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5th May 2011

Dear Sirs,

Waste Acceptance Criteria Testing for a Sample of Ash

A sample of solid residue was examined in order to determine if the material was classed as hazardous waste and the results are provided below.

Waste Acceptance Criteria (WAC) Analysis

Determinand	Units	Ash	Inert Waste Limit	Non-Reactive Hazardous Waste Limit	Hazardous Waste Limit
Acid Neutralisation Capacity (pH4)	mol/ Kg	0.15	-	-	-
Acid Neutralisation Capacity (pH7)	mol/ Kg	0.22	-	-	-
Loss on Ignition	%	4.5	-	-	10
Total Organic Carbon	%	1.0	3	5	6
Mineral Oil (C_{10}-C_{40})	mg/Kg	340	500	-	-
PAH Total	mg/Kg	238	100	-	-
BTEX	mg/Kg	33	6	-	-
PCBs (7 congeners)	mg/Kg	<0.01	1	-	-
pH	-	10.1	-	>6	-

Leachate testing was then performed in accordance with the requirements of EN 12457-3 using a 2 –stage batch test at a liquid/solid ratio of 2 litres/Kg and 10 litres/Kg.

Leachate Analysis Results-Ash

Eluate Analysis	Conc. Eluate	
Liquid : Waste Ratio	2:1	8:1
pH	9.6	10.2
Temperature (° C)	20	20
Conductivity (µS/cm)	7760	2340
	mg/l	mg/l
Arsenic	<0.001	<0.001
Barium	0.11	0.09
Cadmium	<0.001	<0.001
Chromium	9.78	3.89
Copper	0.014	0.002
Mercury	<0.001	<0.001
Molybdenum	0.155	0.043
Nickel	<0.003	<0.003
Lead	<0.009	<0.009
Antimony	<0.003	<0.003
Selenium	<0.003	<0.003
Zinc	<0.020	<0.020
Chloride	11215	1315
Fluoride	0.26	0.20
Sulphate	2189	1175
Total Dissolved Solids	7122	2250
Phenol Index	21.9	6.7
Dissolved Organic Carbon	34.8	12.8

Leached	
2:1	10:1
mg/Kg	mg/Kg
<0.002	<0.01
0.22	0.15
<0.002	<0.01
19.56	18.46
<0.04	<0.08
<0.002	<0.01
0.31	0.33
<0.006	<0.03
<0.018	<0.09
<0.006	<0.03
<0.006	<0.03
<0.04	<0.20
22430	21670
0.5	0.9
4378	4007
14244	17234
43.8	41.3
69.6	73.8

BS EN12457-3 Limit Values L:S 10:1		
Inert Waste	NR Haz Waste	Haz Waste
0.5	2	25
20	100	300
0.04	1	5
0.5	10	70
2	50	100
0.01	0.2	2
0.5	10	30
0.4	10	40
0.5	10	50
0.06	0.7	5
0.1	0.5	7
4	50	200
800	15000	25000
10	150	500
1000	20000	50000
4000	60000	100000
1		
500	800	1000

Conclusion/Comments-

The above results show that the sample would be classed as Non-Reactive Hazardous Waste

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K.Pettit
For/on behalf of Marchwood Scientific Services Ltd

MATERIAL SAFETY DATA SHEET

Tube Bundle Ash

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Tube Bundle Ash

MANUFACTURER: Produced as a waste stream from Energy from Waste gasification

ADDRESS: RSM Contract AS, Aasbieveien 16, STOA, 4848 ARENDAL, N-Norway

EMERGENCY: Dial 999

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

Tube bundle ash is a fine grey powder with odour. The ash contains significant quantities of the following:

Calcium Oxide (CaO) – 32%w/w in the Secondary chamber
Silicon Dioxide (SiO_2) – 25%w/w in the Secondary Chamber
Sulphur Trioxide (SO_3) – 38%w/w in the Fall Chamber
Sodium Oxide – (Na_2O) – 29%w/w in the Fall Chamber

Metal silicates and oxides are also be present in small quantities in addition to Crystallised Silica.

As a product of waste combustion, tube bundle ash can contain a trace amount of metals including Mercury (Hg), Cadmium (Cd), Lead (Pb), Arsenic (As) among others. There may also be small amounts of Dioxins, Furans and Polychlorinated biphenyls (PCBs).

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Tube Bundle Ash is a solid grey powder. It is not combustible or explosive. A single, short term exposure to the ash can present a hazard posing serious risk of damage to eyes and potential for burns in the presence of moisture. The potential for burns is a particular risk when the ash is present in the form of a slurry following bundle washing.

POTENTIAL HEALTH EFFECTS

YES: Airborne dust may cause painful irritation or inflammation. Due to the presence of Calcium Oxide or 'quicklime', eye contact may cause serious damage or blindness unless immediate treatment is given. Obtain medical attention SPEED IS ESSENTIAL.

SKIN: Exposure of skin to ash may cause irritation and drying. In the presence of moisture, i.e. when in a slurry, can cause burns.

INGESTION: Bundle Ash must not be ingested. Due to high content of Sulphur Trioxide (SO_3) which is corrosive and hygroscopic in nature, ingestion can result in serious burns.

INHALATION: Breathing in of ash will cause respiratory irritation. With the potential presence of Crystaline Silica prolonged or repeated inhalation of ash may cause silicosis, bronchitis or cancer all seriously disabling and fatal lung diseases. Additionally, as with ingestion, serious burns may result.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Individuals with lung disease (e.g. Bronchitis, Pulmonary Disease, and Emphysema) may be aggravated through exposure.

SECTION 4: FIRST AID MEASURES

EYES: Rinse Eyes thoroughly with water for at least 15 minutes, including under eye lids. Seek medical attention immediately.

