

UK Quality Ash Association

First Sustainability Report for the Coal Fired Power Station Ash Supply Industry

2007

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Introduction

The UK Quality Ash Association (UKQAA) responsibly sourced materials scheme was introduced in 2008 following an initiative within the Concrete Industry to work towards a sector scheme reporting the sustainability achievements. This scheme is known as Concrete Industry Sustainable Construction Strategy, which produced its first report in March 2009.

The UKQAA scheme is designed to both support the concrete industry scheme, but is specific to the fly ash industry covering the wide variety of applications, requiring a range of ash qualities. As a result it is not wholly compatible with the equivalent Concrete Industry scheme.

This report summarises the results of the first year of reporting and outlines the operation of the scheme. A series of Key Performance Indicators are reported, which have been produced based on DEFRA and Environment Agency guidelines.

The Key Performance Indicators (KPI)

The UKQAA scheme is based on five categories of performance indicator resulting in 18 KPIs or clauses A to R. The considerable majority of these KPIs are graded numerically with 1 being the best performance and 4 the worst. Some KPIs are not graded but described by a letter. These KPIs are those that have relevance to the methods of production, but are not seen as benefiting from applying a scoring system. There is no significance to the letter assigned for these KPIs; they are solely to be indicative of the production systems being

operated at a power station.

The data collection for 2007 was carried out between June and December of 2008. During this period of data collection the scheme was trialled using member's returns and requesting their comments.

This resulted in a number of changes being made to the scheme to ensure it was practicable, reported useful and reliable statistics and yet without becoming over burdensome to the membership. As a result of these trials, changes and improvements were made to assist the operation of the scheme.

Nine out of the possible eighteen power stations responded to the call for information, these are listed in the Appendix A. **United Kingdom Quality Ash Association Responsibly Sourced Materials Certificates** were issued to power stations providing data.

The following are requirements of the Operating Procedure and explanations of the 18 KPIs (in italics) and the results from the contributing members for data collected during 2008, relating to production in 2007.

Category 1 - Sustainable Consumption and Production

Management Systems (including legal compliance)

The power station shall have systems in place to operate in a legal, efficient and financially sustainable manner with continuous improvement in the management of quality, the environment and human resources. This shall be assessed using the following KPIs:

Clause A - Environmental Management Systems: *The existence of an operation Environmental Management scheme. There are four Grades as follows:*

Grade 1 - ISO14001

Grade 2 - BS8555 - Level 5

Grade 3 - BS8555 - Level 4

Grade 4 - BS8555 - <Level 4

Results for 2007: All UKQAA member power stations operated ISO 14001 systems. The overall score was 1.0.



Figure 1 - A new slip road from the A4211 to the M1 using PFA for the embankment

Waste

The power station shall manage all waste streams effectively and aim to minimise the waste disposed of to landfill. This shall be assessed by the following KPIs:

Clause B – Waste and type of production facility: Some ash is processed to produce a saleable product, particularly for the concrete and block markets. The processes considered here are those that potentially result in a waste stream and/or consume significant amounts of energy (>5kWh per tonne). They do not include normal selection techniques, which are classified as Category A. This category defines the type production facility being used as follows:

Category A = Selection and/or no processing of ash carried out.

Category B = Mechanical size classification of ash when required.

Category C = Carbon reduction equipment used when required (may include ammonia removal).

Category D = Both size classification and carbon reduction carried out (may include ammonia removal).

Category E = Size classification, carbon reduction and more complex product separation.

This KPI is not considered a measure of the sustainability of the ash production process. This is because in making some ashes saleable a degree of physical processing may be carried out. For example, the coarser fractions and/or the unburned carbon fractions may be removed in order to make the ash more suitable for sensitive applications. This inevitably involves producing some potential waste streams, though many of these residues will be used for less critical applications or within the power station boundary.

The overall intent of ash processing is to produce more saleable ash, thereby reducing the overall amount of material going to landfill. Therefore, the producers have been graded into four categories, with those operating the most sophisticated equipment either by necessity or design being indicated by the code letter.

Result for 2007: Seven power stations had no classification or selection systems, e.g. Category A. There was one station with carbon reduction (Category C) and one station with both carbon reduction and classification (Category D).



