

Pulverised Fuel Ash – an issue of definition?

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ABSTRACT

Within the United Kingdom, European Union (EU) legislation is having an increasing effect on the way of working within industry. Such legislation affects all aspects of life ranging from health and safety, dangerous substances, specification, production, emissions to the atmosphere, etc.

European harmonization of material standards has brought many advantages in simplifying and broadening the applications that can use fly ash, more commonly known as Pulverised Fuel Ash (PFA) in the UK. Work creating these product standards has progressed producing documents that are acceptable throughout the EU. As a result, PFA can now be used as an aggregate, as a cementitious material counting fully or partially towards the cement content in concrete, as a road construction material, as a fill material, etc. This has been advantageous to the PFA industry. However, membership of the European Union (EU) has not been all beneficial.

Laws within the EU result from 'Directives' produced by the European Commission. Directives instruct the member countries in the scope and basic requirements of National laws that should be adopted; these are subsequently refined by legal judgments from the European Court of Justice. Some of these directives can have a direct or indirect impact on the use of many materials in the construction industry. The EU Waste Directive is one such document which has led to a considerable number of problems, especially within the UK. The wording of the Waste Directive has been interpreted differently within EU countries with the UK interpretation resulting in a particularly complex regulatory system affecting many well established construction materials, including PFA.

This paper will review both the beneficial and detrimental legislation being applied in the UK and the future of power station ash as we see it.

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INTRODUCTION

The United Kingdom has a long history of independence and as a country is used to legislating and producing standards, codes and advisory documents for use in construction. The UK legal system interprets laws in a very simple, but exacting way, which is to the 'letter of the law' and it is treated as being binding. The wording of laws and regulations are therefore critical in the interpretation and their full enactment. However, in recent years the UK's ever closer ties with the European Union have led to more and more regulation emanating from the European Commission and Parliament rather than the UK government. Some of these directives are having and will have an increasing and considerable effect on the working practices of the UK construction industry.

EUROPEAN DIRECTIVES

The European Commission has the task of administering the requirements of the European Union. It has the power to propose new law to the European Parliament and the Council of the EU. When these bodies reach an agreement the member states are obliged to implement the law. Figure 1 shows this schematically.

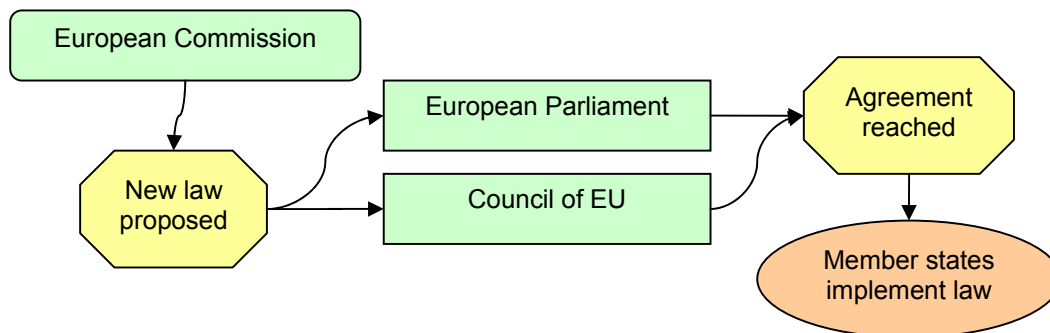


Figure 1 – The process of creating EU law.

There are four levels of EU law:

- **Regulations:** These come into effect as soon as they are passed at the European level and no National legislation is required. They tend to be initiated by the Commission and normally specific to adjusting EU law.
- **Directives:** EU Directives bind all Member states to an overall objective, but leave the question as to how to achieve this to National legislation. Some countries, like the UK treat and enact Directives in a very precise way and implement them to the letter, called gold plating, whereas other countries may have very differing interpretations that may even require no action on their part!

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- **Decisions:** These can be addressed to a country, a company or even an individual and are binding on them.
- **Recommendations and opinions:** These are not legally binding.

