

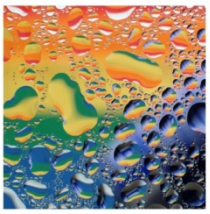

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2011 ESA IBA dataset

In 2011 eighteen energy from waste (EfW) facilities monitored incinerator bottom ash (IBA) according to the Environmental Services Association Protocol (2010) for the sampling and testing of IBA using a morning and an afternoon sample on a single day in each month[1]. Some facilities did not commence monitoring until February 2011 and some were unable to take samples in specific months because there was an outage at the facility (e.g. for maintenance).

Table 1 presents the results of the hazard assessment and Table 2 presents key concentration data by facility. The dataset shows that:

- on the basis of the 2011 data, the IBA from the participating facilities would be characterized as 'non-hazardous' according to the approach laid out in the ESA protocol (2010);
- eight facilities reported zero exceedances;
- no participating facility recorded seven or more exceedances, the level which would have triggered a hazardous classification[2];
- twenty five out of 411[3] samples across all participating facilities were reported to exceed a threshold for a hazard property;

1 Since January 2013 the EfW facilities have been collecting the two IBA samples on different randomly selected days per month to ensure better representation of input waste.

2 The ESA protocol (2010) sets a threshold of seven exceedances to trigger hazardous status to take account of the inherent variability of IBA at the very small scale at which it is tested in the laboratory and takes into account the fact that some results will exceed the hazard thresholds purely by chance rather than being truly hazardous. This approach, authorised by the Environment Agency, is explained in the Explanatory Note (ESA, 2012).

- Thirteen of the reported exceedances were due to analytical problems in the determination of irritancy/corrosivity (H4) via the 'alkali reserve' test. Although these samples may in reality not have been exceedances, a precautionary approach was taken in the light of the incomplete analytical results and they were classed as exceedances[4]. These analytical problems were addressed for 2012 and it should be noted that only one sample was recorded as an H4 exceedance in 2012 (WRc, 2013).

Conclusions

The 2011 dataset represents ash collected under the first twelve months of a new sampling and testing protocol. The IBA from the participating facilities was characterized as 'non hazardous' according to the approach laid out in the ESA protocol. When apparent exceedances caused by analytical teething problems are removed, only thirteen samples were exceedances out of a total of 411 analysed.

References

ESA (2010) A sampling and testing protocol for the assessment of hazard status of incinerator bottom ash. http://www.esauk.org/publications/reports/ESA_IBA_Sampling_and_Testing_Protocol.pdf

ESA (2012) IBA sampling and testing protocol for the assessment of hazard status of incinerator bottom ash. An explanatory note. July 2012. http://www.esauk.org/reports_press_releases/esa_reports/ESA_Sampling_and_Testing_Protocol_Explanatory_Note.pdf

WRc (2012) Assessment of Hazard Classification of UK IBA. WRc plc. December 2012. UC9213.05.

WRc (2013) 2011 ESA IBA dataset. April 2013. UC9496.02

3 The hazard assessment of IBA was carried out on a full 12 month dataset for each facility (WRc, 2012). As four EfW facilities were unable to commence the monthly monitoring until February 2011, the hazard assessment was based on a total of 419 samples, including eight samples collected from those four facilities in January 2012. This report provides data for the calendar year 2011 only, a total of 411 samples. 2012 data are reported in WRc (2013).

4 Where pH exceeds 11.5 a further test is required to complete the assessment of these properties based on the buffering capacity of the ash. This buffering capacity ('alkali reserve') test involves calculating the quantity of acid needed to bring the pH down to a specific pH. For thirteen samples either a second test was not undertaken or the wrong test was carried out (e.g. carbonate concentrations on a water extract). Taking a precautionary approach these samples were reported as an exceedance for both H4/H8.

Table 1 IBA hazard assessment by facility in first twelve months of collecting samples according to the ESA protocol

Key

√ = below relevant hazard thresholds
NST = no sample taken due to facility commencing monitoring after Feb 2011
NSO = no sample collected due to an outage in 2011.
H4, H7, H14 = sample exceeding thresholds for these hazardous properties (H4 = irritancy, H7 = carcinogenicity, H8 corrosivity and H14 = ecotoxicity):
H4/H8[1] = no data for alkali reserve. Hazard assessment for H4 and H8 based on a pH ≥11.5 alone.
H4/H8[2] = incorrect alkali reserve method used. Hazard assessment for H4 and H8 based on a pH ≥11.5 alone. Data in 2012 is consistently below the H4 hazard threshold with the correct method used and it is considered that the 2011 samples would not have been an exceedance if the correct method had been used.

