

The

QUALITY PROTOCOL

for the production of pulverised fuel ash (PFA) and furnace bottom ash (FBA) for use in construction and manufacturing

<u>Contents</u>	<u>Page</u>
1. Introduction	3
2. Producing PFA and FBA	7
3. Providing evidence of compliance with the Quality Protocol	9
4. Application and use of PFA and FBA	10
Appendix A Definitions	11
Appendix B Typical chemical composition of PFA and FBA	13
Appendix C Standards and specifications for determining the quality of PFA and FBA	15
Appendix D Good practice for the use of PFA and FBA	18

Inside cover:

This Quality Protocol was funded by Defra as a business resource efficiency activity. It was developed by the Environment Agency and WRAP (Waste & Resources Action Programme) in consultation with Defra, industry and other regulatory stakeholders. The Quality Protocol is applicable in both England and Wales. It sets out criteria for the production and use of products from pulverised fuel ash (PFA) (including cenospheres) and furnace bottom ash (FBA) arising from the combustion of coal, with and without co-combustion materials, for the purpose of energy production.

Foreword

Background

The Waste Protocols Project is a joint Environment Agency and WRAP (Waste & Resources Action Programme) initiative in collaboration with industry, funded by the Department for Environment Food and Rural Affairs (Defra) as a business resource efficiency activity.

Uncertainty over the point at which waste has been fully recovered and ceases to be waste within the meaning of Article 1(1)(a) of the EU Waste Framework Directive 2006/12/EC has inhibited the development and marketing of materials produced from waste which could be used beneficially without damaging human health and the environment. In some cases, this uncertainty has also inhibited the recovery and recycling of waste and its diversion from landfill.

Interpretation of EU legislation is ultimately a matter for the European Court of Justice and there is now a substantial body of case law on the interpretation of the definition of waste in Article 1(1)(a) of the Waste Framework Directive. Drawing on the principles established in this case law, it is possible to identify the point at which certain wastes cease to be waste and thus when the Waste Framework Directive's waste management controls no longer apply. This identification is the purpose of the waste protocols project.

More specifically, depending on the circumstances of the waste stream concerned, the project seeks to achieve the following outcomes:

- to produce a Quality Protocol identifying the point at which waste having been the subject of a complete recovery operation, may become a non-waste product or material that can be either reused by business or industry, or supplied into other markets, enabling such fully recovered products to be used without the need for waste management controls; and
- to produce a statement that confirms to the business community what legal obligations they must comply with to use the treated waste material.

What is a Quality Protocol?

A Quality Protocol sets out criteria for the production of a product from a specific waste type. Compliance with these criteria is considered sufficient to ensure that the fully recovered product may be used without harm to human health or the environment and therefore without the need for waste management controls. In addition, the Quality Protocol indicates how compliance may be demonstrated and points to good practice for the use of the fully recovered product.

The Quality Protocol further aims to provide increased market confidence in the quality of products made from waste and so encourage greater recovery and recycling.

1. Introduction

1.1 What is this Quality Protocol?

1.1.1 This Quality Protocol has been developed by WRAP (Waste & Resources Action Programme) and the Environment Agency in consultation with industry and other regulatory stakeholders. It is applicable in both England and Wales.

1.1.2 The Quality Protocol sets out criteria for the production and use of products derived from *pulverised fuel ash* (PFA) (including *cenospheres*) and *furnace bottom ash* (FBA) arising from combustion of coal with and without *co-combustion materials*. If these criteria are met, products from PFA and FBA will normally be regarded as having been fully recovered and to have ceased to be waste when they have been despatched to the customer¹.

1.1.3 *Processors* and *users* are not obliged to comply with the Quality Protocol. If they do not, the PFA or FBA which they produce and use will be considered to be waste and *waste management controls* will apply to its handling, transport and application.

1.1.4 Definitions for terms which appear in *italics* when they are first used in the Quality Protocol are provided in Appendix A.

1.2 The purpose of the Quality Protocol

1.2.1 This Quality Protocol has three main purposes:

- i. to clarify the point at which PFA and FBA ceases to be waste and waste management controls are no longer required;
- ii. to provide users with confidence that the PFA and FBA they purchase conforms to agreed quality standards;
- iii. to protect human health and the environment (including groundwater) by setting standards for PFA and FBA produced, and by describing acceptable good practice for its use in designated applications.

