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Coal Fired Power Station Ash Products and EU Regulation

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ABSTRACT

The UK has a long history of the use of coal fired power station ash products in a range of applications in construction. These range from use in concrete as a cementitious material through to its use as a fill material in embankments. While there have been no environmental problems associated with these uses, environmental regulations emanating from the European Union (EU) are increasingly impacting on the use of these materials. Unfortunately it is not a single set of regulations that are being applied, but three separate and apparently disconnected initiatives; these are Registration, Evaluation and Authorisation of Chemicals (REACH), Essential Requirement 3 (ER3) and the Waste Framework Directive (WFD).

Coal fired ash products such as fly ash (FA) and furnace bottom ash (FBA) are treated by the Environment Agency (EA) for England and Wales as waste materials falling under the Waste Framework Directive (WFD). Being classified as a waste theoretically leads to a series of exemptions and licences being required before use of these materials in construction applications, involving the contractor in expense and time. In practice the EA have taken a reasonably pragmatic approach in the majority of cases, but the WFD has clearly had a negative impact on ash sales. In order to alleviate this bureaucracy the principle of defining 'end of waste' criteria was created using a document called a 'Quality Protocol' (QP) for FA and FBA. This, after many years of work, is due to be published in 2010.

While the requirements of the QP protect the environment from any perceived threat from FA and FBA, a separate regulation, REACH, was imposed against industry for all chemical products placed on the market. As the QP defined when FA and FBA cease to be wastes, they are thereafter products which have to be registered under REACH. If the QP and REACH were not sufficient protection to the environment, ER3 is being implemented through product standards, which places limit values on potentially polluting toxic compounds. Of course, the testing standards being applied for these three initiatives are potentially all very different.

The result of this tri-regulation approach within the EU is duplication and excessive bureaucracy on products that have a proven track record. While the UK government's and EU's stated aim is to encourage recycling, these various regulations will have the opposite effect.

This paper will outline the requirements of these regulations and detail some of the problems associated with compliance and the production and supply of power station ash products in the UK.

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1. Introduction

Coal fired ash products have been used in the UK since the early 1950s in a range of applications in construction. The common applications are as a cementitious material in concrete, an

aggregate for grouting, a fill material for embankments, aggregates in block manufacture etc and range through to more unexpected uses such as fillers in fire protection, rubber backed products, paints and similar. While there have been no environmental problems associated with these uses to the knowledge of the

electricity supply industry, environmental regulations emanating from the European Union (EU) are increasingly impacting on the sale and use of these materials. These initiatives are all well intentioned and aimed at protecting the environment and improving sustainability. In fact, the full use of by-product ash materials has significant potential for reducing overall CO₂ emissions by replacing virgin aggregates and by partial substitution of cement.

The European Union and UK Governments have both supported increased use of secondary and by-product materials such as fly ash (FA) and furnace bottom ash (FBA). However, environmental regulations have the potential for the opposite effect. There are three separate and apparently disconnected initiatives from the EU; these are Registration, Evaluation and Authorisation of Chemicals (REACH) (EEC 2006), Essential Requirement 3 (ER3) of the Construction Products Directive (CPD) (EEC 1988), and the revised Waste Framework Directive (WFD) (EEC2008a). These, with the problems they create, are outlined below.

2. The Waste Framework Directive (WFD)

In 1990, the UK regulations (UK 1990), revised in 1994 and 2005, were introduced enacting the original WFD (EEC 1975). As the implications of the full implementation of these regulations were understood, it was clear these were not practicable. The WFD was flawed because it failed to define clearly such terms as 'product', 'recovery', etc. This was particularly true in the UK which has a 'letter of the law' approach to the legal interpretation of regulations. EU Directives are deliberately imprecise and generic to allow member countries some flexibility in interpretation. However, this resulted in a number of European Court of Justice Cases that complicated the issue even further. In 2008, the WFD (EEC 2008a) was revised with the intention of defining 'by-products', end of waste criteria, etc, however, in reality it has only added more complication to the legal situation. What is clear in the WFD is that 'end of waste' criteria could be defined, taking a material from waste to product status. In most of the UK these criteria are contained in, as yet to be published, an Environment Agency for England and Wales document called a 'Quality Protocol' (QP). The Scottish Environment Protection Agency (SEPA) has not adopted this approach but taken a less formal 'light regulatory touch' approach to the whole issue. The QP has been in preparation since 2006 for fly ash (FA) or Pulverised Fuel Ash (PFA) as its known in the UK, and furnace bottom ash (FBA). However, discussions on such an approach have been ongoing since 2000.

The QP places some demands on the producer of FA/PFA and FBA and on the user, depending on the applications involved. The applications were split into three distinct groupings;

- Bound applications, e.g. where the FA/PFA and FBA are an integral part of an impervious material such as concrete, concrete blocks, asphalt, paints, and similar, have no specific requirements other than how the ash is produced and sold to appropriate materials standards.
- Grouting, e.g. where FA/PFA is used as an aggregate in grouting of caverns, mines, fissures, etc. For these uses a Code of Practice (CoP) has been in use for some years, produced by BRE (BRE 2006). This is being updated to reflect the requirements of the QP and will describe limitations for the ash to be compliant with the QP.

