.1	--	0.2	>67%	--	88%	91%	94%
Chromium	1	7	44%	17	0%	29	47%	9	104%	105%	101%
Cobalt	1	1	67%	4	0%	109	101%	21	101%	105%	96%
Copper	2	13	7%	22	4%	15	22%	--	100%	96%	99%
Lead	2	4	22%	4	0%	3	>40%	--	106%	99%	100%
Manganese	5	210	15%	1040	5%	1730	55%	2970	115%	#	92%
Molybdenum	1	1	67%	3	0%	17	52%	9	94%	94%	108%
Nickel	1	4	22%	11	0%	128	6%	--	94%	98%	99%
Selenium	2	<2	--	2	0%	2	40%	--	88%	98%	93%
Silver	0.1	0.1	>0%	<0.1	--	0.2	0%	--	73%	75%	125%
Tin	1	<1	--	2	0%	<1	--	--	123%	##	--
Zinc	5	11	48%	23	0%	176	87%	62	96%	95%	88%

Results expressed in mg/kg dry weight unless otherwise specified

Comments: - # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**crm**	**lcs**	**lcs**	**mb**	**mb**					
Sample Identification		QC	QC	QC	QC	QC					
Depth (m)		--	--	--	--	--					
Sampling Date recorded on COC		--	--	--	--	--					
Laboratory Extraction (Preparation) Date		16/9/08	12/9/08	16/9/08	12/9/08	16/9/08					
Laboratory Analysis Date		16/9/08	12/9/08	16/9/08	12/9/08	16/9/08					
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	--	98%	--	<1	--					
Barium	5	--	99%	--	<5	--					
Beryllium	1	--	99%	--	<1	--					
Boron	5	--	104%	--	<5	--					
Cadmium	0.1	--	100%	--	<0.1	--					
Chromium	1	91%	102%	102%	<1	<1					
Cobalt	1	90%	101%	102%	<1	<1					
Copper	2	--	98%	--	<2	--					
Lead	2	--	99%	--	<2	--					
Manganese	5	96%	102%	108%	<5	<5					
Molybdenum	1	97%	99%	98%	<1	<1					
Nickel	1	--	97%	--	<1	--					
Selenium	2	--	97%	--	<2	--					
Silver	0.1	--	101%	--	<0.1	--					
Tin	1	--	97%	--	<1	--					
Zinc	5	96%	106%	104%	<5	<5					

Results expressed in mg/kg dry weight unless otherwise specified

Comments: - # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**175506**	**175507**	**175508**	**175509**	**175510**	**175511**	**175512**	**175513**	**175514**	**175515**
Sample Identification		201	202	211	301	302	311	401	402	411	601
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E005.2											
Moisture	**EQL**										
Moisture	--	1	--	18	--	--	36	3	--	41	--

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**175516**	**175517**	**175518**	**175519**	**175520**	**175521**	**175522**	**175523**	**175524**	**175525**
Sample Identification		602	611	701	702	711	901	902	911	1001	1002
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E005.2											
Moisture	**EQL**										
Moisture	--	--	32	--	1	12	--	--	41	1	1

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**175526**	**175527**	**175528**	**175529**	**175530**	**175531**	**175532**	**175533**	**175534**	**175535**
Sample Identification		1011	1301	1302	1311	1401	1402	1411	1501	1502	1511
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08
Method : E005.2											
Moisture	**EQL**										
Moisture	--	43	--	--	21	--	1	3	1	--	14

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**175536**	**175537**	**175538**	**175539**	**175540**	**175541**	**175542**	**175543**	**175506d**	**175506r**
Sample Identification		1601	1611	1701	1702	1711	1801	1802	1811	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--
Laboratory Extraction (Preparation) Date		12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	12/9/08	--
Laboratory Analysis Date		15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	15/9/08	--
Method : E005.2											
Moisture	**EQL**										
Moisture	--	2	28	--	--	22	--	--	1	--	--