1.3 Complying with the Quality Protocol

1.3.1 PFA and FBA will normally be regarded as having ceased to be waste, and therefore no longer subject to waste management controls when despatched to the customer, providing it:

¹ Waste is exempt from REACH (Registration, Evaluation, Authorisation and Restriction of Chemical substances) as it is covered by separate waste management controls. But once fully recovered or recycled, substances cease to be waste and waste management controls no longer apply. REACH may potentially apply instead at that point. If REACH applies, the MSDS will be a standard document that must be provided to customers. Further information on this and other processes relating to REACH is available from the website (www.hse.gov.uk/reach) of the UK REACH Competent Authority. Specific advice may be available from the Competent Authority Helpdesk on 0845 408 9575 or email ukreachca@hse.gov.uk

- does not contain any chemical in excess of the maximum values specified in Appendix B;
- meets the requirements of an *approved standard* and thus requires no further processing before use; and
- is sold for use in one of the designated applications listed in Section 4.

1.3.2 Processors must demonstrate that these criteria have been met. They can do this in the ways set out in Section 3.2, that is by ensuring that they keep the records listed in that Section.

1.3.3 Processors of PFA and FBA should note that, regardless of whether the criteria set out in 1.3.1 are met, the processing of PFA and FBA and its storage on the site of production will continue to be covered by the site's *environmental permit*. However, if products from PFA and FBA are produced and used in accordance with this Quality Protocol, they will cease to be waste and waste management controls will not apply once they are despatched to a customer.

1.3.4 If PFA or FBA that complies with the Quality Protocol is mixed with other waste materials, the resulting mix will be considered to be a waste and subject to waste management controls.

1.3.5 If PFA or FBA that complies with the Quality Protocol is mixed with non-waste materials, the blend will not be waste.

1.4 Failure to comply with the Quality Protocol

1.4.1 Where this Quality Protocol is not complied with, for example the PFA or FBA does not meet an approved standard or the processor cannot demonstrate evidence of compliance, the PFA or FBA produced will be considered to be waste. In such circumstances, the processor/user must comply with the appropriate waste management controls for the transportation, storage and use of the PFA or FBA and may be committing an offence if they do not do so.

1.4.2 Detailed guidance on waste management controls can be obtained from the Environment Agency's National Customer Contact Centre on 08708 506 506 or from its website (<http://www.environment-agency.gov.uk/subjects/waste>).

1.4.3 It must be demonstrated that the PFA or FBA will actually be used in one of the designated market sectors. Processors and users of PFA and FBA should note that, even if the Quality Protocol is complied with and the PFA and FBA has ceased to be waste, the material will become waste again and subject to waste management controls if, for example, it is at any stage:

- disposed of; or
- stored indefinitely with little prospect of being used.

1.5 Updating the Quality Protocol

1.5.1 We plan to review and update this document in February 2011 and every two years thereafter.

- 1.5.2 However, this document may be subject to change before the review dates. Triggers for change could include a significant change in coal combustion processes used in the UK² and a change in legislation or case law.
- 1.5.3 This Quality Protocol may be withdrawn by the Environment Agency if it becomes apparent that it is generally being misused and/or misapplied.
- 1.5.4 This Quality Protocol will be adopted as a technical regulation under Technical Standards and Regulations Directive 98/34/EC as amended.³ We recognise that there may be codes of practice or standards which apply in *European Economic Area* (EEA) States other than the UK setting out requirements for the production of products from PFA and FBA. We accept that processed PFA and FBA may cease to be waste when despatched to a customer provided that it has been produced in compliance with:
- a relevant standard or code of practice of a national standards body or equivalent body of any EEA State; or
 - any relevant international standard recognised for use in any EEA State; or
 - any relevant technical regulation with mandatory or de facto mandatory application for marketing or use in any EEA State

