



Energeia

European Legislation in the United Kingdom

A Threat to Coal-Fired Power Station Product Utilization?

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The United Kingdom has been using coal fired power station ash products in construction applications for many years. During that period utilization has reached 100 percent of bottom ash and approximately 50 percent of fly ash, based on 2003 data. In the main, these materials have not been considered as wastes, but as products in their own right. They have been seen as being particularly suited for the applications, often imparting considerable technical and environmental benefits. The European Union (EU) has not taken the common sense approach as adopted within the USA of C2P2, where the environmental regulators are keen to promote the use of by-product and recycled materials where appropriate. As members of the EU, the United Kingdom has seen, with some dismay, the effects EU legislation is having on the ash industry. This article outlines only some of the problems that we are tackling.

EU DIRECTIVES - THE ROUTE TO COMMON LEGISLATION ACROSS EUROPE?

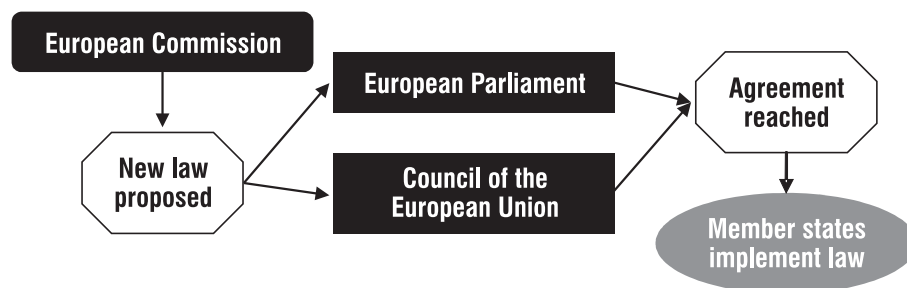
The European Commission has the task of producing legislation for approval



by both the European Parliament and the Council of the EU. Once a law is agreed upon, a Directive is issued, which directs the member states to enact laws in their own countries taking into account the requirements of the directive. Should a member state fail to enact appropriate laws, there are provisions within the European Court of Justice to apply fines to the offending member states. These fines can be very high — into millions of Euros per day. This puts the lawmakers and regulators under a great deal of pressure to respond fully to a

directive and sometimes they would appear to create a bureaucratic nightmare for industry.

In recent years, much of this legislation has had an increasing environmental tone to it. However, directives are not written by technical experts and also are the product of the needs of differing EU languages. The result is often that they are difficult to interpret and fail to define critical aspects of the problem they are trying to address. One such example is the Waste Framework Directive (WFD).



European Legislation in the United Kingdom, (cont.)

The overarching aims of the WFD 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 will reduce 're-use, recycling and recovery' and innovation in new ways of recovering and recycling materials, 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.

This definition of waste is accepted by most as being satisfactory in the WFD. Nevertheless the directive fails in that it does not define such terms as by-product, recovery, product, etc. The

lack of a definition of recovery, e.g. when a waste ceases to be a waste and becomes a product, has the most marked effect on such products. Therefore, even materials that are being sold for useful applications, such as fly ash, blast furnace slag, etc., are classified as wastes until they are incorporated into the final product. This means that coal ash normally requires licensing or exemption permits in order for the construction industry to use them. Obtaining 'Waste Management Licenses' in the United Kingdom 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. Whilst there are some exemptions permitted to waste management licenses, these are for very specific applications. For other applications there are no exceptions within the legislation to allow the regulator to take a less burdensome approach with by-products. 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. However, it is noted that the EU has recognized that the WFD is flawed and requires some form of guidance document.

The guidance document is called the 'Thematic Strategy Review on Prevention and Recycling of Waste' and was finally published in December 2005 after a long delay. The document states:

- 1) ... Therefore, an amendment to the Directive is proposed which would establish waste-stream-based environmental criteria to determine when a waste ceases to be a waste...
- 2) ... Additionally, the Commission will publish a Commission Communication containing guidelines, based on the jurisprudence of the European Court of Justice and addressing the issues of by-products in relevant industry sectors, on when by-products should or should not be considered as waste in order to clarify the legal situation for economic operators and competent authorities...

This implies that coal fly ashes would no longer be classified as wastes if they meet certain environmental requirements. So would this appear to be the immediate answer to this problem? Not so – for the Directive has to be amended and the environmental requirements have to go before 'comitology,' a process of discussion and agreement by the EU regulators. They will effectively decide what criteria will be set to decide whether a material is a waste, a by-product, recovered from being a waste, etc. The Commission guidelines will eventually be forthcoming to complete the picture, but on what timescale? This may take months or even years before being finalized and there is a danger that yet another highly bureaucratic system will be evolved. So what happens in the meantime?