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**175517d**	**175517r**	**175527d**	**175527r**	**175537d**	**175537r**	**175507s**	**175528s**		
Sample Identification		QC	QC	QC	QC	QC	QC	QC	QC		
Depth (m)		--	--	--	--	--	--	--	--		
Sampling Date recorded on COC		--	--	--	--	--	--	--	--		
Laboratory Extraction (Preparation) Date		12/9/08	--	12/9/08	--	12/9/08	--	12/9/08	12/9/08		
Laboratory Analysis Date		15/9/08	--	15/9/08	--	15/9/08	--	15/9/08	15/9/08		
Method : E005.2											
Moisture	**EQL**										
Moisture	--	34	6%	1	--	25	11%	--	--		

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

LabMark
ENVIRONMENTAL LABORATORIES

Laboratory Report No: E040146
Client Name: Ash Development Association of Australia
Contact Name: Lauren Robertson
Client Reference: Environmental Monitoring

Date: 27/10/08
This report supercedes reports issued on: N/A

Final
Certificate
of Analysis

Laboratory Identification		**181286**	**181287**	**181288**	**crm**	**lcs**	**mb**				
Sample Identification		1101	1102	1111	QC	QC	QC				
Depth (m)		--	--	--	--	--	--				
Sampling Date recorded on COC		15/10/08	15/10/08	15/10/08	--	--	--				
Laboratory Extraction (Preparation) Date		24/10/08	24/10/08	24/10/08	24/10/08	24/10/08	24/10/08				
Laboratory Analysis Date		24/10/08	24/10/08	24/10/08	24/10/08	24/10/08	24/10/08				
Method : E026.2											
Acid extractable metals - mercury	**EQL**										
Mercury	0.05	1.90	1.82	0.81	100%	99%	<0.05				

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

LabMark
ENVIRONMENTAL LABORATORIES

Laboratory Report No: E040146
Client Name: Ash Development Association of Australia
Contact Name: Lauren Robertson
Client Reference: Environmental Monitoring

Date: 27/10/08
This report supercedes reports issued on: N/A

Final
Certificate
of Analysis

Laboratory Identification		**181286**	**181287**	**181288**	**crm**	**lcs**	**mb**				
Sample Identification		1101	1102	1111	QC	QC	QC				
Depth (m)		--	--	--	--	--	--				
Sampling Date recorded on COC		15/10/08	15/10/08	15/10/08	--	--	--				
Laboratory Extraction (Preparation) Date		24/10/08	24/10/08	24/10/08	24/10/08	24/10/08	24/10/08				
Laboratory Analysis Date		24/10/08	24/10/08	24/10/08	25/10/08	25/10/08	25/10/08				
Method : E022.2											
Acid extractable metals	**EQL**										
Arsenic	1	20	17	3	99%	96%	<1				
Barium	5	69	124	144	--	89%	<5				
Beryllium	1	4	2	1	90%	99%	<1				
Boron	5	147	104	42	84%	105%	<5				
Cadmium	0.1	0.2	0.2	<0.1	93%	95%	<0.1				
Chromium	1	76	36	9	101%	100%	<1				
Cobalt	1	15	14	12	93%	91%	<1				
Copper	2	46	25	7	105%	98%	<2				
Lead	2	22	12	3	92%	99%	<2				
Manganese	5	249	110	38	97%	92%	<5				
Molybdenum	1	8	5	1	105%	94%	<1				
Nickel	1	51	28	19	100%	97%	<1				
Selenium	2	12	6	2	79%	93%	<2				
Silver	0.1	0.4	0.3	0.1	90%	95%	<0.1				
Tin	1	5	2	<1	75%	95%	<1				
Zinc	5	112	33	10	87%	96%	<5				

Results expressed in mg/kg dry weight unless otherwise specified

Comments: -

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**191025**	**191026**	**191027**	**191028**	**191029**	**191030**	**191031**	**191032**	**191033**	**191034**
Sample Identification		201	202	211	301	302	311	901	902	911	1301
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08
Laboratory Analysis Date		--	--	--	--	--	--	--	--	--	--
Method : E019.2											
TCLP Preparation	**EQL**										
TCLP Fluid No.	--	1	1	1	1	1	1	1	1	1	2
Initial pH (pH units)	--	4.6	4.2	11.0	11.1	10.8	9.2	10.5	10.7	8.3	11.7
pH after HCl (pH units)	--	NA	NA	2.6	3.3	3.6	2.7	2.8	3.0	2.7	11.7
Final pH (pH units)	--	4.9	4.9	5.0	5.3	5.3	5.0	5.0	5.1	4.9	10.8

Results expressed in pH units unless otherwise specified

Comments: -

E019.2: Soil leached for 18 hours with fluid as specified above . Refer to relevant water method for results. TCLP preparation is equivalent to AS4439.3 (also known as ASLP).