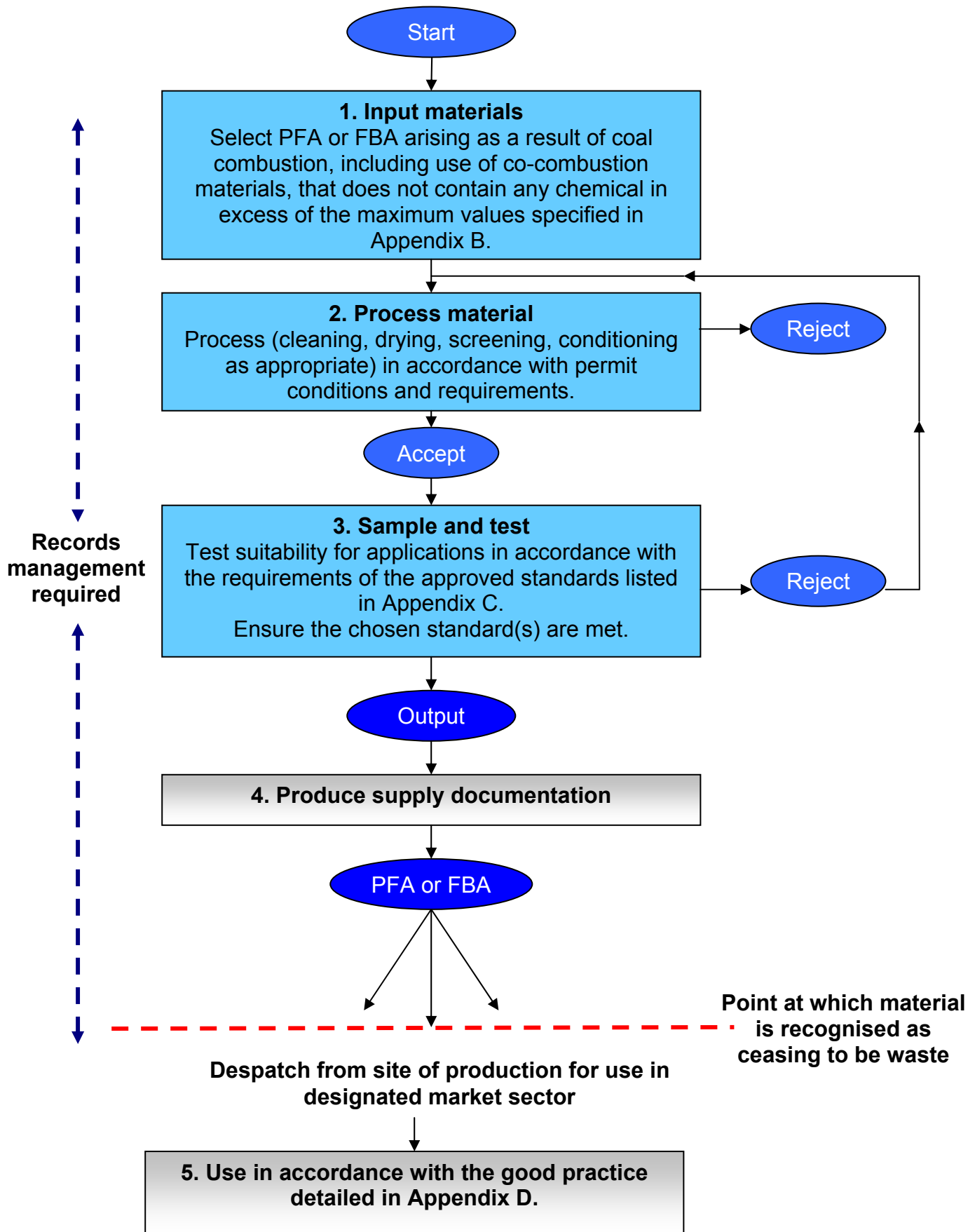
These must give levels of product performance, protection of human health and the environment which are equivalent to those required to those required in this Quality Protocol.

- 1.5.5 An outline of the main stages and control mechanisms of the Quality Protocol is presented in Figure 1. These are described further in Sections 2 and 3.

² That is, the change has caused the composition of PFA and FBA to significantly exceed the ranges stated in Appendix B.

³ The Technical Standards and Regulations Directive 98/34/EC seeks to ensure the transparency of technical regulations and is intended to help avoid the creation of new technical barriers to trade within the European Community.

