

## **V14/9/2015 - ESPP note to EU Commission DG GROW and JRC concerning integration of “ashes” into the EU Fertiliser Regulation:**

ESPP considerations for the definition of EU Fertiliser Regulation (FR) criteria for use of ashes as (a) a fertiliser or (b) a fertiliser raw material

### **1) Context**

#### **1a) Potential**

There is a significant potential for developing the use of combustion and incineration ashes:

➔ Use as a **fertiliser production raw material**<sup>i</sup>:

Such use is already operational on an industrial scale in one fertiliser factory (ICL Netherlands), is being considered by others (in other MS), and is likely to accelerate with possible regulation obliging P-recovery from sludge mono-incineration ash in e.g. Germany, Switzerland.

➔ Use, for some ashes, **directly as a fertiliser**:

Such use is already operational or currently under construction for poultry litter ash in a number of plants (e.g. Fibrophos UK, BHSL Ireland, BMC Moerdijk Netherlands, Sanders France ...), operational for MBMA<sup>ii</sup> (meat and bonemeal ash<sup>iii</sup>, e.g. SARIA UK, Fibrophos UK, Wykes Engineering UK) and is already authorised in some cases for ash from wood or peat combustion (e.g. in Finland<sup>iv</sup>, see also ADEME 2007<sup>v</sup>).

Very approximately, ESPP has estimated the potential for phosphorus recovery from ashes to fertilisers as follows (this assumes that the phosphorus can be recovered in an agronomically useful form conform to contaminant and safety criteria):

- SSIA (sewage sludge incineration ash) = 121 000 tP/y
- poultry litter ash = 100 000 tP/y<sup>vi</sup>
- MBMA (meat and bonemeal ash, including ash from slaughterhouse wastes, etc.) = 224 000 tP/y

This would represent approx. 39% of EU mineral P fertiliser consumption (based on 2013 fertiliser data).

The above does not include other significant ash resources such as wood and biomass combustion ash<sup>vii</sup> or paper industry ash<sup>viii ix</sup>. In some cases, these may only contain low levels of phosphorus, but may contain significant levels of other nutrients, e.g. potassium.

#### **1b) New combustion products**

This note addresses “ashes” generated by traditional combustion processes, that is incineration or biomass thermal energy production, as covered by existing EU waste incineration Directive 2000/76/EC or large combustion plants Directive 2001/80/EC, and now the Industrial Emissions Directive 2010/75/EU (IED). There are a number of new processes/products under development/coming onto the market which may produce thermal residues with different characteristics, such as thermal mineralisation<sup>x</sup> or HTC (hydro thermal carbonisation). These are not presently covered by this note but could possibly be additionally included with appropriate additional information.

## 1b) “Processed” manure

It is important to legally make it clear that ash from manure combustion is NOT considered to be livestock manure nor to be “*manure ... in a processed form*” under the Nitrates Directive. Although ash does not contain nitrogen, it is important that application should not be limited by this clause of the Nitrates Directive when implementation plans also regulate P application

## 2) Use of ash as a fertiliser vs. as a fertiliser raw material

Where ash is **used as a fertiliser** (i.e. applied to land or mixed\* [without chemical processing with other fertiliser products] then applied to land) it should respect

- “general” FR safety and agronomic efficacy criteria for the FR category for which it is sold (fertiliser, soil improver ...)
- specific safety criteria for ashes as discussed below, as relevant depending on the input material and process
- specific agronomic requirements for ashes: ashes should not be labelled as EU fertilisers unless they are proven to have agronomic efficacy (this is additional to the “general” FR agronomy requirements)

Where ash is NOT used directly as a fertiliser, but is used as a **raw material in a fertiliser production process\*** (e.g. replacing P-rock in a sulphuric acid or a phosphoric acidulation process ...), then the FR safety and agricultural efficacy criteria should not apply. This is because (a) the FR criteria will apply to the finished product and (b) there are no such criteria for P-rock when used as a fertiliser manufacturing raw material. It is the responsibility of the fertiliser manufacturer to ensure that the raw material - process combination results in a finished product which is effective and safe, and meets EU Fertiliser Regulation requirements.

FR validation of certain ashes as a fertiliser raw material is important because it should enable producers of these ashes to supply them to fertiliser production sites (for use as a fertiliser raw material) **without waste status transport / use permits**. We note that, as we understand it, any ash which is covered by the FR either as a fertiliser or as a fertiliser raw material will cease to be considered waste (de facto **End-of-Waste status**) and so will become **subject to REACH**<sup>xi</sup> (but with **application of Art. 2(7)d for “recovered substances”** where the specified conditions are fulfilled) and that this End-of-Waste status will apply ONLY for the specified use (fertiliser or fertiliser production raw material). REACH also specifies the uses covered by the product registration.