Current environmental legislation applicable in the EU always takes precedence, even when it is known that an area of law is under review. This is to prevent the unscrupulous from appealing against some part of the environmental law and continuing to irrevocably destroy the environment while the appeal process is completed. The result of this is that users of ash products are technically obliged to comply with various requirements, such as applying for exemptions, waste management licenses (WML), etc., all of which are slow and time consuming and some very expensive. For example, a WML costs £13,000 to £20,000. The results of this bureaucracy are additional costs, lost construction time and contractor frustration. Often the contractor will opt for the simpler solution – use natural aggregates over which the Environment Agency has no jurisdiction. An alternative approach has been for the contractor simply not to declare that he is using ash in his project!

This less than satisfactory situation is not unique to coal fired power station ash products. Many by-products and recycled products are in the same situation purely because the original European Directive and subsequent national laws are ill thought out. However, in the interim the big danger to these products is that they will lose markets to natural materials while this bureaucratic mess is sorted out. The result will be less recycling and use of ash in construction!

OTHER ISSUES

One would have expected that one such EU Directive causing serious problems would be enough. However, the EU does produce large numbers of

European Legislation in the United Kingdom, (cont.)

directives. For example, there are 58 directives relating to agricultural tractors. The following are some of the ones currently affecting the operation of coal fired power stations:

- ▶ Integrated Pollution Prevention and Control (IPPC) Directive
- ▶ Waste Incineration Directive (WID)
- ▶ Habitats Directive
- ▶ Large Combustion Plant Directive (LCPD)
- ▶ Emissions Trading Scheme
- ▶ Chromium VI directive
- ▶ Regulated Dangerous Substances (RDS) Directive
- ▶ Persistent Organic Pollutants directive
- ▶ Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) Directive

Coupled with the sheer number of directives, when the United Kingdom's government adopts these directives, the legal system tends to interpret the wording of a directive very precisely. Many of these directives are imprecise and contain English that is open to differing interpretations. This often results in complex and bureaucratic regulation involving a great deal of work for industry and often to legal challenges through the European Court of Justice. The EU court decisions, in the main, only cause further confusion. The overall result is years of frustration, delays and confusion to the ash supplier and the contractor - often with no benefits being found to either the environment, sustainability, industry, etc., or markets for ash.

CONCLUSION

The EU law-making process has failed Europe by creating a bureaucratic and complex system. While these problems are being addressed, in the interim industry is struggling to comply with and understand the purpose

of all the paperwork. Perhaps we are in this situation because nowadays we have professional politicians and bureaucrats with little experience of the industries that make an economy work?

It is clear the coal fired power station ash industry is one of these industries whose markets are suffering. We hope it will not be too long until some common sense prevails again in the EU, preferably before our international ash conference called AshTech 2006, which is due to be held on 15 - 17 May 2006 in Birmingham, United Kingdom - see www.ashtech2006.org.

In 1997 Dr. Sear joined the newly formed United Kingdom Quality Ash Association and has been working since to promote the interests of coal-fired power station operators as UKQAA Technical Officer. He received his Ph.D., from the University of Wolverhampton. He may be reached at: lkasear@ukqaa.org.uk.



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happening at . . .**

www.worldofcoalah.org

WOCA is a conference that combines the previous international symposia of the **American Coal Ash Association** and **Center for Applied Energy Research**. It will focus on the science, applications and sustainability of coal ash worldwide. It is planned to encompass all aspects of coal combustion products (CCP's) as well as gasification products.

The meeting will be held May 7-10th at the Northern Kentucky Convention Center, which is located across the river from Cincinnati!

For more information, email:

wocainfo@aca-usa.org or
wocainfo@caer.uky.edu

PRESS COVERAGE

From Nanotubes to Slag: CAER Research Featured in the Media



Rodney Andrews

CAER Associate Director of Carbon Materials, Rodney Andrews and Dept. of Chemical and Materials Engineering Associate Professor, Bruce Hinds, have been in the headlines quite a bit lately.

After the article that they co-authored with Mainak Majumder and Nitin Chopra appeared in the November issue of *Nature*, their work was featured by the local newspaper and as the university's public radio station. While these media outlets may sound provincial to some, they represent the seldom-seen crossover from academic accolades to public recognition, which doesn't happen often. The article is entitled "Nanoscale Hydrodynamics: Enhanced Flow in Carbon Nanotubes."

What is causing all the interest is that in this article, the group describes a way for fluids to pass through membranes made of nanotubes — at rates 10,000 to 100,000 times faster than conventional wisdom predicted. The finding adds weight to the idea that nanotube membranes could be used to

form fast, highly-efficient filters used in everything from military uniforms to drugs to food. The rapid-flow effect had been theorized, but the University of Kentucky group is the first to confirm it.

According to Hinds, liquids can zip through the membranes because the arrangement of carbon atoms in nanotubes provides a "flat" surface that is "nearly friction free."

This finding implies that nanotube membranes could be used as filters that could be "set" to let some materials pass through, while keeping others out. It also could be possible to electrically open or close the tubes, letting materials pass only when desired. The applications for these membranes are numerous.