Figure 1: Main stages and control mechanisms of the Quality Protocol



2. Producing PFA and FBA

2.1 Regulating the production process

- 2.1.1 The combustion of coal with and without co-combustion materials is subject to control under an environmental permit. This Quality Protocol does not affect the obligation by producers to comply with all the conditions of the environmental permit that applies to the combustion of coal for energy production.
- 2.1.2 The PFA and FBA may be subjected to processing in order to meet the requirements of the standard or specification, for example, testing for loss of ignition, conditioning or screening. Regardless of whether this is completed on- or off-site, it should also be covered – directly or indirectly – by the relevant environmental permit.
- 2.1.3 The criteria set out below must be met in order to produce products from PFA and FBA that will normally be regarded as complying fully with this Quality Protocol and which therefore cease to be waste when despatched to the customer.

2.2 Criteria for producing non-waste products from PFA and FBA.

2.3 Input materials

- 2.3.1 The PFA and FBA must not contain any chemical in excess of the maximum values⁴ specified in Appendix B.
- 2.3.2 Therefore, it will be essential to control the type and amount of the coal and co-combustion materials in order to achieve this.
- 2.3.3 The Quality Protocol will not apply to PFA or FBA that exceeds the maximum values.

2.4 Outputs

- 2.4.1 The PFA and FBA must meet the requirements of an *approved standard* and thus require no further processing before use.
- 2.4.2 Appendix C lists the approved standards that apply to PFA and FBA for various end uses at the time of publishing this Quality Protocol. Additional standards may be approved for inclusion when the Quality Protocol is reviewed.
- 2.4.3 Processors should be aware that any standard may be subject to regular review and must ensure they comply with the latest revision.

⁴ These values were used to assess the level of potential risk to human health and the environment from the use of PFA and FBA. Greater values may have a different impact that has not been recognised by this Quality Protocol.

2.5 Designated applications

2.5.1 The PFA and FBA must be sold for use in one of the *designated applications* listed in Section 4.

2.5.2 It is expected that users will follow the good practice outlined in Appendix D.

3. Providing evidence of compliance with the Quality Protocol

3.1 Evidence of compliance with the approved standard

3.1.1 Processors must be able to demonstrate compliance with the requirements of this Quality Protocol.

3.1.2 Some of these records may already be required as part of the processor's environmental permit conditions. This Quality Protocol does not affect the obligations on processors to comply with these environmental permit conditions.

3.2 Records management

3.2.1 Evidence of compliance with the requirements of this Quality Protocol may be demonstrated by retaining copies of supply documentation issued to the customer. It is expected that this will include documents that show:

- date of supply;
- quantity by weight/volume;
- name and address of receiving business/establishment;
- nature of receiving business/establishment (classified according to designated application);
- date of last test to approved standard;
- a copy of a materials safety data sheet⁵ (MSDS);
- a copy of the Quality Statement.

3.2.2 The Quality Statement should contain the following information:

- a statement that the PFA or FBA product was provided according to this Quality Protocol; and
- the date on which the PFA or FBA product was provided.

3.2.3 Processors should retain records of all inspection and testing carried out in accordance with the appropriate approved standard.

3.2.4 Processors should maintain a record of all Quality Statements issued against each sale of PFA or FBA.

3.2.5 These requirements are additional to any statutory record-keeping obligations. However, some records may be used to fulfil both a regulatory obligation and evidence of compliance with the Quality Protocol.

3.2.6 The processor will normally be expected to:

⁵ For additional guidance refer to Health and Safety Executive (HSE) leaflet Why do I need a safety data sheet? And the Approved Code of Practice: The compilation of safety data sheets Third edition 130 HSE Books 2002 ISBN 0 7176 2371 8. For further information contact the HSE InfoLine by telephone 08701 545500 or email hseinformationservices@natbrit.com or visit www.hse.gov.uk.

- keep and retain specified records for a minimum of two years; and
- make them available for inspection by the regulator (if requested).

4. Application and use of PFA and FBA

4.1 Designated applications

- 4.1.1 As with all construction materials, the users of PFA and FBA should take full account of any environmental impact resulting from its use and ensure that its use does not compromise the future sustainable use of water resources.
- 4.1.2 To comply with this Quality Protocol and to ensure protection of human health and the environment, the PFA and FBA products must be used in accordance with the good practice detailed in Appendix D and destined for use in one of the following applications:

4.2 PFA

4.2.1 Bound applications

Used as an ingredient/component within another product and is fully bound within that product.