Figure 2 - PFA particles are spherical - giving them some unique properties

Emissions to air and water (excluding CO₂)

The power station shall endeavour to minimise emissions to air and water from the production process (excluding CO₂). This shall be assessed by the following KPIs:

Clause C - No. of reportable environmental incidents on a per site basis: To indicate degree of control in preventing accidental dust emissions, discharges of water, etc to the natural environment. Report the number of significant dust emissions to air and releases to ground water incidents during the year. These are split into 4 grades as follows:

Grade 1: Zero incidents

Grade 2: 1 or 2 incidents

Grade 3: 3 or 4 incidents

Grade 4: More than 4 incidents

The ash sales plant is only a small part of a coal fired power station. This KPI only relates to environmental incidents associated with the ash sales facilities, such as releases of dust from silo filter, accidental loss of ash destined for sale into water courses, etc. These do NOT include releases associated with the power station that are outside of the control of the ash producer/supply division.

Result for 2007: There were no incidents of emissions to air and water reported. The overall score was 1.0

Stakeholder Engagement

Power stations shall aim to communicate and work constructively with the supply chain and other relevant stakeholders. This shall be assessed by the following KPIs:

Clause D - Communication with other parties, e.g. power station staff, ash users, etc: BS 8900 Standard for stakeholder engagement. The provision of methods for communicating with other parties affected by the production of ash products.

A = Regular consultations with supply chain, e.g. coal buyers, power station engineers, etc.

B = Provision of data relating to the production and sale of ash products to all parties.

C = System for providing information to ash users, e.g. newsletters, meetings, etc.

The reported KPI is graded depending on the number of the above that are being carried out, with Grade 1 when all three are being implemented and Grade 4 when none are being implemented.

Result for 2007: Seven stations are graded as 1, having all three communications systems in place, with two stations graded as 2 having only two in place. The overall score was 1.2



Figure 3 - PFA used as a reinforced earth embankment

Quality & Performance

A power station shall market and develop materials and products that contribute to a sustainable built environment. This shall be assessed by the following KPIs:

Clause E - Compliance with products standards: The proportion of material supplied in compliance with the appropriate product standards, for example EN450-1, EN12620, EN13055-1, Spec. for Highway Works, etc and shown on delivery documentation.

This KPI is to assess the degree of control and compliance with recognised standards for the product. Material not supplied and/or controlled in any manner shall be regarded little more than an alternative disposal route.

There are four grades defined:

Grade 1 = 100% of material is sold to recognisable standards.

Grade 2 = >90% and <100% sold

Grade 3 = >80% and < 90% sold

Grade 4 = <80% sold.

Material sold as 'run of station' or as unspecified 'fly ash/PFA' will achieve a low grading. For example if all ash is sold as 'run of station' then this is 0% sold complying to a recognised standard, e.g. a grade 4 supplier.

Result for 2007: Two stations report supplying 100% of their material to recognisable standards, where the others were all grade 4. The overall average score was 3.3.

This is one area where significant improvements are feasible by supplying material to recognised European and British standards or specifications.



Figure 4 - PFA is used in concrete to enhance durability

Category 2 - Climate Change and Energy

Energy Efficiency

The power station shall aim to use energy more efficiently in production and transport processes. This shall be assessed by the following KPIs:

Clause F - CO₂ Emissions (Production): Electricity consumption for processing. Some ash processes require electricity to beneficiate the ash making it saleable in some markets, e.g. concrete and block making. So the energy usage is directly associated with trying to reduce waste to landfill, e.g. such processing is beneficial. This KPI is closely associated with Clause B, Waste KPI. There are a number of differing processes available to the ash producer ranging from selection methods through to sophisticated processing equipment.

They are graded into the average electricity consumption per tonne of ash sold and split into Grades A to D.

Grade A – 0 to 5 kWh per tonne of ash sold

Grade B – 5 to 10 kWh per tonne of ash sold

Grade C – 10 to 20 kWh per tonne of ash sold

Grade D – >20 kWh per tonne of ash sold

Result for 2007: As per the Clause B KPI, there were seven stations with no processing so were graded as A. There was one station with carbon reduction (Category C) and one station with both carbon reduction and classification (Category D).

