# Steel Slag Aggregate Quality Protocol

## Consultation Response Document

May 2014

The development of the steel slag aggregate Quality Protocol has been a joint initiative between the Environment Agency and WRAP (Waste & Resources Action Programme) in consultation with Natural Resources Wales and the steel slag industry. It sets out end of waste criteria for the production and use of steel slag aggregates in construction applications.

The draft Quality Protocol was released for UK Consultation on the 5 March 2014 for 8 weeks, to seek wider stakeholder views on the document.

Although the consultation is now closed you can still view the documents and consultation questions on line at: **https:\\consult.environment-agency.gov.uk/portal/ho/waste/quality_protocol/steel_slag**

This document contains the full details of the consultation responses.

### What happens next?

After consideration of the consultation responses, the final documents will be sent for EU notification as per the Technical Standards Directive requirements. This process can take up to three months to complete.

We anticipate that the Quality Protocol will then be published later on this year.

If you would like to speak to us regarding this consultation please contact our National Customer Contact Centre on 03708 506 506 or email **EndofWaste@environment-agency.gov.uk**.

# Consultation Responses

## Comment 1

In the Technical Report, section 3.9, it states:

BOS slag fine aggregates are used as an activator in slag bound mixtures (SBM) for road construction and for towpaths as surfacing material. BOS slag is used in the construction of canal and river towpaths. The relevant standard for production of this material is BS EN 14227-2:2004.

In this respect, Appendix A - Definitions needs to be amended as currently the role of steel slag as an aggregate only in bound applications is defined. This is incorrect and the role of activator/ binder should also be included.

Therefore we would recommend that the term Bound Applications is edited to include steel slag as an activator/binder as well as an aggregate.

## Response 1

The definition in Appendix A of Bound Applications is: Applications for which the aggregate is encapsulated within a bituminous, cementious or hydraulic binder.

This is a generic definition of a bound application. The steel slag aggregate in this context could be both the ‘aggregate’ and part of the ‘hydraulic binder’. Therefore its role as an activator/binder is included, and no change is proposed to the definition of a bound application.

## Comment 2

Section 1.4.2 states: If Quality Protocol compliant material is mixed with waste materials, the resulting mix will be considered to be a waste and subject to waste management controls. If Quality Protocol complaint material is mixed with non-waste materials, the result mix will not, as a result of this, be waste

This paragraph potentially hampers the use of Quality Compliant steel slag (= a product) when used in an engineering capacity for landfill stabilisation.

This is in conflict with a primary aggregate, which if mixed with a waste, for engineering purposes, would not be considered as waste.

If the steel slag product has been produced with the particular specification and engineering design capability to undertake a stabilisation process then that Quality Compliant material should not be classified as waste and not subject to waste taxation or waste control protocols.

The statement in 1.4.2 is also in conflict with The Technical Report section 3.9 (see below) as BOS Slag can be used successfully as a binder in SBM type products, demonstrating the binding capacity of the material. This is the attribute that can be successfully exploited in the engineering / stabilisation application quoted above (which could also be used in other scenarios outside of a landfill stabilisation application).

Technical Report 3.9

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## Response 2

If any products are mixed with wastes the whole combined mixture will become a waste. This applies equally to primary aggregates and QP compliant steel slag. If any non waste product is destined for use as a binder material within a bound application, the other constituents must also be non wastes for the bound

aggregate to be considered a non waste. However, it is possible that the final mixture of product(s) and waste(s) may meet the end of waste test in any given case.

## Comment 3

Section 2.4.6 states: The steel slag aggregate must require no further processing, including size reduction, for the use for which it is destined at the time it is produced to comply with this Quality Protocol.

This paragraph potentially excludes a third party from purchasing Quality Compliant steel slag (= a product) for further processing according to their own specification for product development applications. This would be counterproductive and should be amended so that further processing to an alternative product specification (e.g. hydraulically bound application) could be carried out.

The third party operation would not require waste licensing as the material being purchased is Quality Compliant and the further processing would be to meet a specific product need and defined application.

## Response 3

This section refers to the requirement for the steel slag to be suitable for use in order for it to achieve end of waste status. If the material meets the standards and specifications set out in Appendix B (and all other protocol requirements as set out in Section 1.3 of the QP) prior to it leaving the site it will have met end of waste. Any additional customer specific processing over and above the required standards and specifications listed in Appendix B of the QP for the use for which it is destined for, would not be considered a waste activity. For example, if the steel slag was destined to be used in a hydraulically bound mixture, once it had met BS EN 13242 it would be considered to have met end of waste, and any further processing to meet additional specific customer requirements (over and above BS EN 13242 requirements) would not require waste controls. However, when additional customer specifications for steel slag are known, where possible the producer must meet these specifications prior to the material leaving the site.