- 1) Hydraulically bound mixtures in pavement construction, e.g. capping, sub-base and road base, and ground stabilisation.
- 2) Type II addition in concrete, e.g. cementitious component in concrete.
- 3) Type I addition in concrete, e.g. as filler or lightweight filler aggregate.
- 4) Cement manufacture, e.g. added as raw material into kiln feed or added to Portland cement.
- 5) Ceramic tiles and brick-making.
- 6) Paints, plastics, rubber and similar.
- 7) Lightweight filler in bitumen-bound materials, e.g. foamed bitumen or asphalt.

4.2.2 Unbound applications

Used without any binding agent.

- 1) Engineering fill e.g. embankment development, raise levels for construction sites and cap contaminated land.

4.2.3 Grout

Uses where the material is hydraulically pumped or injected into the ground to fill void space. The material sets gradually. Setting time depends on the mixture design, water content and ground conditions.

- 1) Lightweight filler for use in grouts.

4.3 FBA

4.3.1 Bound applications

- 1) Lightweight aggregate in concrete, e.g. block manufacture.

4.3.2 Unbound applications

- 2) Aggregate in road construction, e.g. capping layers and sub-base.

Appendix A: Definitions

In this Quality Protocol, the words and phrases below have the following meanings.

Term	Description
Approved standard	The standards listed in Appendix C and any other standard approved by the Environment Agency for inclusion in this Quality Protocol.
Co-combustion materials	Materials combusted with coal (e.g. biomass and petcoke)
Cenospheres	Hollow PFA particles
European Economic Area (EEA)	The EEA States consist of the members of the EU (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK) together with Iceland, Liechtenstein, Norway and Switzerland. Although the Channel Islands and the Isle of Man are part of the UK, they are not part of the EU and businesses registered there are subject to different licensing legislation.
Furnace bottom ash (FBA)	Ash that in a molten state adheres to the boiler tubes within the furnace and falls to the bottom of the furnace where it is cooled using high-pressure water jets and flushed from the bottom of the furnace.
Hydraulically bound mixtures (HBM)	Mixtures that set and harden by hydraulic reaction.
Input materials	Materials such as coal with or without coal co-combustion materials that are used in the coal combustion process to produce energy.
Material safety data sheet (MSDS)	A document containing health and safety information on a hazardous product. It includes the chemical and common names of all ingredients that have been determined to be health hazards if they constitute 1 per cent or greater of the product's composition (0.1 per cent for carcinogens). Also includes precautionary guidelines and emergency procedures for handling the product.
Environmental Permit	Environmental permits or exemptions issued under the Environmental Permitting (England and Wales) Regulations 2007, which came into force on 6 April 2008, or a position adopted by the Environment Agency in accordance with its guidance on the regulation of low-risk activities. From 6 April 2008, the following automatically became environmental permits:

Term	Description
	<ul style="list-style-type: none"> • PPC permits issued under the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended); and • Waste Management Licences (WMLs) issued under the Environmental Protection Act 1990 (as amended). <p>Exemptions from the need for a Waste Management Licence, registered under Regulation 18 and Schedule 3 of the Waste Management Licensing Regulations 1994 (as amended) will now come under Schedule 3 of the Environmental Permitting (England and Wales) Regulations 2007.</p>
Processors	Operators who process PFA (including cenospheres) and FBA in order that they meet necessary standards and specifications for sale in other applications.
Producer	The operator of a coal-fired power station that produces PFA (including cenospheres) and FBA.
Pulverised fuel ash (PFA)	The residual solid material from the combustion process in coal fired power stations. For the purposes of this document, PFA is defined as including coal-combustion PFA, co-combustion PFA and cenospheres.
Source protection zone 1	Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1. This applies at and below the water table. This zone also has a minimum 50 metre protection radius around the borehole. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
Users	Individuals or organisations that obtain PFA (including cenospheres) or FBA from a processor or third party with the intention of using the material for a specific application.
Waste management controls	Controls under legislation that govern the treatment, handling, containment and storage of waste.

