

The Environmental Status of Ferrous Slag in the UK

Nick Jones & Dr. Nizar Ghazireh

- Early 90's EA had concerns regarding Sulphide leaching from air-cooled blast furnace slag
- Minor pollution incidences from old BFS many years ago
- Modern slags have lower S contents
- MPA (then QPA) joined forces with the Environment Agency (then National River Authority) to produce a joint guidance document for the use of BFS in unbound applications

First Air-Cooled Blast Furnace Slag Guidance Document



THE USE OF AIR COOLED BLASTFURNACE
 SLAG AS AN UNBOUND AGGREGATE IN THE
 CONSTRUCTION INDUSTRY

**BACMI / ENVIRONMENT
 AGENCY JOINT
 GUIDELINES**

These guidance notes have been jointly prepared by the British Aggregate Construction Materials Industry and the Environment Agency. The document sets out clear and simple guidance which if followed will minimise the risk of water pollution.

1. INTRODUCTION

Air cooled blastfurnace slag is a by-product of the iron making process. It consists primarily of the silicates and aluminosilicates of calcium and magnesium together with compounds of sulphur, iron, manganese and other trace elements. The solidified slag is usually processed by crushing and screening, then placed in stockpiles prior to use.

In the UK many tens of millions of tonnes of unbound blastfurnace slag have been used in construction projects without any known environment impact and the use of slag as a construction material is regulated by BS 1047. The standard recognises potential for water pollution from sulphur species unless appropriate measures as described below are taken. Concerns about water pollution largely only apply when slag is used as a bulk fill in water logged or poorly drained areas. However, slag is used for a variety of other purposes and good engineering design, appropriate selection of materials and adherence to the specific guidance given below will minimise the risk of pollution.

2. THE ENVIRONMENT AGENCY APPROACH

The Agency recognises that blastfurnace slag can be used as a construction material in many situations without causing water pollution. The Agency is fully aware that blastfurnace slag is a by-product of an industrial process and if not used in the construction industry would have to be disposed of to landfill, with the associated potential to cause water pollution. The Agency approach to the use of blastfurnace slag is to fully accept its use in appropriate circumstances according to the guidelines so as to provide adequate protection to the aquatic environment.

3. SLAG AND THE WATER ENVIRONMENT

BS 1047 recognises that under specific ground conditions such as poorly drained soils, bacterial or chemical action on slag and leachate can give rise to sulphides and other compounds that can be harmful if they enter the water environment. The guidance provided below has been designed to prevent such problems arising.

4. SPECIFIC GUIDANCE

- (i) Materials stored in exposed stockpiles should be utilised in preference to freshly made slag.
- (ii) Unbound blastfurnace slag should not be used in water logged or poorly drained areas.
- (iii) Unbound blastfurnace slag should not be used below the water table.
- (iv) Where unbound slag is used in the construction of large exposed trafficked areas such as vehicle parks and major carriageways good practice, e.g. compaction and avoidance on ponding, should be followed to minimise ingress of water.
- (v) Situations where the use of large quantities of unbound blastfurnace slag could give rise to water pollution should be identified at the materials selection stage of the construction project and a method statement produced setting out details of how the slag will be stored and handled and the measures taken to protect the aquatic environment.

For further information and advice either of the listed below.

Mr Fred Leitch
 British Aggregate Construction
 Materials Industry (BACMI)
 156 Buckingham Palace Road
 London SW1W 9TR
 Tel: 0171 730 8194
 Fax: 0171 730 4355

Mr David Griffiths
 Environment Agency
 Rio House
 Waterside Drive
 Aztec West
 Almondsbury
 Bristol BS12 4UD
 Tel: 01454 624400
 Fax: 01454 624032

ENVIRONMENT AGENCY HEAD OFFICE

Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 4UD
 Tel: 01454 624 400 Fax: 01454 624 409

ENVIRONMENT AGENCY REGIONAL OFFICES



ANGLIAN Kingsfisher House Goldhay Way Orton Goldhay Peterborough PE2 5ZR Tel: 01733 371 811 Fax: 01733 231 840	NORTH WEST Richard Fairclough House Knuttsford Road Warrington WA4 1HG Tel: 01925 653 999 Fax: 01925 415 961	SOUTH WEST Manley House Kestrel Way Exeter EX2 7LQ Tel: 01392 444 000 Fax: 01392 444 238
NORTH EAST Rivers House 21 Park Square South Leeds LS1 2QG Tel: 0113 244 0191 Fax: 0113 246 1889	MIDLANDS Sapphire East 550 Streetsbrook Road Solihull B91 1QT Tel: 0121 711 2324 Fax: 0121 711 5824	THAMIS Kings Meadow House Kings Meadow Road Reading RG1 8DQ Tel: 0118 953 5000 Fax: 0118 950 0388
SOUTH EAST Guildbourne House Chatsworth Road Worthing West Sussex BN11 1LD Tel: 01903 832 000 Fax: 01903 821 832	WELSH Rivers House/Plas-yr-Afon St Mellons Business Park St Mellons Cardiff CF3 0LT Tel: 01222 770 088 Fax: 01222 798 555	

For general enquiries contact
 your local Environment Agency
 Office on 0645 333 111.

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

**ENVIRONMENT AGENCY
 EMERGENCY HOTLINE
 0800 80 70 60**



- In view of changes within European standardisation, the document was updated
- The Environment Agency were satisfied with the revised document **but** the waste regulatory department within the EA refused to sign up to this document unless it clearly states that slag is a waste and needed to be regulated as such
- This was a result of the European definition of waste - Palin Granite case

- Stand off between the slag industry and the EA
- Several meetings over many years followed to try and find common ground
- The EA started to develop Quality Protocols for waste materials
- The Slag Industry agreed to work together with EA on a ‘**without prejudice**’ basis (The industry consider slag to be by-products)

- Since 2007 Blast Furnace Slag classified as By-Product - no need for a protocol
- However, Steel Slag (BOS and EAF) did not meet the Environment Agency's interpretation of the definition of a by-product and therefore they considered it to be a waste
- Technical Advisory Group (TAG) formed by the EA, Waste Recycling Action Programme (WRAP) and the slag industry to develop a quality protocol for **steel slag** which ultimately defines the recovery point
- To do this the following stages have to be achieved:

- Financial impact assessment (FIA) highlighting
 - Benefits to industry
 - Benefits to environment – landfill avoidance
 - Market certainty
 - Viable business case

- Risk Assessment
 - Type of applications (bound and unbound)
 - Sampling strategy
 - Chemical analysis and leaching data
 - Evaluation – modelling of various scenarios
 - Risk Assessment at different levels

- **Technical Report**
 - Steel Slag manufacturing information
 - Processing and weathering procedures
 - Material data sheets
 - Storage and haulage
 - Risk assessment – depending on end use

- The Quality Protocol document
 - Very brief summary of the technical report
 - Defines the recovery point when the Steel Slag ceases to be a waste and becomes a product
 - List of the European harmonised standards relevant to the applications of the steel slag
- Quality Protocol implementation
- Independent auditing using a third party

- Started in 2006
- A draft protocol completed in 2007
- This was rejected by the EA in 2007 based on insufficient data, relevance of test methodology and questionable representation of tested samples
- Since then sampling strategy was developed
- Leaching tests were performed in line with EU testing methods
- Different approach to the original risk assessment adopted
- But, the goalposts continue to change

- Interim - Steel slag accepted as **product** once bound.
i.e. asphalt or concrete
- If a protocol is achievable - expected during 2012
- If not, unbound will have a regulatory position with the
EA