This KPI will be increasingly relevant in future years as the sophistication of processing equipment increases. As boilers are fitted with more emissions equipment such as lower NO_x burners, Selective Catalytic Reduction (SCR), etc the energy consumption is likely to increase.

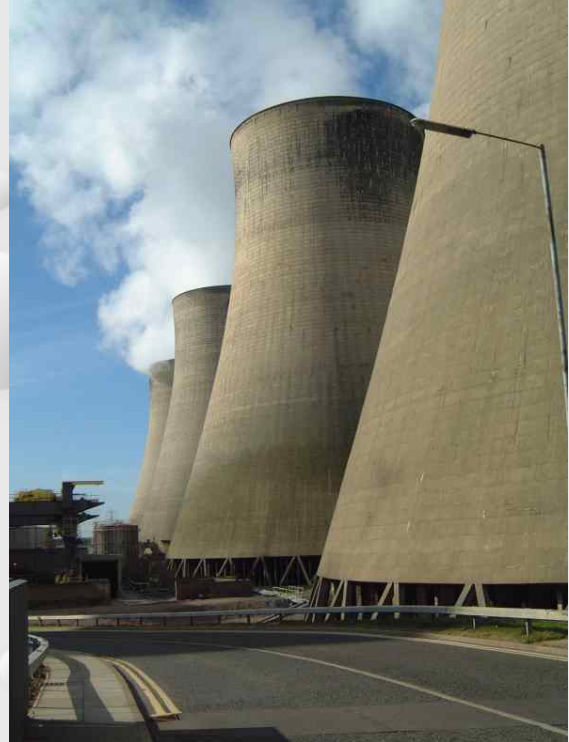


Figure 5 - Cooling towers improve station efficiency!

CO₂ Emissions (Transport)

Clause G: Transportation from the production facility to the construction site: This KPI reports the CO₂ emissions associated with the transportation of materials and products from the production facility to the construction site. The CO₂ associated with the production of ash is normally accepted as being part of the electricity production cycle. As power stations tend to be located away from the heavily populated areas and the larger construction markets, the resulting haulage may have a significant environmental impact and the biggest potential source of green house gas emissions. This KPI uses standard calculation techniques for CO₂ emissions from transport. These are calculated in two ways, from the base data, e.g. the fuel consumption, the distance travelled (including any empty back haul) and tonnes carried or by use of default values using a dedicated Transport Calculator.

Many ash producers sub-contract their haulage and therefore it becomes commercially sensitive information as to the efficiency of the transport methods, whether back hauls are possible, etc. In such circumstances the producer within this scheme has no option but to use the default values. However, using the assumed road freight values only will result in being classified as Grade 4, the lowest. Transport by train and canal barge default values are also given, which are factored into the overall picture based on the tonnage moved in these ways.

The default values are as follows:

For all: 2.630 kg of CO₂ is produced per litre of diesel used.

Type 1: For road freight 0.0626 kg of CO₂ / tonne-km or 0.1007 kg of CO₂ / tonne-mile is produced. Assumes typical fuel usage.

Type 2: For rail freight 0.049 kg of CO₂ / tonne-km or 0.079 kg of CO₂ per tonne-mile is produced.

Type 3: For canal freight use 0.035kg of CO₂/ tonne-km or 0.056 kg of CO₂/ tonne-mile.

From this the overall CO₂ emissions are graded as follows:

Grade 1 – <0.06 kg of CO₂/ tonne-mile

Grade 2 – 0.06 to <0.08 kg of CO₂/ tonne-mile

Grade 3 – 0.08 to <0.10 kg of CO₂/ tonne-mile

Grade 4 – ≥0.10 kg of CO₂/ tonne-mile

Result for 2007: All power stations reported that delivery by standard road freight systems were used predominantly. The overall score was 4.0.



Figure 6 - Delivering PFA to the concrete industry

Provision of Transport information and reduction in impacts

Clause H - Provide information on the environmental impacts of transportation to site of the ash to each contract. This KPI is designed to encourage ash producer and hauliers to keep records of the distances and modes of transport used in the supply of ash products. There are three records as follows:

A = Record delivery miles by transport mode on delivery ticket.

B = Collaborate with partners in reduction of transport impacts, by arranging return loads, etc.