Appendix B: Typical chemical composition of PFA and FBA⁶

Chemical	Units	PFA		FBA	
		Minimum	Maximum	Minimum	Maximum
Aluminium	% w/w	24	26		
Aluminium	mg/kg			2,000	123,000
Aluminium oxide	% w/w			18.91	26.1
Antimony	mg/kg	1	325	0.3	4
Arsenic	mg/kg	4	128	<3	33
Barium	mg/kg	0	36,000	32	3,100
Barium oxide	%w/w			0.12	0.32
Beryllium	mg/kg	0.2	9.1		
Boron	mg/kg	5	310	0.5	145
Cadmium	mg/kg	<0.1	4	0.06	0.6
Calcium	% w/w	5.3	5.7		
Calcium	mg/kg			1,610	33,800
Calcium oxide	% w/w			4.57	8.07
Carbon	mg/kg			23,000	23,000
Chloride	mg/kg	0	2,990	3,000	3,000
Chromium	mg/kg	16	220	16	950
Cobalt	mg/kg	2	115	4	72.9
Copper	mg/kg	10	474	7	310
Fluoride	mg/kg	0	230	<5	145
Fluorine	mg/kg			<5	68.5
Gold	mg/kg			<5	<5
Iron	% w/w	7.7	9.5		
Iron	mg/kg			7,630	119,000
Iron oxide	% w/w			11.96	21.58
Lead	mg/kg	<1	976	<5	100
Magnesium	% w/w	2.1	2.6		
Magnesium	mg/kg			299	15,000
Magnesium oxide	% w/w			1.83	2.92
Manganese	mg/kg	0.27	1,600	31	2223
Manganese oxide	%w/w			0.17	0.31
Mercury	mg/kg	<0.01	1.3	<0.01	0.06
Molybdenum	mg/kg	<2	81	4	22.8
Nickel	mg/kg	8.3	583	40	620
Phosphorous	mg/kg	262	2,818	220	270
Phosphorous	% w/w	0.6	2.1		

⁶ Data for PFA and FBA materials were derived from a variety of available sources including UKQAA and JEP. Data were obtained for coal-fired power stations, coal and petcoke and biomass co-firing, as well as from Aberthaw power station, which uses ammonia injection to improve electrostatic precipitator performance.

Chemical	Units	PFA		FBA	
		Minimum	Maximum	Minimum	Maximum
Phosphorous pentoxide	% w/w			0.23	0.7
Potassium	% w/w	1.8	3.4		
Potassium	mg/kg			166	10,000
Potassium oxide	% w/w			1.31	2.17
Selenium	mg/kg	<1	162	0.3	<1
Silica	% w/w			39.35	53.34
Silicon	% w/w	48	56		
Silicon	mg/kg			325	187,000
Silver	mg/kg	0.126	0.126		
Sodium	% w/w	0.7	1.1		
Sodium	mg/kg			126	5000
Sodium oxide	% w/w			0.3	0.9
Sulphur	% w/w	0.9	1.1		
Sulphur	mg/kg			4,500	4,500
Sulphur trioxide	% w/w			0.08	1.39
Thallium	mg/kg	0.374	0.374		
Tin	mg/kg	<2	1,847	1.2	1.2
Titanium	% w/w	1	1.1		
Titanium	mg/kg			124	5,100
Titanium dioxide	% w/w			0.76	1.05
Total sulphate	mg/kg	1,600	4,240		
Uranium	mg/kg	3.65	3.65		
Vanadium	mg/kg	44	1,339	11	540
Zinc	mg/kg	43.3	918	20	230

Appendix C: Standards and specifications for determining the quality of PFA and FBA

The following standards⁷ are approved for the purpose of this Quality Protocol:

Engineering fill (PFA)

Includes use in embankments and for raising ground levels.

- 1) UK Specification for Highway Works, Series 600, clause 601.17 *Use of fill material.*
- 2) *Design Manual for Roads and Bridges (DMRB). Volume 7.*

Hydraulic bound mixtures in pavement construction (PFA)

Includes capping, sub-base and road base in road construction.