If the steel slag was destined for an application which required a standard or specification which is not included in the QP, it would not be a QP compliant material. Therefore we do not propose to change the wording in Section 2.4.6 of the QP.

## Comment 4

Section 4.3 Use of steel slag aggregate – designated market sectors

4.3.1 To comply with this Quality Protocol, steel slag aggregate must be destined for use in unbound, semi bound or bound applications in civil engineering and construction as set out below and detailed in table B1. Appropriate product descriptions must be used on delivery documentation.

- Unbound uses (BOS and carbon steel EAF slag aggregates only) – aggregates for sub-base, capping, fills, and pipe bedding;
- Semi-bound uses (BOS, carbon steel EAF and high alloy EAF slag aggregates only) – aggregates for surface dressing
- Bound uses (BOS carbon steel EAF, high alloy EAF and AOD slag aggregates) – aggregates for asphalt, concrete and hydraulically bound mixtures

We do not understand the significance of the italics for hydraulically bound mixtures and would ask that it is removed.

The highlighted statement seems to only accept the use of steel slag as an aggregate in these bound applications whereas the current use of steel slag as an 'activator' / binder is already accepted in practice with the steel slag being produced to a defined specification and product application, as referenced again in the Technical Report section 3.9

## Response 4

Definitions of terms that appear in italics when they are first used in the QP are given in Appendix A. This is the first time that hydraulically bound mixtures is mentioned in the text, therefore it is italicised to refer the reader to the definition in Appendix A. This is explained in the introductory section at the beginning of the document.

To make it clear that steel slag can be used either as an aggregate or as part of the binder portion in hydraulically bound mixtures, the wording will be changed to "aggregates for asphalt and concrete and aggregates and activators for hydraulically bound mixtures" where applicable throughout the QP documents.

## Comment 5

Section 4.6 of the Technical Report:

4.6 The REACH Regulation applies to 'substances', 'preparations' (mixtures of substances), and'articles. These are defined in Articles 3(1),(2) and (3) of the Regulation as follows:

Substance: means a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance of changing its composition;

Preparation: means a mixture or solution composed of two or more substances;

Article: means an object which during production is given a special shape, surface or design which determines its function to a greater degree that does its chemical composition.

It might be helpful to add the REACH registration numbers for UK steelmaking slag for reference here as it demonstrates that we already consider the substances, preparations or articles made using steel slag to be products

EINECS 294-410-9 REACH REG No 01-2119487458-21-0008

EINECS 266-004-1 REACH REG No 01-2119487457-23-0016

EINECS 294-410-9 REACH REG No 01-2119485979-09-0010

## Response 5

This additional information will be included in the Technical Report.

## Comment 6

Section 5.12 of the Technical Report

BOS slag has been used in road surface courses (previously called “wearing courses” for nearly 40 years.

This is nearer to 100 years.

## Response 6

This timescale in the Technical Report will be amended.

## Comment 7

Section 5.12 of the Technical Report

However, its use has been mainly in counties along the North East coast of England and South Wales, **usually on roads within the steelworks complexes or on local roads in their immediate vicinity**.

The words highlighted in bold above should be deleted as they are misleading. The product is much more attractive than that and is marketed competitively in as wide a geographical area as possible, limited only by adjacent competing aggregate sources and fuel costs.

## Response 7

The selected words will be removed from the Technical Report.

## Comment 8

Section 5.12 of the Technical Report

BOS slag provides MSSC (Mean Summer SCRIM performance Coefficient) values that would be expected from natural aggregates and it is accepted by the Highways Authorities as a 60 PSV aggregate. BOS slag is permitted to be used widely in large volume applications such as less heavily trafficked motorways and most dual carriageways, as well as many single carriageway roads.

We would suggest the addition of another sentence in conclusion: “This demonstrates the current acceptance of steel slag as an attractive road surfacing product.”

## Response 8

This additional sentence will be included in the Technical Report.

## Comment 9

Section 6.2 of the Technical Report

Bound applications are applications for which the aggregate is encapsulated within a bituminous, cementitous or hydraulic binder.

See point 1 above. An additional sentence needs to be added: “The slag component can also be part of the binder portion of a ‘bound application’.