C = Use alternative fuels and methods of transport to reduce impacts wherever possible, e.g. bio diesel, canal, rail, etc.

From these the various permutations are graded as follows:

Grade 1 – A, B & C

Grade 2 – A and C or A and B

Grade 3 – A only

Grade 4 – None

Result for 2007: About half of the stations are grade 2 and grade 4.

The overall score was 2.8.

Clauses G & H are areas where the use of more efficient vehicles, rail or even barge deliveries could have significant benefits. Closer liaison between hauliers and power stations may produce some immediate results by encouraging fewer empty return journeys, for example.



Figure 7 - Delivering PFA to the grouting market

Category 3 - Natural Resources and Enhancing the Environment

Materials Efficiency

The power station shall aim to minimise the disposal of ash products to landfill where they can be utilised within the construction industry. This shall be assessed by the following KPIs:

Clause I - Annual Utilisation of PFA (fly ash): *This recognises the need to use all primary, secondary and recycled materials in the most efficient manner. This is designed to encourage the producer to market their fly ash (PFA) as much as possible for beneficial use within the construction market. Land reclamation has been excluded as this, though more preferable than disposal is less preferable than the product being sold for construction applications.*

This is expressed as percentage of total annual production (dry weight) sold to the construction market. This KPI is split into four groups as follows:

Grade 1 - >80% of production sold

Grade 2 - >50% but < 80% sold

Grade 3 - >20% but <50% sold

Grade 4 - <20% sold

Result for 2007: A wide scatter results for this KPI, with the overall average being 3.0, >20% but <50% sold. Increasing the proportion of material has been a long term aim of the fly ash industry and there is clearly still some way to go to achieve this aim.

Clause J - Annual Utilisation of Furnace Bottom Ash (FBA): *This recognises the need to use all primary, secondary and recycled materials in the most efficient manner. This is designed to encourage the producer to market their FBA as much as possible for beneficial use within the construction market. Land reclamation has been excluded as this, though more preferable than disposal is less preferable than the product being sold for construction applications.*

This is expressed as percentage of total annual production (dry weight) sold to the construction market. This KPI is split into four groups as follows:

Grade 1 - >90% of production sold

Grade 2 - >70% but < 90% sold

Grade 3 - >40% but <70% sold

Grade 4 - <40% sold

Result for 2007: The buoyancy of the block market resulted in the considerable majority of power stations selling their FBA. The overall average score was 1.1. With the recession during late 2008/2009 it is expected less FBA will be sold.

Complaints

Clause K – Complaints: *This KPI is designed to record the number of complaints/incidents associated with the production and supply of ash products to the construction industry. It is a measure of the producer's customer care strategy.*

Records of problems associated with the production and delivery of ash products reported by public, site staff, etc are to be kept and reported on an annual basis. It is split into four grades as follows:

Grade 1 – No incidents p.a.

Grade 2 – 1 to 2 incidents

Grade 3 – 3 or 4 incidents

Grade 4 - >4 incidents

Result for 2007: All power stations reported no complaints were received during the period.

Category 4 – Creating sustainable communities

The power station shall aim to minimise accidents by adopting health and safety management systems, by engagement with their workforce, by offering education and training and fair employment practices and liaise with the local community. This shall be assessed by the following KPIs:

Health and Safety

Clause L – Health and Safety Lost Time Accidents. *This KPI is a measure of the H&S culture and its importance within a company. It is based on the RIDDOR lost time accidents, see <http://www.hse.gov.uk/riddor/guidance.htm>, and reported as the number of days resulting from lost time accidents expressed as the number of days lost per member of staff per annum.*

There are four gradings as follows:

- Grade 1 – NIL lost days per staff*
- Grade 2 - <1 lost day per staff*
- Grade 3 - <3 lost days per staff*
- Grade 4 - >3 lost days per staff*

Result for 2007: Most stations achieved an accident free record, but there were some significant exceptions. The overall score was 1.9. This would appear to be an area where major improvements need to be made.