Directives form the main basis of the law affecting the Construction industry. To enact these Directives member states are called upon to create the product standards needed. The primary aim is to remove technical barriers to trade by creating harmonised standards that everyone can agree on.

The Construction Products Standards Directive¹ (CPD) is responsible for creating many hundreds of standards over the last 15+ years. The task is run for the industry by CEN (European Committee for Standardization)² which has;

- 28 National Members and the representative expertise they assemble from each country. These members, chosen from the British Standards Mirror Committees in the UK, vote for and implement European Standards;
- 8 Associate Members and two Counsellors;
- The CEN Management Centre, Brussels.

The construction sector is strategically important for Europe providing building and infrastructure on which all sectors of the economy depend. With 11.8 million operatives directly employed in the sector, it is Europe's largest industrial employer accounting for 7% of total employment and 28% of industrial employment in the EU-15. It is estimated that 26 million workers in the EU-15 depend in one way or another on the construction sector. About €910 billion was invested in construction in 2003, representing 10% of the GDP and 51.2% of the Gross Fixed Capital Formation of the EU-15. The standards affecting PFA are reviewed as follows.

SPECIFICATIONS, CODES AND PRODUCT STANDARDS

One issue with PFA is whether it is a 'waste' or a 'product'? However, there are numerous Euro Norm (EN) product standards that control the use of PFA as a product in a range of applications throughout the EU. Each EU member country publishes the EN under their own National standards programme, for example in the UK all standards are published as BS EN's. However, a National standards body is not allowed to change the wording within the EN in any way, even spelling errors are retained. A National Foreword and an Annex are permitted, but these must not contradict or impose additional requirements over those within the EN. As such the foreword and annexes are simply advisory or 'informative' sections. At the time of writing this paper there are the following BS EN's applicable to PFA from coal fired power stations:

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- BS EN 14227-1 - Hydraulically bound mixtures. Specifications. Cement bound granular mixtures.
- BS EN 14227-3 - Hydraulically bound mixtures-Specifications – Part 3 Fly ash bound mixtures.
- BS EN 14227-4 - Hydraulically bound mixtures. Specifications. Fly ash for hydraulically bound mixtures to BS EN14227-3.
- BS EN 14277-5 - Hydraulically bound mixtures. Specifications. Hydraulic road binder bound mixtures.
- BS EN12620 – Aggregates for concrete
- BS EN450 Parts 1 & 2 – Fly ash for concrete.
- BS EN197-1 – Cement. Composition, specifications and conformity criteria for common cements.
- BS EN 14216 - Cement. Composition, specifications and conformity criteria for very low heat special cements.
- BS EN 998-1 - Specification for mortar for masonry. Rendering and plastering mortar.
- BS EN 998-2 - Specification for mortar for masonry. Masonry mortar.

Under EU law an EN standard takes precedent over National standards if it is a 'harmonised standard'. A harmonised standard is produced with the intention of being appropriate throughout the entire EU. Often they are second generation standards created when voluntary standard is revised. It is for this reason any conflicting standards have to be withdrawn. This has to take place typically within 6 to 12 months of the publication of the EN. As new standards are being published various National specification documents have to be revised accordingly to prevent conflicts. One such document is The Specification for Highway Works published by the UK Highway Agency.

There are some standards that are not harmonised such as:

- BS EN206-1 Concrete. Specification, performance, production and conformity. This standard is NOT harmonized, so there are the following national documents that give details:
 - BS8500-1: Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier.
 - BS8500-2: Concrete. Complementary British Standard to BS EN 206-1. Specification for constituent materials and concrete.

BS EN206-1 is not harmonised because it has proven impossible to reach an EU wide agreement for producing concrete, specifically relating to issues with site-

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batched concrete and quality assurance. As a result EN206-1 has not been published in at least one EU country and/or is little used in others.