## Response 9

The additional sentence will be added to Section 6.2 of the Technical Report "Steel slag can be used as an aggregate in bituminous and cementitious bound mixtures and also as aggregates and/or activator in hydraulically bound mixtures"

## Comment 10

Section 10.15 of the Technical Report

Steel slag aggregate currently has a strong market as a construction product with proven historic use. This will be sustained and potentially further stimulated if steel slag aggregate classification as a waste is removed.

These sentences appear to contradict each other. We would recommend the following wording instead: “Steel slag aggregate currently has a strong market as a construction product with proven historic use. This will be sustained and potentially further stimulate by adoption of the Quality Protocol, which clearly defines compliant material as bone fide product.

## Response 10

Section 10.15 of the Technical Report will be reworded to take account of the suggestion above.

## Comment 11

The comments below relate to the document “4. Steel Slag Chemical Risk Assessment”. Specifically, the comments refer to “section 6: Risk Assessment – Human Health”, and consider the risk assessment for local residents living in proximity to construction works and not workers on the site.

General comments:

In the risk assessment, airborne dust concentration for local residents’ exposure during construction activity was initially estimated to be 500 micrograms per cubic metre (µg/m3) as PM10 (from Environment Agency contaminated land exposure assessment model 2003). Concentrations of metals were calculated on the basis that the dust is comprised entirely of steel slag, which represents a worst case scenario.

The human health risk assessment for exposure to the airborne dust was conducted by comparing the calculated concentrations of individual substances in the dust with chronic health based values (e.g. long-term Environmental Assessment Levels (EALs)/EPAQS or Air Quality Guidelines or Air Quality Objectives). In most cases, exposure modelling calculations were then conducted to estimate potential exposure. This was done using conservative exposure estimations and assuming worst case conditions, e.g. with no measures to reduce dust exposure. In two other cases, namely arsenic and manganese, exposure concentrations were estimated taking into account the use of dust control methods (e.g. wetting).

Overall, from considering the risk assessment process as described in appendix D, we agree that risks to public health from exposure to emissions are low if operations are properly run and regulated, i.e. provided that adequate control measures to reduce dust exposure are adopted, as indicated in Tier 3 of the risk assessment in appendix D.

Other comments:

The text in section 6 states that short-term EALs are considered more appropriate for the assessment of residents for exposure to construction activities than long-term EALs because exposure is likely to occur over the short-term, high dust levels are likely to be intermittent and the dust will not always be blown in the same direction. Although this initially seems reasonable, we consider that the method for deriving the short term EALs as cited in the document IPPC H1 (Environment Agency 2010), would not be appropriate for use in the risk assessment for residents. The IPPC H1 document indicates that the short-term EALs were derived using 15-minute workplace Short-term Exposure Levels (STELs) with an adjustment factor to allow for general population exposure. We understand that these 15-minute STEL values are intended for the assessment of peak exposure for acute effects over a 15 minute averaging time and thus not suitable for repeated exposure (even over the short term). Furthermore, the most sensitive health endpoints for some of the contaminants are cancer (e.g. arsenic and chromium VI,) a chronic effect, for which short-term exposure values derived from 15-minute STELs, would not be appropriate.

However, as noted above, the actual risk assessment conducted (outlined in appendix D) used the more appropriate long-term health based values. It may be helpful for Chapter 6 to be clearer; that chronic health based values were used in the risk assessment to avoid confusion on this point.

The long-term EAL for vanadium (5 micrograms per cubic metre) is greater than the short-term EAL (1 microgram per cubic metre). The reason for this difference is not explained in the document and the justification is unclear. It would be more precautionary if the risk assessment used a lower chronic health value, for example, the US Agency for Toxic Substances Disease Registry (ATSDR) chronic minimal risk level for vanadium of 0.1 micrograms per cubic metre (www.atsdr.cdc.gov/ToxProfiles/tp58.pdf). The tier 2, conservatively estimated air concentration of 0.02 micrograms per cubic metre is below this value, which still indicates that there is unlikely to be an appreciable risk to health.

Table 6.1 gives an incorrect value for the long-term EAL for manganese. This should be 0.15 micrograms per cubic metre and not 150 micrograms per cubic metre, the correct value is cited and used in the risk assessment in appendix D.

Throughout section 6, the appendix giving details of the risk assessment method is often incorrectly cited as appendix E, when it is appendix D.

## Response 11

To confirm, the dust risk assessment scenario used only the long term EAL for vanadium. This was taken from the current version of the Annex F of the H1 Horizontal Guidance. We note your comment that if the lower ATSDR value was used the material would also have passed the risk assessment for vanadium. However we will retain the current value in the risk assessment.

All the other points are noted and the Chemical Risk Assessment document will be updated to take account of the suggestions provided.