- Unbound or Fill, e.g. for land reclamation, embankments, landscaping, etc. This is considered by the EA to be the greatest risk to the environment. A continual programme of leaching assessment of the FA and FBA produced will be carried out. Whether the ash is deemed to be a non-waste depends on the maximum surface area of the contract, the leaching data from the ash and the location of the contract. For smaller contracts (<12,500m²), this will be permit straightforward automatic approval if all the criteria are met, whereas for larger contracts a web based assessment tool will be used. If this should fail the web-based Environmental Sensitivity Assessment, then a full environmental risk assessment will have to be carried out and/or engineering solutions applied to the satisfaction of the EA. An industry CoP is being produced to explain the procedures in detail.

The ash producer will have to regularly test his products for leaching potential and provide this information to the user for unbound applications. The test procedure being proposed is the Upflow Percolation Test (CEN 2004), whereas traditionally the producers have used Waste Acceptance Criteria (WAC) (EEC 1999) leaching test methods using 2 t 8:1 or 10:1 water solids ratios (BSI, 2002a & b). As a result of this difference, a series of comparisons are to be carried out on the two different test procedures and an agreed correlation arrived at.

While this system has yet to be finalised and implemented, the creation of the support documents is progressing and firm deadlines have been set. This approach should become fully operation within the UK (except Scotland) in early 2010. As ash compliant with the QP will not be classified as waste, it then becomes a product and will have to demonstrate compliance with REACH as described below.

3. Essential Requirement 3 (ER3)

The Enterprise and Industry Directorate – General (DG Enterprise), part of the EU Commission, produces Mandates from Directives which are sent to various bodies including Comité Européen de Normalisation (CEN) to prepare appropriate standards. CEN is the standardisation body for construction products, which then sets up Technical Committees (TC) to produce standards in response to the mandates.

The CPD is the EU regulation that enables harmonised products standards to be created throughout the union. The CPD contains Annex I, which lists the so called 'Essential Requirements', which are the minimum requirements that must apply to construction products. One of these is ER3;

Hygiene, health and the environment

The construction work, must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants or neighbours, in particular as a result of any of the following:

- *the giving-off of toxic gas,*
- *the presence of dangerous particles or gases in the air.*
- *the emission of dangerous radiation*
- *pollution or poisoning of the water or soil,*
- *faulty elimination of waste water, smoke, solid or liquid wastes,*
- *the presence of damp in parts of the works or on surfaces within the works.*

The requirement is applied to five specific aspects of construction;

- *Indoor environment*
- *Water supply*

- Waste water disposal
- Solid waste disposal
- Outdoor environment

NB: Noise protection is dealt with in another Interpretative Document.

The CPD has been cited in conjunction with other Directives and Mandates in various aspects of sustainability and the environment.

3.1. Construction Products Regulations (CPR)

The CPD is due to be replaced by the Construction Products Regulations (CPR) (EEC 2008b), which will require that only CE marked products be placed on the market, when an appropriate harmonised standard exists. This has not been the case in the UK in the past, CE marking was not compulsory, but this is changing under CPR where required by a standard. As a result, some practices within the ash supply industry may have to be changed. The supply of fly ash sold will have to comply with an appropriate standard. ER3, which will remain in CPR, will become compulsory.

3.2. Release of Dangerous Substances

The Release of Dangerous Substances (RDS) from construction materials is covered by mandate M366 (EEC 2005) which required the implementation of ER3. CEN formed a Technical Committee, TC351 - Assessment of release of dangerous substances and BSI created the UK mirror committee B557 in July 2005. These committees have been instructed to produce a series of harmonised standards for assessing the release of dangerous substances, e.g. test methods. To form part of CE-marking, relevant substances will have to be mandated for every construction product. Substances will be split into technical classes and assessed by either the "Without Testing (WT)", "Without Further Testing (WFT)" or Further Testing (FT) procedures with the following aspects being covered;

- Release to soil, ground water and surface water;
- Emission from construction products into indoor air and;
- Emissions of radiation.

An extensive list of proposed compounds (EU 2009) running to 36 pages of chemicals that could be analysed for has been produced. While only some of these compounds may exist in significant quantities, there will be a possible requirement for comprehensive testing of concrete. The potential for extensive and needless testing does exist. For this reason the number of interested parties and delegates involved with TC351 from industry has grown rapidly, especially as this committee covers ALL construction products. CEN TC351 meetings have approximately 60 possible delegates in attendance and this makes for difficulties in decision making. Various task groups under TC351 have been set up to look at issues of Barriers to Trade, Horizontal Test Procedures, Sampling, Content Analysis, and Validation of the resulting test methods. Work is proceeding at a rapid pace at CEN's insistence, but there are fundamental aspects to the whole issue that need resolution before the agreed test methods will become available.