- 3) BS EN 14227-4: 2004 *Hydraulically bound mixtures – Specifications – Part 4: Fly ash for hydraulically bound mixtures.*
- 4) BS EN 14227-3: 2004 *Hydraulically bound mixtures – Specifications – Part 3: Fly ash bound mixtures*
- 5) BS EN14227-14: 2006 *Hydraulically bound mixtures – Specifications – Part 14: Soil treated by fly ash.*
- 6) prEN 13282, Part 1: *Composition, specifications and conformity criteria of rapid hardening hydraulic road binders.*
- 7) prEN13282, Part 2: *Composition, specifications and conformity criteria of normal hardening hydraulic road binders.*
- 8) UK Specification for Highway Works, Series 800, clause 830-832, 834, 840 *Hydraulically bound mixtures/soil treated by fly ash.*

Lightweight filler in bitumen-bound materials (PFA)

Uses include foamed bitumen, asphalt.

- 9) BS EN 13055-2: 2004 *Lightweight aggregates. Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications.*

Additions in concrete (PFA)

Includes use as a cementitious component in concrete (Type II addition), filler aggregate (Type I addition) and lightweight filler aggregate (Type I addition)

- 10) BS EN 450-1: 2005 *Fly ash for concrete. Definition, specifications and conformity criteria.*

⁷ These standards or specifications may be updated. Please refer to the most up to date version.

- 11) BS EN 450-2: 2005 *Fly ash for concrete. Conformity evaluation.*
- 12) BS EN 206-1: 2000 *Concrete. Specification, performance, production and conformity.*
- 13) BS 8500-1: 2006 *Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier.*
- 14) BS EN12620: 2002 *Aggregates for concrete.*
- 15) BS EN 13055-1: 2002 *Lightweight aggregates. Lightweight aggregates for concrete, mortar and grout.*

Cementitious component in cement manufacture (PFA)

- 16) BS EN 197-1: 2000 *Cement. Composition, specifications and conformity criteria for common cements.*
- 17) BS EN 413-1: 2004 *Masonry cement. Composition, specifications and conformity criteria.*
- 18) BS EN 14216: 2004 *Cement. Composition, specifications and conformity criteria for very low heat special cements.*
- 19) BS EN15368: 2008 *Hydraulic binder for non-structural applications: Definitions, specifications and conformity criteria.*
- 20) prEN13282, Part 1: *Composition, specifications and conformity criteria of rapid hardening hydraulic road binders.*
- 21) prEN13282, Part 2: *Composition, specifications and conformity criteria of normal hardening hydraulic road binders.*
- 22) BS EN 206-1: 2000 *Concrete. Specification, performance, production and conformity.*
- 23) BS 8500-1: 2006 *Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier.*
- 24) BS EN 14227-1: 2004 *Hydraulically bound mixtures – Specifications – Part 1: Fly cement bound granular mixtures.*

Cement manufacturers may specify requests additional to these standards in order to balance the chemistry (e.g. silica and alkalis) in raw feed materials for cement clinker manufacture.

Lightweight aggregate in concrete (FBA)

- 25) BS EN 13055-1: 2002 *Lightweight aggregates. Lightweight aggregates for concrete, mortar and grout.*

- 26) BS EN 206-1: 2000 *Concrete. Specification, performance, production and conformity.*
- 27) BS 8500-1: 2006 *Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier*
- 28) BS EN 771-3: 2003 *Specification for masonry units. Aggregate concrete masonry units (dense and lightweight aggregates).*
- 29) BS EN 771-4: 2003 *Specification for masonry units. Autoclaved aerated concrete masonry units.*
- 30) BS EN 998-1: 2003 *Specification for mortar for masonry. Rendering and plastering mortar.*
- 31) BS EN 998-2: 2003 *Specification for mortar for masonry. Masonry mortar.*

Aggregate in road construction (FBA)

- 32) BS EN 13242: 2002 *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction.*
- 33) UK Specification for Highway Works, Series 600, clause 601.17 *Use of fill material.*
- 34) UK Specification for Highway Works, Series 800, clause 830-832, 834, 840 *Hydraulically bound mixtures/soil treated by fly ash.*

Grout applications

Used as a cementitious component and a lightweight filler aggregate in grouts

- 33) BS EN 12715: 2000 *Execution of special geotechnical work. Grouting.* Permits the use of PFA as part of the cementitious content and as a filler material in grout.
- 34) BS EN 13055-1: 2002 *Lightweight aggregates. Lightweight aggregates for concrete, mortar and grout.*

Other uses

- 35) Ceramic tiles and brick making.
- 36) Paints, plastics, rubber and similar (cenospheres).