The above standards and codes have been written by a system of National sub-committees reporting to CEN committee for each standard or group of standards. Typically a CEN committee will meet at least once a year and the views of the National committees discussed and the text of a standard revised until an agreement is reached. Though these committees nowadays always work in English, there are some 20 official languages within the EU. Interpretation and application of text has to be carefully worked through, so the various versions of the standards do not change interpretation when translated. Though a slow process, eventually a consensus is reached and the standard is published. Thereafter standards are revised at 5 yearly intervals by the same process.

This process can take a considerable amount of time. The first harmonised standard produced for common cements took some 20+ years to complete. However, thereafter other committees tend to use the completed standard as a template, which considerably speeds up the process. For example the revision of EN450 'Fly ash for concrete' took 5 years to complete, yet the standard for Ground Granulated Blast-furnace Slag uses a similar format and structure and took only 2 years.

The revised version of EN450-1 was published in May 2005. This standard is probably the most complex PFA standard in the world. It covers the requirements for PFA for use in concrete and details rules for co-combustion ashes as well as coal PFA. Co-combustion is where small proportions of secondary fuels are combusted in conjunction with the coal that would not have any detrimental effect on the properties of the resulting PFA. The scope of the standard is such that it can be used throughout Europe allowing for everyone's needs. Many other standards have proven to be highly flexible and workable, though there are some that leave a great deal to be desired. However, any problems can be resolved during the 5 year revision stage.

In addition to the various ENs there are numerous British product standards specifically relating to PFA as a product as follows;

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- BS 3892-1:1997 Pulverized-fuel ash. Specification for pulverized-fuel ash for use with Portland cement^a
- BS 3892-2:1996 Pulverized-fuel ash. Specification for pulverized-fuel ash to be used as a Type I addition
- BS 3892-3:1997 Pulverized-fuel ash. Specification for pulverized-fuel ash for use in cementitious grouts
- Specification for Highway Works – various categories of fill

In general the process of producing harmonised EN standards has proven successful in producing standards that are fully accepted by all the countries involved and truly harmonised throughout the EU. For example, the cement standard, EN197-1, has been used for a number of years and now fully accepted within the construction industry. It has proven to be a flexible standard and yet gives the consumer the confidence in the product.

While the standardisation process has, in the main, been very successful, there is another route by which legislation can be enacted upon the construction industry. This is through the direct application of European Directives to industry.

THE EUROPEAN DIRECTIVES SPECIFICALLY AFFECTING PFA

Initially European Directives were overarching documents that gave instructions to various bodies, such as the CPD to CEN requiring them to produce standards for construction. However, in recent years these directives have become more specific and directly impinging on the construction industry. These directives have not been subject to the consideration of the experts within the fields involved. As a result their interpretation and implementation is proving highly problematical and expensive to industry, especially with the UK approach to their interpretation. The following are examples of poorly thought out legislation:

THE WASTE FRAMEWORK DIRECTIVE

Since the introduction of PFA, well in excess of 50 million tonnes of power station ash products have been used in a wide variety of applications in the UK³. To our knowledge there has been no recorded incident of significant environmental pollution due to use of these products, and yet they are under threat on environmental legislative grounds.

The legislation that potentially affects PFA and numerous other by-product materials stems from the EU "The Waste Framework Directive (75/442/EEC as amended by 91/156/EEC)" (WFD). This directive was enforced in England and

^a This standard will be withdrawn in February 2006 as it is replaced by BS EN450-1:2005

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Wales by the Environmental Protection Act of 1990. A series of exemptions were permitted under resulting legislation, The Waste Management License (WML) regulations, which were produced in 1994 and are interpreted using DOE Circular 11/94⁴. These have been partially modified recently⁵ and now incorporate charging and amending the list of exemptions to waste management licensing to prevent abuses.