SKIN: Remove contaminated clothing. Wash with copious cool water. Seek medical attention for skin irritation or following exposure to wet ash i.e. slurry.

INGESTION: Rinse mouth with water. Drink plenty of water. Do not induce vomiting. Seek medical attention

INHALATION: If inhalation of dust causes irritation of nose or coughing move person to fresh air. Carefully remove any dust from nasal passages and rinse mouth with water until clear. Seek medical attention.

SECTION 5: FIRE-FIGHTING MEASURES

There are no risks of fire or explosion from Tube Bundle Ash as the material is non combustible.

EXTINGUISHING MEDIA: Use extinguisher appropriate for surrounding fire. Tube Bundle Ash is non combustible.

SECTION 6: ACCIDENTAL RELEASE MEASURES

ACCIDENTAL RELEASE MEASURES: Wear appropriate personal protective equipment as described in section 8. When cleaning up spill avoid actions which could lead to the ash becoming airborne. Wet Ash should be removed by mechanical means where possible and taken to an appropriate licensed disposal site. Ash must not be washed into common sewer.

SECTION 7: HANDLING AND STORAGE

HANDLING AND STORAGE: When Dry, Tube Bundle Ash should be kept in containers, silos or sealed bags.

Engulfment hazard. Do not enter a confined space, such as the boiler, in order to prevent burial or suffocation. Ash can build up on surface walls or tube bundles and fall off unexpectedly.

All pneumatic conveyance systems should be effectively earthed. The potential exists for static build up in conveyance lines and injury to personnel or equipment upon discharge.

Wet tube bundle ash does not need to be stored in sealed container as there is no risk of airbourne dust. The container should however be water tight to ensure full containment of the slurry and avoid leakage. It must also be corrosion resistant, see Section 10.

OTHER PRECAUTIONS: Avoid actions which could lead to ash becoming airborne. Promptly remove any clothing contaminated with ash (wet or dry) and wash skin as directed in section 4.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

WORKPLACE EXPOSURE LIMITS: Workplace Exposure Limits (WEL's) of 10mg/m^3 total inhalable dust and 4mg/m^3 respirable dust (8 hour TWA) are listed in EH40 for ash. The ash also contains:

i) Calcium Oxide – 2mg/m^3 exposure limit
ii) Silica, Crystalline, Quartz – 0.025mg/m^3 exposure limit

ENGINEERING CONTROLS: Use local exhaust ventilation or other suppression methods to prevent exposure limit being reached.

RESPIRATORY PROTECTION: When exposed to ash dust above the exposure limit, potentially during boiler cleaning, a HSE approved respirator should be worn. When handling slurry no respiratory protection is required as there is no risk of airbourne dust.

EYE PROTECTION: Goggles (HSE standard) should be worn when handling dust or wet ash to prevent contact with eyes. Wearing contact lenses when working with ash is not recommended.

SKIN PROTECTION: Wear water proof gloves, boots and clothing to prevent skin contact. Change heavily contaminated clothing as soon as possible and launder before reuse.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Tube Bindle Ash is composed of inorganic material with a small proportion of carbon particulate resulting from the incomplete combustion of the parent fuel. The Ash is extracted during cleaning of the boiler tubes.

APPEARANCE:	Grey Powder	**ODOUR:**	Yes
PHYSICAL STATE:	Solid/Liquid (Dust/Slurry)	**BOILING POINT:**	>1000°C
FREEZING POINT:	None (Solid)	**VAPOR PRESSURE (mmHg):**	N/A
VISCOSITY:	None (Solid)	**SPECIFIC GRAVITY (H_2O = 1):**	0.7 (Dry) 1.4 (wet)
SOLUBILITY IN WATER:	Partially Soluble, forms highly alkaline solution	**VOLATILE ORGANIC COMPOUNDS (VOC):**	N/A
OTHER:	Hygroscopic	**pH**	**>10.8**

SECTION 10: STABILITY AND REACTIVITY

STABILITY: Stable.

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: None

HAZARDOUS POLYMERIZATION: None

CORROSIVITY OF METALS: The ash, when wet, can be particularly corrosive to metals, especially including aluminium.

SECTIONS 11 & 12: ECOLOGICAL & TOXICOLOGICAL INFORMATION

PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water. Similarly Dioxins and furans are highly persistent and readily accumulate in animal tissue and can impact on fish and animal health.

SECTION 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Hazardous and is classed as ‘controlled waste’ in the UK. It has no special requirements for disposal at a facility licensed by the ‘Waste regulation Authority’. The National Association of Waste Disposal Contractors (NAWDC) can provide a list of licesnsed members.

SECTION 14: TRANSPORT INFORMATION

Hazardous , Corrosive

SECTION 15: REGULATORY INFORMATION

Risk Phases:

- Irritating to skin
- Risk of serious damage to eyes

Safety Phrases:

- Avoid eye and skin contact by wearing eye protection, clothing and gloves
- Avoid breathing dust

- On contact with eyes or skin, rinse immediately with plenty of clean water. Seek medical advice after eye contact

SECTION 16: OTHER INFORMATION

Legislatiion:

- Health & Safety at Work, etc. Act 1974
- Control of Substances Hazardous to Health Regulations (COSHH) 2002
- Control of Substances Hazardous to Health (Amendment) Regulations 2004
- Environmental Protection Act 1990
- HSE Guidance Note EH40 (Workplace Exposure Limits)
- Any authorised manual on First Aid by St.John's/St. Andrews/Red Cross.
- Manual Handling Operations Regulations 1992 (as amended)
- Data Sheet prepared in accordance with the Safety Data Sheets Directive (91/155/EEC, as amended by Directives 93/122/EC and 2001/58/EC)