Clause M - Health and Safety Management Systems: *This KPI is a measure of the level of interest and compliance in Occupational Health and Safety Management Systems (OHSAS) within the company. To demonstrate a competent H&S management system is in operation there are three options as follows:*

- A = Compliant with OHSAS 18001*
- B = RoSPA awards*
- C = Annual UKAS compliance verification carried out*

These are graded depending on the number of initiatives the company is involved with as in the following:

- Grade 1 - All of A, B & C compliant*
- Grade 2 –Two only of A, B & C carried out*
- Grade 3 –One only of A, B & C carried out*
- Grade 4 – None*

Result for 2007: All stations barring one reported Grade 1 compliance. The overall average score was 1.2.

Clause N- Engagement with workforce. *This KPI is an indication of the producer's interest in their staff and working conditions and to provide the opportunity of constructive engagement with employees. The three options are as follows;*

- A = Investors in People*
- B = Liaison with Trade Union or Employee Councils*
- C = Regular staff meetings.*

Which are graded as follows:

- Grade 1 – A, B & C*
- Grade 2 – Any two of A, B & C*
- Grade 3 – Any one of A, B & C*
- Grade 4 – None*

Result for 2007: All power stations are graded as 1.

Clause O – Education and training: This KPI is to assess the investment in vocation training and/or professional education courses plus whether any staff training and development programmes are in place. The options are split into four groups as follows:

Grade 1 - Training programme and professional education courses offered

Grade 2 - Training programme only or professional education courses only

Grade 3 - Supervised on the job training only

Grade 4 - No formal training given

Result for 2007: All power stations are graded as 1.

Clause P – Employment: This KPI is to assess the interaction with local communities on employment issues. There are three options as follows:

A = Have a published equal opportunity policy

B = Provide evidence of local recruitment initiatives

C = Provide evidence of established links with local schools/colleges.

These are grouped as follows:

Grade 1 - A, B & C

Grade 2 - A & one other

Grade 3 - A

Grade 4 – None

Result for 2007: The overall average result was 1.7, due to some stations being grade 4.

Clause Q – Local Community: This KPI is to assess the planning and design of operations in a manner that provides an acceptable quality of life for the local community. It indicates the degree of liaison with the local community and the response to complaints. There are four grades as follows:

Grade 1 – Community engagement programme, a formal system of complaints, the provision of work experience positions and support for community projects including school visits.

Grade 2 - Community engagement programme and a formal system of complaints.

Grade 3 - A formal system of complaints.

Grade 4 – No community engagement or complaints system.

Result for 2007: All power stations are graded as 1.



Figure 8 – The UKQAA is involved with conferences, lunchtime seminars, etc are available to all

Category 5 – Overall Business Responsibility

The power station parent company shall aim for the highest standards of corporate responsibility. This shall be assessed by the following KPI:

Clause R – Business in the community – The Corporate Responsibility Index¹: Business in the Community's CR Index is the UK's leading benchmark of responsible business. The Index assesses the extent to which corporate strategy is integrated into business practice throughout an organisation. This KPI is not restricted just to the ash producing aspects, but to the whole power station business. The index issues awards on an annual basis and these are graded as follows:

Grade 1 – Platinum Award

Grade 2 – Gold Award

Grade 3 – Silver Award

Grade 4 – Bronze Award

Grade 5 – Participant in alternative scheme

Grade 6 – None participant in any scheme

Result for 2007: There is one operating company that is a non participant in this scheme, due to the legal nature of their company. Though the overall result was 2.2, excluding their stations, this was 1.4, e.g. Platinum and Gold awards were the norm.

Analysis of the Key Performance Indicators

The Basic analysis of the KPIs

The Key Performance Indicators are analysed to produce an overall percentage sustainability rating which ranges from 0% to 100%. The individual KPI gradings are not weighted in any manner. The numeric KPIs are summed to produce a total KPI grading score. The alphabetic KPIs, Clause B and Clause F that relate to the energy consumption and type of processing being carried out are excluded. This total score may range from 16 to 65.