Laboratory Identification		**191035**	**191036**	**191037**	**191038**	**191039**	**191040**	**191041**	**191042**		
Sample Identification		1302	1311	1401	1402	1411	1501	1502	1511		
Depth (m)		--	--	--	--	--	--	--	--		
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08		
Laboratory Extraction (Preparation) Date		24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08		
Laboratory Analysis Date		--	--	--	--	--	--	--	--		
Method : E019.2											
TCLP Preparation	**EQL**										
TCLP Fluid No.	--	1	1	1	1	1	1	1	1		
Initial pH (pH units)	--	9.6	9.7	4.9	6.1	6.3	4.6	4.6	5.6		
pH after HCl (pH units)	--	4.7	4.2	2.3	2.6	2.8	NA	NA	2.5		
Final pH (pH units)	--	6.3	5.6	4.8	4.8	4.8	4.8	4.8	4.8		

Results expressed in pH units unless otherwise specified

Comments: -

E019.2: Soil leached for 18 hours with fluid as specified above . Refer to relevant water method for results. TCLP preparation is equivalent to AS4439.3 (also known as ASLP).

Laboratory Identification		**191025**	**191026**	**191027**	**191028**	**191029**	**191030**	**191031**	**191032**	**191033**	**191034**
Sample Identification		201	202	211	301	302	311	901	902	911	1301
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08
Laboratory Analysis Date		2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09
Method : E026.1											
TCLP mercury	**EQL**										
Mercury	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Results expressed in ug/l unless otherwise specified

Comments:

E026.1: Filtered TCLP leachate acidifed with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS. Results are expressed as per the leachate.

Laboratory Identification		**191035**	**191036**	**191037**	**191038**	**191039**	**191040**	**191041**	**191042**	**191025d**	**191025r**
Sample Identification		1302	1311	1401	1402	1411	1501	1502	1511	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--
Laboratory Extraction (Preparation) Date		29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	--
Laboratory Analysis Date		2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	2/1/09	--
Method : E026.1											
TCLP mercury	**EQL**										
Mercury	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	--

Results expressed in ug/l unless otherwise specified

Comments:

E026.1: Filtered TCLP leachate acidifed with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS. Results are expressed as per the leachate.

Laboratory Identification		**191035d**	**191035r**	**191026s**	**lcs**	**mb**					
Sample Identification		QC	QC	QC	QC	QC					
Depth (m)		--	--	--	--	--					
Sampling Date recorded on COC		--	--	--	--	--					
Laboratory Extraction (Preparation) Date		29/12/08	--	29/12/08	29/12/08	29/12/08					
Laboratory Analysis Date		2/1/09	--	2/1/09	29/12/08	29/12/08					
Method : E026.1											
TCLP mercury	**EQL**										
Mercury	1	<1	--	100%	113%	<1					

Results expressed in ug/l unless otherwise specified

Comments:

E026.1: Filtered TCLP leachate acidifed with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS. Results are expressed as per the leachate.

Laboratory Identification		**191025**	**191026**	**191027**	**191028**	**191029**	**191030**	**191031**	**191032**	**191033**	**191034**
Sample Identification		201	202	211	301	302	311	901	902	911	1301
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08
Laboratory Analysis Date		30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08
Method : E022.1											
TCLP metals	**EQL**										
Antimony	10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10
Arsenic	10	<10	<10	<10	<10	<10	<10	30	20	<10	<10
Barium	50	420	320	990	1650	1940	770	1940	1910	960	1020
Cadmium	1	2	2	<1	3	3	<1	3	2	<1	<1
Chromium	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	130
Copper	50	100	110	<50	<50	<50	<50	<50	<50	<50	<50
Lead	10	<10	<10	<10	<10	10	20	<10	<10	<10	<10
Nickel	50	<50	<50	<50	<50	50	<50	<50	<50	<50	<50
Selenium	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Silver	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Zinc	50	70	70	<50	340	300	<50	200	150	<50	<50

Results expressed in ug/l unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.1: Filtered TCLP leachate acidifed with nitric/hydrochloric acid. Analysis by ICP/MS. Results are expressed as in the leachate.