The overarching aims of the EU Waste Framework Directive are as follows:

- **Waste Management Hierarchy.** Waste management strategies must aim primarily to prevent the generation of waste and to reduce its harmfulness. Where this is not possible, waste materials should be reused, recycled or recovered, or used as a source of energy. As a final resort, waste should be disposed of safely (e.g. by incineration or in landfill sites).
- **Self-Sufficiency at Community and, if possible, at Member State level.** Member states need to establish, in co-operation with other Member States, an integrated and adequate network of waste disposal facilities.
- **Best Available Technique Not Entailing Excessive Cost (BATNEEC).** Emissions from installations to the environment should be reduced as much as possible and in the most economically efficient way.
- **Proximity.** Wastes should be disposed of as close to the source as possible.
- **Producer Responsibility.** Economic operators, and particularly manufacturers of products, have to be involved in the objective to close the life cycle of substances, components and products from their production throughout their useful life until they become a waste.

The aims of the directive are very laudable and fully supported by most. However, the same directive does seem to have created a situation that has in fact reduced '*re-use, recycling and recovery*' simply because these terms are ill defined both in the mind of the producers, end users and regulators. While various bodies have asked for clarification, to date little has happened that gives the producer or user any confidence the aims are achievable. In fact the directive is in danger of having the opposite effect – to reduce the existing of use of by-products and suppress the development of new means of recovery and recycling. The problem is outlined as follows.

The definition of waste used in the EU Waste Framework Directive is:

- 'Waste' means any substance or object which the holder disposes of or is required to dispose of.
- 'disposal' means :
 - The collection, sorting, transport and treatment of waste as well as its storage and tipping above or below ground.

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- The transformation operations necessary for its re-use, recovery or recycling.

This definition is satisfactory in itself but the directive fails to define such terms as by-product, recovery, product, etc. Therefore, even materials that are being sold for useful applications, such as PFA, blast furnace slag, etc are classified as wastes and technically require licensing in order to permit their use. Obtaining 'Waste Management Licences' (WML) in the UK is a complex procedure and primarily designed to control waste disposal sites. As one would expect they require trained personnel, complex control procedures, etc – in fact the bureaucracy expected for running a waste disposal site. Applying this bureaucracy to by-products, when naturally occurring alternatives have no such burden, leads to a situation where the by-product is seriously disadvantaged.

It is clear at some point a waste, when used in a construction application, must become a product that is it is said to be 'recovered'. Much of the case law emanating from the European Court of Justice (ECJ) resulting from the Waste Framework Directive revolves about when a 'waste' is or is not recovered! Case law has generally supported the definition given within the Waste Framework Directive, but the ECJ has broadly failed to clarify the missing definitions. Some of the decisions resulting are difficult to understand by the regulator, the Environment Agency (EA), and industry.

As a result of the uncertainty created by the WFD and subsequent case law, the UK Environment Agency (EA) has stated that there is doubt as to the validity of much DOE 11/94. Therefore, they have been forced to take the view that a by-product such as PFA are 'wastes', requiring either an exemption certificate or WML and the associated bureaucracy prior to use. In addition, the EA take the strict legal interpretative view that the waste only ceases to be a waste when it is incorporated into the final product, for example in the case of PFA grouts when the material sets. This leads to grouted caverns being classified as landfill sites until the WML is handed back. So far, except for the largest of contracts, most grouting contractors and councils wish to avoid the bureaucracy of obtaining the WML and the stigma associated with using 'wastes' in land remediation. As a result they opt for using natural sand, increasing the environmental impact considerably.

The poor drafting of the Waste Framework Directive and subsequent case law has made life unnecessarily difficult for both industry and the EA. Discussions between the electricity supply industry and the EA have explored many options including the use of quality protocols, as pioneered by the Waste & Resources Action Programme (WRAP). However, apparently due to legal advice the EA have been forced to reject such protocols for PFA as a possible solution.

The ash industry sees the only hope is with the EU through the 'Thematic Strategy Review on Prevention and Recycling of Waste' that will produce

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guidance on its interpretation. It is our understanding⁶ that the EU proposals, due to be published in July 2005, will be;

- To produce legally binding guidelines that wastes/residues/by-products would no longer be classified as waste once they meet the technical and mechanical requirement in the product standards of the materials they are replacing.
- This means that PFA would no longer be classified as wastes if they meet technical requirements of a standard, such as BS EN450-1 "Fly Ash for Concrete".