Facility	No. of	Jan -11		Feb -11		Mar -11		Apr -11		May -11		Jun -11		Jul -11		Aug -11		Sep -11		Oct -11		Nov -11		Dec -11	
ID	exceedances	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
A	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B	0	✓	✓	✓	✓	✓	✓	✓	✓	NSO	NSO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
D	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
E	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
H	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I	1	✓	✓	✓	✓	✓	✓	H14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
J	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	H7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K	1	✓	✓	✓	✓	H4 /H8[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	H14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
M	2	NST	NST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	H14	H14
N	2	✓	✓	✓	✓	✓	✓	✓	✓	H14	✓	✓	✓	H14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
O	2	✓	✓	✓	✓	✓	✓	H7	H7 H14	NSO	NSO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
P	3	NST	NST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	H4 /H8[1]	H4 /H8[1]	✓	H4	✓	✓	✓	✓	✓	✓	✓	H4
Q	5	NST	NST	H4 /H8[1]	H4 /H8[1]	✓	H7	✓	✓	✓	✓	✓	NSO	NSO	NSO	NSO	NSO	NSO	NSO	NSO	NSO	H4/ H8[2]	H4/ H8[2]	✓	✓
R	5	NST	NST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	H4/ H8[2]	H4/ H8[2]	H4/ H8[2]	H4/ H8[2]	H4/ H8[2]	H4/ H8[2]	✓	✓

Table 2 Statistics of relevant determinand results for 2011 IBA dataset

Facility No.	Determinand	pH	Alk Res	Al	Cd	Cr	Cu	Pb	Mg	Ni	P	K	Zn	TPH >C5-C44
			g/100g	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
All facilities	**Average**	**11.7**	**0.78**	**21625**	**11.2**	**246**	**1900**	**820**	**6980**	**134**	**4838**	**3564**	**2107**	**144**
	95th Percentile	**12.6**	**3.84**	**39364**	**30.1**	**990**	**3679**	**1608**	**10251**	**417**	**7551**	**5228**	**3292**	**310**
	Maximum	**12.9**	**5.40**	**74775**	**72.4**	**1358**	**17871**	**2296**	**12300**	**1050**	**8660**	**17297**	**9389**	**324**
A	Average	12.0	0.21	22194	7.0	73	1844	550	7195	60	5247	3616	1929	
	95th Percentile	12.4	0.44	27119	12.8	99	2870	1007	9914	94	7209	5105	2469	
	Maximum	12.5	0.50	42130	14.8	141	7315	1050	10206	105	7420	5201	3566	
B	Average	11.8	1.14	15528	2.8	148	2067	383	4344	114	1952	2620	1736	156
	95th Percentile	12.4	4.20	31430	7.6	277	5188	680	7712	203	4976	5529	3581	251
	Maximum	12.6	4.23	38709	8.5	280	5649	1159	8066	257	5363	5899	4291	262
C	Average	11.6	0.25	28300	10.5	85	2368	684	9254	75	5591	4590	2440	43
	95th Percentile	12.5	0.94	40507	18.0	107	4592	1048	12217	114	8207	5630	3869	43
	Maximum	12.6	1.80	46580	72.4	109	5787	1380	12300	163	8660	17297	4166	43
D	Average	11.6	0.16	13225	11.2	331	1738	1389	4597	184	1164	1269	1839	158
	95th Percentile	12.5	0.27	28741	26.6	758	2042	1912	7382	440	1455	2007	2264	305
	Maximum	12.6	0.32	44900	28.0	906	2243	2167	9240	565	1474	2214	2573	310
E	Average	10.7	2.23		26.1	812	1789	1456		296			1861	
	95th Percentile	11.7	3.99		51.1	1211	2303	1986		472			2289	
	Maximum	11.7	4.02		64.8	1240	2414	2296		581			2590	
F	Average	12.2	0.23	22100	6.2	66	1467	565	6126	54	5539	3173	1935	29
	95th Percentile	12.6	0.50	32360	10.5	80	2695	817	8115	91	7714	4139	3658	29
	Maximum	12.7	0.51	39475	11.5	91	2927	919	8147	100	8146	4315	5279	29
G	Average	12.2	0.27	25541	10.0	109	1904	481	7462	88	5251	3679	2691	49
	95th Percentile	12.6	0.48	35722	16.8	153	4523	837	8971	157	7110	4765	3807	49
	Maximum	12.7	0.64	43019	34.8	171	5761	857	9577	220	7359	5022	4056	49
H	Average	10.9	0.59	29195	8.10	291	1579	917	7569	129	4862	3249	1590	
	95th Percentile	11.5	1.24	30517	15.0	720	3016	1362	7849	288	5516	3399	2303	
	Maximum	12.4	1.72	30664	20.2	1147	7956	1379	7880	451	5588	3415	2380	
I	Average	11.6	0.28	24062	6.8	71	1960	585	7568	72	5757	3881	1879	29
	95th Percentile	12.5	0.81	37303	14.4	114	2568	1199	9681	120	7550	5042	2430	29
	Maximum	12.7	1.04	46539	17.3	124	6399	1294	9903	209	8220	6266	2463	29