Recently, TC154, the CEN committee responsible for producing standards for aggregates, has taken up the role of trying to agree practical criteria in respect of RDS into their standards. This will involve paring down the extensive list of compounds to a logical

and sensible requirement and setting out the boundaries for the testing and evaluation. However, one of the main problems with the implementation of RDS is the lack of harmonised test methods that have been properly evaluated. To avoid this, it has been proposed that the Dutch test methods should be adopted, which have been in use for a number of years. However, there are many EU standards for environmental testing, but most of these are considered inappropriate because that have not been validated, that is proven to be consistent across laboratories.

Early indications suggest RDS will mainly impact on recycled, manufactured and by-product materials, such as coal fired ash products. Natural aggregates will apparently escape unscathed, which by implication suggests there is something wrong with recycled, manufactured and by-product materials. This has not been met with any support by the producers of the latter, as one can imagine.

4. Registration, Evaluation and Authorisation of Chemicals – REACH Regulation

The European Commission put proposals forward in 2003 to develop a system of registration for chemicals which is known as Registration, Evaluation and Authorisation of Chemicals – REACH (EEC 2006). The two most important aims are to improve the protection of human health and the environment from the hazards of chemicals and to enhance the competitiveness of the EU chemicals industry.

Under REACH, the burden of proof for demonstrating the safe use of chemicals will be transferred from Member States to the producing industry. Thus, it will be up to industry to ensure that risks to human health and environment are avoided or adequately controlled. Enterprises that manufacture or import more than one metric ton of a chemical substance per year will be required to register the chemical in a central database. This database is operated by EU Chemicals Agency (ECHA) (ECHA 2009). A chemical dossier will have to be submitted by the producer/importer containing information on properties, uses and safe ways of handling the chemical being registered. This affects about 30,000 differing producers involving some 100,000 chemical substances. The costs to industry is estimated as being €2.8 to 5.2 billion.

4.1. The scope and responsibilities of REACH

The primary responsibility under REACH falls on the manufacturers of individual chemical substances involved and not on the concrete producer. The REACH text gives the following specific exemptions from registration;

The following substances which occur in nature, if they are not chemically modified. Minerals, ores, ore concentrates, cement clinker, natural gas, liquefied petroleum gas, natural gas condensate, process gases and components thereof, crude oil, coal, coke.

For example natural aggregates, because they occur in nature as minerals are exempt. In addition, materials that are classified as 'wastes' under the Waste Framework Directive are also exempt from registration. However, where a product ceases to be a waste, it then becomes a product and has to be registered under REACH.

4.2 Registration

There was a pre-registration phase where all materials had to be pre-registered by 1 December 2008. This attracted 1082 registrants for FA and FBA throughout the EU. Thereafter the European Ash Association (ECOBA) (ECOBA 2009) brought together a Supplier Information Exchange Forum (SIEF) in which the various producers work together to create a 'Chemical Dossier' which will be used for full registration, which has to take place by 1 December 2010. The information in the chemical dossier will have to provide evidence demonstrating the safe use of the substance.

Producers and importers are required to collect and submit data to ECHA on the hazardous properties of all substances (except Polymers and non-isolated intermediates) manufactured or imported into the EU in quantities above 1 metric ton per year. In addition, risk assessments and control measures documents will have to be produced for downstream users. This information is to be contained in a chemical Safety Report and Safety Data Sheets (SDS).

5. An Overview of EU Environmental Legislation affecting ash products

As will be observed, there are three separate sets of regulation impacting on the sale of ash products. These have arisen at differing times and from differing directions, but they have very similar aims – protecting the environment from the perceived contamination caused by such products. What is of greatest concern is the apparent lack of a co-ordinated approach and the large number and types of test methods that may be required? However, whether all this testing will protect the environment from something that, if sensibly used, has never caused any pollution is doubtful. The considerable majority of environmental incidents in the UK have stemmed from those carrying out reckless and/or illegal activities and not from responsible industries doing their best to reduce the landfill of a useful material.

As ash products are often competing with naturally occurring aggregates, the latter seem to have few requirements under ER3 and REACH and of course not involved with any QP. It is well known that natural aggregates can contain toxic chemicals, such as arsenic, asbestos, etc as they are naturally occurring materials and yet they appear to have few environmental requirements being applied. It seems that while the EU Commission and UK Governments both profess to promote recycling and the use of secondary and by-products materials, the legislative burden they are producing is actively discouraging the use of by-product materials like ash.

It is clear there needs to be a review at the highest level within the EU of the regulations being enacted. This needs to consider the ever increasing burden being applied to industry and to remove the duplication of requirements covering similar areas of environmental protection. Critical to this is the production of harmonised, validated test methods that can be used with confidence throughout the EU for a wide range of materials, whether natural, recycled or by-product.

6. Conclusions

There is a plethora of initiatives in existence aimed at reducing the potential environmental impact of materials. REACH and ER3

seem to duplicate the essential aims in controlling the use of potentially dangerous chemicals from reaching the environment from construction products. The QP approach plays a similar role for 'wastes', such as recycled and by-product materials. However, there is no apparent co-ordination of these approaches and much bureaucratic duplication will result in great expense, duplication, time and effort in ensuring compliance. Nevertheless, there is apparently no attempt within the EU to harmonise test methods across REACH or ER3, or to consolidate and/or rationalise legislation.

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