This exciting endeavor is another example of teamwork between the Center for Applied Energy Research and its on-campus counterparts.



Jack Groppo

The work of Jack Groppo, a mining engineer and long-time CAER researcher, has been included in an article from the November/December 2005 issue of *Power Magazine*. The piece is entitled "Making IGCC Slag Valuable," and is about Charah Inc.'s processing system that separates unburned carbon from IGCC slag. The process is used at Tampa Electric's Polk Station. Jack and other ECT group members performed collaborative research with Charah on this project.

Research Directions in Coal Combustion Product Science and Engineering

Jim Hower
UK Center for Applied Energy Research
Jimmy Knowles
The SEFA Group

At the meeting of the Technical Research Committee at the summer 2004 meeting of the American Coal Ash Association in Detroit, we solicited opinions on the needed directions of research in support of the coal combustion product (CCP) industry. Not surprisingly, the meeting's attendees expressed the view that research needs are largely a response to the need to respond to evolving environmental standards, unintended consequences of the Clean Air Act. Since that time, the US EPA has promulgated the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR), both of which will impact all utilities, with the CAIR being of particular importance for utilities in the eastern US.

An area of significant growth in CCP utilization in the past decade has been the expansion of the use of flue-gas desulfurization (FGD) gypsum in wallboard manufacturing. The percentage of FGD gypsum used in the US wallboard industry is approaching 30%, and growing every year. Considering the need to remove more mercury from the flue gas stream, will that percentage be jeopardized if scrubbers are tuned to remove even more Mercury? Potential problems are being investigated. For example, NETL has contracted with US Gypsum in an investigation of Mercury volatilization in the calcination and drying phases of wallboard manufacture. The disposal of wallboard in landfills is also a concern, both for volatilization and leaching at atmospheric conditions as well as for the potential for microbial mobilization of Mercury. In any case, even if there is not a problem with Mercury release, the perception of the construction use of or the disposal of a Mercury-bearing material may be a public-relations barrier for expanded FGD gypsum utilization.

In any case, the production of FGD gypsum is expanding, potentially doubling by 2010. What will be done with all of the gypsum? While there is

a practical limit to the need for wallboard, there still exists the potential for growth in the market for synthetic (FGD-derived) gypsum. Currently, 12 of the approximately 60 wallboard plants in the US were built exclusively for synthetic gypsum. Many of the remaining plants are aging, and the possibility exists that they could eventually be replaced by new or upgraded plants designed for the use of synthetic gypsum. Location is a potential problem due to the economics of FGD gypsum transport. Therefore, some markets, for example on the west coast, could be more economically served by mined gypsum. Expansion of the synthetic gypsum market could be provided by enhanced use of wallboard in remodeling in place of new development. Additional markets for synthetic gypsum are in cement manufacture and in agriculture. The latter market, in particular, will demand attention to the amount of Mercury in the CCP. Added units in the near term will include spray dryer and circulating fluidized-bed combustion, bringing materials less familiar to current markets into wider production, and potentially wider re-use.

The "blue plume" of SO_3 emissions, a consequence of SCR oxidation of SO_2 , from power plants can be mitigated with lime, sodium-carbonate, ammonia, or MgO injection. Sodium harms the pozzolonic activity of class F fly ash. In addition, the enhanced levels of the alkali increase the potential for alkali-silicate reaction in concrete.

The use of higher- and lower-sulfur coal blends to meet emission standards can lead to inconsistency in fly ashes. Varying amounts of higher-calcium subbituminous coals with high-iron (high-S) coals can swing the fly ash between the extremes of class C and class F. This can happen over the course of a shift if the percentage of coal types in a bunker changes. It can also be a seasonal problem if the high moisture of a

subbituminous coal mitigates its use in the winter months. In either case, the customer is not going to see a consistent fly ash quality.

The use of non-coal fuels in co-combustion can also cause problems. For example, the combustion of petroleum coke can result in significant additions of carbon to the fly ash. The pet coke-derived carbon, however, may not have the same absorptive properties as coal-derived carbon, generating misleading predictions of behavior with air-entraining agents. The chemistry of non-coal fuels is also a potential topic of research. For example, petroleum coke adds significant amounts of vanadium and nickel to fly ash and tire-derived fuel contributes zinc from both the rubber and the wire in the belt.

Overall, carbon on fly ash continues to be a problem. Installation of low- NO_x burners took considerable amounts of ash off the market. Not all carbons are equal with respect to air entrainment. While there may be structural problems inherent in the use of high-LOI ash, careful examination of the properties of fly ash carbons could have the potential of widening the range of useable ashes, provided regulatory agencies and Ready-Mix suppliers could be convinced of the worth of the material.

With continued growth of coal combustion, the addition of non-coal fuels into combustion blends, and the continuing evolution of environmental standards, we anticipate no shortage of research topics of vital interest to the CCP community.

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