*\* We note that the **definition of “mixing”** is important, as is the choice of terminology (mix, blend ... ). This must distinguish between processes where the ash is chemically modified to produce a chemically different substance and processes where it remains essentially the same in the final product spread on the field. There will be grey areas, such as when ash is mixed with phosphate fertiliser chemicals after an acidulation process, where the remaining acidity may somewhat modify or react with the ash. However, this distinction between use as a fertiliser / as a raw material will be a general challenge in the modified FRs and the corresponding definitions of mixing / blending / process should apply to ash in the same way as to other categories of fertiliser/soil amendment covered by the FRs.*

### 3) Definition of “ash” for Fertiliser Regulation purposes

#### 3a) Combustion conditions

(3ai) It does not seem necessary to invent new combustion conditions criteria, because the terms of existing regulations can be used :

- **“incineration” Directive 2000/76/EC<sup>xii</sup>** Article 6 = conditions of incineration 850°C, TOC in ash <3%

(3aii) We note that these same conditions are specified in Annex III Chapter IV, Section 2 of **EU Animal By Products Regulation 592/2014** “*Combustion plants must be designed, built, equipped and operated in such a way that even under the most unfavourable conditions the animal by-products and derived products are treated for at least for 2 seconds at a temperature of 850 °C or for at least 0,2 seconds at a temperature of 1 100 °C.*”

(3aiii) However, not all bio-mass burning plants (e.g. for energy production, or in specific industry sectors) are subject to the above cited Directives. In these cases, it would be appropriate to authorise ash from plants not respecting the above Directives’ combustion conditions subject to

- Only accepting “clean” biomass input materials, that is not contaminated (e.g. exclude treated or painted wood). Exclude also all input materials susceptible to contain significant levels of manures, human bio-wastes, food wastes or industrial wastes (in order to exclude possible pathogen risks)
- Define some minimum conditions for these “clean” biomass combustion ashes (refer to existing legislation or standards if possible): these could either be conditions concerning the combustion conditions (but these may be locally and sector variable) or conditions concerning ash characteristics (combustion specific contaminant levels, organic carbon ...)

#### 3b) Input materials

We would suggest to cover in the FRs any ash produced by incineration or combustion of organic wastes or biosolids (combustion conditions as defined above), including separately collected or sorted food wastes, subject to the following exclusions:

- Hazardous chemical wastes, hospital wastes, radioactive materials (not deliberately added to the waste stream)
- MSWI Municipal Solid Waste Incinerator (any waste stream with >5% by weight mixed municipal solid refuse)

We note that this definition (3a and 3b above) is probably **narrower than the definition of EINECS 931-597-4** “*The product from the burning of a combination of carbonaceous materials*” which is registered under REACH as an inorganic UVCB (substance of Unknown or Variable composition, Complex reaction products or Biological materials).

**General criteria for ashes from animal by-products** as input materials may be specified by the proposed Fertilisers Regulation / Animal By Products Regulation modification.

### 3c) Nutrient content

It does not seem justified to specify minimum (total) P (or K) concentrations for ash:

- **for use as a fertiliser RAW MATERIAL:** in the future a company may find an efficient process to extract P from ash containing very low P concentration. There is no reason to exclude this a priori, it is industry's choice to select raw materials which are economically efficient in their production process.
- **for use as a FERTILISER.** Different ashes might be valuable fertilisers for P, for K or for other nutrients/micronutrients, subject to these being plant-available (see below, point 5), or as a soil improver (calcium or silicate content). A product with low levels of all nutrients and micro-nutrients will not find a market (nutrient information will be on the label) and/or will probably be anyway excluded from sale as a "fertiliser" under FR general product specifications (it may have a market as a "soil improver"). However, we do propose to define a minimum level of plant availability for the total phosphorus content (see point 5 below).

### 4) Safety criteria

The comments on safety criteria below could apply identically to both ash used as a fertiliser and ash used as a raw material.

#### 4a) Organic contaminants & pathogens present in bio-wastes

Ashes, subject to the above combustion conditions, have no risk of containing most **organic contaminants**: pathogens, pharmaceuticals, organic chemicals, hormones .... Specific limits are therefore not necessary for these ashes. However, see (4c) below.

#### 4b) Mineral contaminants, e.g. heavy metals

Ashes may contain '**mineral' contaminants (heavy metals)**, but these are mostly limited in the (proposed modified) Fertiliser Regulation general safety and quality criteria for each product category. Specific limits are therefore not appropriate for ash used as a fertiliser (for ash used as a fertiliser raw material, see above §2).