Laboratory Identification		**191035**	**191036**	**191037**	**191038**	**191039**	**191040**	**191041**	**191042**	**191025d**	**191025r**
Sample Identification		1302	1311	1401	1402	1411	1501	1502	1511	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--
Laboratory Extraction (Preparation) Date		29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	--
Laboratory Analysis Date		30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	30/12/08	--
Method : E022.1											
TCLP metals	**EQL**										
Antimony	10	<10	<10	10	<10	<10	10	10	<10	<10	--
Arsenic	10	90	<10	10	20	<10	50	50	<10	<10	--
Barium	50	310	1580	200	300	80	120	120	50	450	7%
Cadmium	1	<1	<1	5	2	<1	11	10	<1	2	0%
Chromium	50	180	<50	<50	<50	<50	<50	<50	<50	<50	--
Copper	50	<50	<50	70	50	<50	100	90	<50	110	10%
Lead	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	--
Nickel	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	--
Selenium	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	--
Silver	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	--
Thallium	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	--
Zinc	50	<50	<50	300	140	110	330	300	50	80	13%

Results expressed in ug/l unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.1: Filtered TCLP leachate acidifed with nitric/hydrochloric acid. Analysis by ICP/MS. Results are expressed as in the leachate.

Laboratory Identification		**191035d**	**191035r**	**191026s**	**lcs**	**mb**					
Sample Identification		QC	QC	QC	QC	QC					
Depth (m)		--	--	--	--	--					
Sampling Date recorded on COC		--	--	--	--	--					
Laboratory Extraction (Preparation) Date		29/12/08	--	29/12/08	29/12/08	29/12/08					
Laboratory Analysis Date		30/12/08	--	30/12/08	30/12/08	30/12/08					
Method : E022.1											
TCLP metals	**EQL**										
Antimony	10	<10	--	93%	93%	<10					
Arsenic	10	90	0%	100%	91%	<10					
Barium	50	320	3%	#	84%	<50					
Cadmium	1	<1	--	97%	98%	<1					
Chromium	50	190	5%	79%	75%	<50					
Copper	50	<50	--	88%	87%	<50					
Lead	10	<10	--	96%	107%	<10					
Nickel	50	<50	--	87%	82%	<50					
Selenium	20	<20	--	98%	92%	<20					
Silver	1	<1	--	97%	99%	<1					
Thallium	5	<5	--	97%	108%	<5					
Zinc	50	<50	--	97%	90%	<50					

Results expressed in ug/l unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.1: Filtered TCLP leachate acidifed with nitric/hydrochloric acid. Analysis by ICP/MS. Results are expressed as in the leachate.

Laboratory Identification		**191025**	**191026**	**191027**	**191028**	**191029**	**191030**	**191031**	**191032**	**191033**	**191034**
Sample Identification		201	202	211	301	302	311	901	902	911	1301
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08
Laboratory Analysis Date		29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08
Method : E005.2											
Moisture	**EQL**										
Moisture	--	--	--	22	--	--	37	--	3	42	--

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**191035**	**191036**	**191037**	**191038**	**191039**	**191040**	**191041**	**191042**	**191025d**	**191025r**
Sample Identification		1302	1311	1401	1402	1411	1501	1502	1511	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--
Laboratory Extraction (Preparation) Date		24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	24/12/08	--
Laboratory Analysis Date		29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	29/12/08	--
Method : E005.2											
Moisture	**EQL**										
Moisture	--	1	20	--	--	3	--	1	20	--	--

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**191035d**	**191035r**								
Sample Identification		QC	QC								
Depth (m)		--	--								
Sampling Date recorded on COC		--	--								
Laboratory Extraction (Preparation) Date		24/12/08	--								
Laboratory Analysis Date		29/12/08	--								
Method : E005.2											
Moisture	**EQL**										
Moisture	--	1	0%								

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.