Facility No.	Determinand	pH	Alk Res	Al	Cd	Cr	Cu	Pb	Mg	Ni	P	K	Zn	TPH >C5-C44
			g/100g	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
J	Average	10.5	1.74		20.3	777	1686	1160		293			1799	
	95th Percentile	11.1	3.83		39.4	1216	2289	1556		555			2487	
	Maximum	11.2	3.96		44.2	1315	2383	1641		673			2571	
K	Average	11.0	1.89		19.5	670	1681	1200		185			1932	
	95th Percentile	11.8	4.22		43.3	1206	2078	1755		379			2304	
	Maximum	12.1	4.33		68.4	1358	2140	2109		433			2357	
L	Average	12.0	0.33	23788	9.0	78	1840	693	8638	77	5785	3989	2179	
	95th Percentile	12.5	0.88	36066	15.5	100	2401	1046	10901	118	7340	5179	2806	
	Maximum	12.6	1.08	44492	16.9	102	3968	1529	11920	120	8001	6182	3367	
M	Average	11.9	0.15	31461	10.6	87	2901	585	7027	77	5577	3763	3044	
	95th Percentile	12.6	0.31	52501	18.4	112	6369	1079	9409	131	7228	5030	5345	
	Maximum	12.6	0.38	62875	19.0	126	17871	1121	10428	254	7639	5240	9389	0
N	Average	11.6	0.19	28845	7.0	137	2348	905	8146	129	4441	3858	2336	40
	95th Percentile	12.4	0.47	45356	12.6	254	4622	1614	10601	279	5677	5233	3600	40
	Maximum	12.5	0.51	74775	16.5	586	4857	1648	11684	300	6318	5310	5739	40
O	Average	11.4	1.93	13773	9.5	409	1415	1140	5010	241			1766	170
	95th Percentile	12.4	4.13	27134	16.0	675	2184	1567	6451	634			2147	311
	Maximum	12.5	4.27	38201	19.5	900	2231	1689	9082	721			2473	324
P	Average	12.5	1.02	14578	18.3	85	1840	693	5672	112			2257	
	95th Percentile	12.7	2.08	22168	40.6	122	2901	1363	8651	172			3278	
	Maximum	12.7	2.20	23100	64.2	131	3034	1540	9350	185			3465	
Q	Average	12.3	0.84	17264	8.4	73	1765	754	8664	142			2417	9
	95th Percentile	12.9	1.39	27576	17.9	101	2163	1153	10143	421			2845	9
	Maximum	12.9	1.53	29300	21.6	105	2232	1446	11067	1050			2897	9
R	Average	12.2	1.11	18660	7.6	67	1926	589	8211	85			2363	9
	95th Percentile	12.9	4.64	25160	15.0	91	2882	930	9136	170			3083	9
	Maximum	12.9	5.40	26007	29.8	100	3178	1501	10237	232			3236	9

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