Overall Sustainability figure: The overall sustainability rating is calculated using the following formula and can range from 0 to 100%:

$$\text{Sustainability rating in \%} = \left[1 - \frac{(\text{Score} - 16)}{50} \right] \times 100$$

Issue of certificates: A certificate bearing the logo of the UKQAA shall be issued to all the power stations providing information:

- The power station name
- The company name
- The sustainability rating in %
- The production plant type



Figure 9 – The UKQAA attends Ecobuild every year

Overall Results for 2007

The overall average UKQAA Sustainability Rating for the power stations that submitted returns for 2007 was:

Average Score	28.6
Average Sustainability Rating	74.4%

Setting Targets for 2008 and onwards

The overall aim of the scheme is for continuous improvement. Therefore, it is not expected that any KPI will reduce in comparison with previous years, with the possible exception of Clause R. Clause R may be changed to be more indicative than prescriptive as the Corporate Responsibility index is not available to all UKQAA full members.

The scheme will continue and collection for 2008 data is currently in progress. One primary aim is to collect data from all UKQAA members' power stations, e.g. all 18 operational coal fired power stations. An annual report shall be produced as soon as practicable after all the data is collected and analysed.

The following KPIs are those identified where substantial improvements could be made in 2008 and subsequent years.

Clause E - Compliance with products standards

Showing compliance with a recognised product standard would seem to be an area where considerable improvements could be made relatively easily. There are numerous standards for the sale of ash products, many of which compliance is more an issue of the introduction of Factory Production Control systems. Some producers have adopted this approach promoting their ash as compliant with quality standards. Others have opted for the 'run of station' supply scenarios for which there are no warranties implied.

The aim for 2008 is for an overall average grading of <3.0 for this KPI.

Clause G: Transportation from the production facility to the construction site and Clause H - Provide information on the environmental impacts of transportation to site of the ash to each contract.

The norm for transporting ash from the power station to the user is by road haulage. As a result the overall grading is 4, with no evidence of any significant moves towards more sustainable transportation methods. Many power stations are reporting the 'default' haulage impact, implying there is little data collection. Closer liaison between hauliers and power stations may produce some immediate results by encouraging fewer empty return journeys, for example. The collection of haulage data, mileage, fuel use, etc would be a starting point for a general reduction in the environment impact of transporting ash. This is one area there is significant areas for improvement.

The aim for 2008 is for an overall average Clause G grading of <4.0 and a Clause H rating of <2.5.

Clause I - Annual Utilisation of PFA (fly ash) and Clause J - Annual Utilisation of Furnace Bottom Ash (FBA)

This has been the long term aim of the members of the UKQAA for many years, to increase utilisation of ash products thereby preventing material being land filled. The 2008/9 recession has not helped particularly in the sale of FBA due to the severe downturn in the housing market and therefore, the block market.

The aim for 2008 and onwards is to achieve an utilisation grading of <2.5 for PFA (Clause I) and <1.3 for FBA (Clause J).

Clause L - Health and Safety Lost Time Accidents

The number of loss time accidents was adversely affected by a small number of days lost, but where staffing levels are very low. This results in an apparent poor result. The aim for 2008 is to eliminate lost time due to RIDDOR accidents completely, e.g. an overall average grade of 1.0.



Figure 10 - Using trains wherever possible to reduce transport impacts

General

The data contained in this report represents the first year of the UKQAA Sustainability reporting system. There have been changes and improvements as data has been forthcoming and no doubt this iterative process will continue for some considerable time until the scheme is well established. At this time there is no intention to seek 3rd party accreditation for compliance with this scheme or the compliance of this scheme with recognised standards, e.g. BES 6001 or the equivalent British Standard.

If you have any queries or comments about this document, please contact the UKQAA.

Appendix A

The following power stations have contributed to the collection of KPIs for 2007. The UKQAA would like to thank them for their hard work in collecting the statistics:

- **Scottish & Southern**
 - Fiddlers Ferry
 - Ferrybridge
- **International Power**
 - Rugeley
- **ScotAsh**
 - Longannet
- **EDF Energy**
 - Cottam
 - West Burton
- **RWE NPower**
 - Didcot A
 - Tilbury B
 - Aberthaw B

For contact details please see the UKQAA web site.

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In general usage the term 'fly ash' is used for pulverized coal ash but it can also cover ash from burning other materials. Such 'fly ash' may have significantly differing properties and might not offer the same advantages as ash from burning pulverized coal. UKQAA datasheets only refer to PFA / fly ash produced from the burning of predominantly coal in power stations.

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ⁱ See <http://www.bitc.org.uk/index.html> for full details.