This approach is in line with quality protocol approach suggested in discussions with the EA.

OTHER DIRECTIVES

There are other examples of Directives affecting products placed on the market that have been ill-conceived or poorly worded, that theoretically have the potential of a supplier ending up in court.

While the Waste framework Directive is a rather complex situation with many legal aspects to it, the situation with the so-called 'Chromium VI'⁷ directive is substantially more simple, but equally problematical. This is designed to reduce the incidence of CrVI dermatitis, setting limits for "cements and cement containing preparations". Again the problems revolve around poor wording that is open to misinterpretation and is not understood by anyone in Europe.

Other examples of directives destined to cause problems are;

- 'Persistent Organic Pollutants' directive⁸ states that products cannot be placed on the market containing certain chemicals, such as dioxins and furans. However, PFA contains a finite, though very small (<3 ng/kg TEQ⁹), amount of dioxins and furans and some food products can contain higher amounts, such as cod liver oil capsules (1.9 to 46 ng/kg TEQ¹⁰). Can these be placed on the market?
- 'Registration, Evaluation, Authorisation and restriction of Chemicals (REACH)' directive¹¹ and the extent this affects materials not normally considered as 'chemicals'. Again there are massive bureaucracy and interpretation issues that must be resolved.

This poor legislation results in various bodies lobbying and applying pressure to the UK and EU regulators and politicians. However, they are equally finding it hard to comply as some of the biggest fines are against EU members through the European Court of Justice for failure to implement directives, no matter how poorly worded.

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THE FUTURE FOR COAL FIRED POWER STATION ASH PRODUCTS

At this time the ash industry has reluctantly been forced to accept the mantle that coal fired power stations products are wastes on a legal basis. However, the EU thematic strategy review may now re-dress the problems. However, the blight of being a 'waste' has already reduced usage as many grouting contracts have declined from applying for Waste Management Licenses and simply reverted to using sand! It is estimated some 100,000 tonnes of PFA has been lost to grouting contracts in 2003/4!

All these issues raised by the various directives take time to resolve and reduce the effectiveness of bodies who are supposed to be promoting the use of these products, rather than fighting regulators, politicians and civil servants. As a minimum they introduce another layer of bureaucracy to industry that does not benefit the product, the environment or the public.

CONCLUSIONS

The European Union has produced many codes and standards that have been helpful to the PFA industry and these are generally well written. There is a degree of 'Euro' speak in these documents, but in most cases they are sufficiently refined by the experts involved in order to successfully replace National Standards. They have been accepted in most European countries without problems and been beneficial to all sides of industry. It is clear that PFA is considered a product within the standards.

Conversely, more recent trends have been to produce EU Directives that impinge on industry directly. In many cases these documents are poorly thought through and open to differing interpretations, leading to confusion to the suppliers, the construction industry and the regulators who are supposed to enact these laws.

The EU has begun to recognise there is a problem with the complexity with some directives and initiated reviews where they feel appropriate. One such is the 'Thematic Strategy Review on Prevention and Recycling of Waste'. However, this process is in itself is bureaucratic and carried out in a somewhat secretive manner. In the meantime producers, contractors and regulators will continue are being taken to the ECJ after falling fowl of poorly drafted directives.

What are the solutions to these problems? I believe;

1. The EU commission should be required to consult more effectively with the experts involved within the industries affected, e.g. the power and construction industries for PFA, perhaps through the appropriate CEN Technical committee.
2. The commission should recognise that some countries adopt a very exact interpretation of the wording of these documents, so called gold plating,

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and the wording must be sufficiently thought through and robust to prevent misinterpretations.

3. That there should be another EU body other than the European Court of Justice that can resolve and interpret directives. For every badly written directive that ends up in the EU court for interpretation, results in gain for nobody other than the legal profession. The timescales to bring an ECJ case are protracted and costs can easily involve many millions of Euros.

While there have been benefits from the EU, there is a need to improve the method of producing directives and the consistency of interpretation throughout the member states. Additionally, the increased bureaucracy is reducing competitiveness of the EU.

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