In these uses, PFA material enters a separate manufacturing process where it is controlled. Therefore this Quality Protocol accepts the use of a 'customer specification' agreed between the processor and the customer.

Appendix D: Good practice for the use of PFA and FBA

The use of materials, whether of waste origin or not, may carry a potential risk of pollution to groundwater and surface waters if used inappropriately. The following good practice takes account of all potential environmental issues such as proximity to abstraction boreholes, proximity to groundwater and the nature of the site's geology.

Good practice – some generic and some specific to PFA and FBA – has already been established for the use of products in the applications designated by this Quality Protocol. The work of developing this Quality Protocol also identified some additional measures that further reduce the risk to the environment from unbound applications and grout.

All applications

- All applications of PFA and FBA permitted under this Quality Protocol must comply with all recommendations from the Health and Safety Executive (HSE)⁸. For example, using appropriate PPE and dust suppression measures.
- In order to help characterise a site and locate aquifers, users should refer to the map contained in Environment Agency, 2007 *Underground, under threat. Groundwater protection: policy and practice. Parts 1–4*. Bristol: Environment Agency⁹. Available from: <http://www.environment-agency.gov.uk/subjects/waterres/groundwater/1463256/>¹⁰

Bound applications

- When using products in contact with water intended for human consumption, follow the guidance given in Drinking Water Inspectorate (DWI) Advice Sheet 7 *Construction products for water retaining structures in water collection, treatment and distribution systems*.⁷ This document can be found on the DWI's website (<http://www.dwi.gov.uk/31/pdf/Advicesheet7.pdf>).⁸

Unbound applications

- The advice given in *Environmental code of practice for the sale and use of pulverised fuel ash (PFA)* published by the United Kingdom Quality Ash Association (UKQAA) in January 2003 must be followed. This document can be found on the UKQAA's website⁸ (<http://www.ukqaa.org.uk/Environment/Code%20of%20Practice%20January%202003.pdf>).¹¹
- The following regional surface area limits for unbound applications should be followed:
 - Wales region – 250,000 m²
 - Northwest and Southern region – 500,000m²
 - South West region – 750,000m²

⁸ More information can be found at the HSE website, at the following link: <http://www.hse.gov.uk/> [accessed 4 August 2008]

⁹ This information may be updated. Please refer to the most up to date guidance.

¹⁰ [Accessed 4 August 2008]

¹¹ If the UKQAA code of practice is changed so that it no longer meets Environment Agency requirements, the Quality Protocol may be withdrawn.

Surface areas of up to 1 million m² would be acceptable in all other regions

The majority of unbound applications of PFA are likely to be less than these surface areas and demonstrate a low risk of impact to surface water quality.

Grout applications

- The advice given in *Stabilising mine workings with PFA grouts – environmental code of practice* (BR488) published by BRE in May 2006 must be followed. This document can be purchased from BRE Press (www.brepress.com; to find the document, search on 'grout').¹²

Additional measures¹³ for both unbound applications and grout

- They must not be used in areas designated a source protection zone 1 (SPZ1).¹⁴
- A risk assessment following the guidelines for Environmental Risk Assessment and Management DETR July 2000. Available from: <http://www.defra.gov.uk/environment/risk/eramguide/index.htm> [Accessed 4 August 2008] must be completed if the product is intended to be used below the water table, or above the water table if used in applications exceeding 150m².

Please note:

It is our intention that post consultation, this section will contain the core elements we would expect to see in a generic code of practice for unbound and grouting applications using any construction materials. This will be subject to us working in collaboration with industry to update the codes of practice during the six month period from consultation start to the end of post-consultation review.

¹² If the BRE code of practice is changed so that it no longer meets Environment Agency requirements, the Quality Protocol may be withdrawn.

¹³ Following consultation, we intend to work with industry to update the codes of practice to include the additional measures listed above and ensure that it aligns with current legislation and terminology.

¹⁴ See the Environment Agency's website (<http://www.environment-agency.gov.uk/subjects/waterres/groundwater/>) for information on source protection zones.