However, **Cu and Zn** may not be limited in the general criteria for mineral fertilisers of the (proposed modified) FRs, in which case specific limits could possibly be included for ash used as a fertiliser and for fertilisers produced using ashes as a raw material, or could be included in the FRs for all mineral fertilisers (with monitoring only if input materials are susceptible to contain significant levels of these elements). Exemptions from such limits may be appropriate in some uses (e.g. forestry)

#### 4c) Dioxins/furans, PAHs

Specific limits and monitoring should be defined for the '**combustion specific' possible contaminants**, in order to ensure trust and avoid possible user or public concern about possible presence of these in ashes.

##### 4ci) dioxins and furans ...

In the UK Poultry Litter Ash Quality Protocol, the maximum limit is 20 ng/kg *WHO-TEQ PCDD/F* <https://www.gov.uk/government/publications/quality-protocol-poultry-litter-ash> This limit was agreed following extensive risk-based analysis and discussion.

The German fertiliser regulation sets 5 or 30 ng/kg WHO-TEQ PCDD/F (per dry matter) depending on the crop use.

*NOTE: it could be appropriate to apply these specific limits both to ash as a fertiliser and to ash used as a raw material, for administrative simplicity and to avoid introduction of these specific contaminants into the fertiliser production chain (measuring them only in the final fertiliser product would effectively be dilution of pollution). However, exemption from this limit could be granted where ash is used as a raw material, and where the fertiliser production using it includes a process which removes dioxins and furans (the fertiliser producing company should justify that its process eliminates or removes these pollutants, and should also carry out sampling of the final product to show that these pollutants are not present).*

#### 4cii) PAH's (poly aromatic hydrocarbons)

Proposal : 1 mg/kg dry matter.

*NOTE: same comments regarding ash used as a fertiliser raw material as for dioxins/furans above.*

#### 4d) Animal By-Products

**Animal by-products:** as already discussed in the Fertiliser Working Group and elsewhere, ash of animal by-products offers significant potential for P and K recycling, and should be authorised, subject to appropriate safeguards concerning the incineration conditions<sup>xiii</sup>. The combustion conditions specified above in (2), i.e. as per Incineration Directive 2000/76/EC art. 6 and Animal By-Products Regulation art. 6(7)c should be adequate to ensure health safety, but specific monitoring of installations using animal by-products may be appropriate to ensure that these conditions are rigorously respected and ensure user/consumer trust.

### 5) Agronomic efficacy

On the basis of current knowledge, **it does not appear justified to FR recognise all ashes as “fertilisers” (for use directly on the field)** because the phosphorus content is not plant available<sup>xiv</sup> (e.g. in glass matrix form), except possibly in exceptionally acidic soils, tropical climates, or over a very long time scale (not compatible with farm crop management<sup>xv</sup>). However, potassium content does tend to be plant-available in most ashes. The ‘default’ for ashes (ashes as defined above) would therefore be FR recognition of ashes only as raw materials for fertiliser production processes, not as fertilisers: that is, ashes would not be authorised as fertilisers unless evidence is provided (for specific types of ash) that they have a fertiliser value (agronomic efficacy).

However, in some cases, use of ashes as fertilisers may be justified because of content of other nutrients (K, Mg ...).

If certain ashes are to be authorised for direct use as a (phosphorus) fertiliser (see below) then a **minimum % of phosphorus plant availability** (% of total P which is plant available, see comment above and comment on minimum total P under 3c) should be required, e.g. at least 50% of total P ammonium citrate soluble. The parameter should be included in labelling.

Possibly in the future, producers of other specific biosolids ashes (e.g. combustion of other types of manure ..) may demonstrate that their ash is an effective fertiliser (plant available nutrients), in which case such ashes could be added to FR annexes on a case-by-case, evidence supported, base.

#### 5a) Direct fertiliser use of poultry litter ashes

**Ash from combustion of poultry litters is already demonstrated to be an effective fertiliser (P, K) and, according to our information, is already used in Europe, e.g.:**

- Fibrophos UK
- Sanders France (under construction)
- BMC Moerdijk
- BHSL Ireland
- Other ?

References for fertiliser efficiency of poultry litter ash:

- BMC Moerdijk has already compiled a technical dossier for the inclusion of their product as a PK fertiliser in Annex I of the FR 2003/2003, presented to the EU Fertiliser Working Group in March 2015.
- Field data from Fibrophos <http://www.fibrophos.co.uk/phosphate-in-fibrophos-fertiliser/>

Poultry litter combustion ashes above should therefore be FR validated for direct use as a fertiliser, subject to the input material containing:

- At least 30-50% (to be defined) poultry manure (dry weight)
- And at least 80%-90% (to be defined) poultry litter = manure + organic bedding from poultry houses (dry weight)

#### 5b) Direct fertiliser use of MBMA

“Kalfos” ash from MBM combustion as produced by the Saria group in the UK has been demonstrated over the last three years to be effective at promoting grass growth in a range of farm and controlled laboratory conditions<sup>xvi</sup>. The release of phosphorus and other benefits to the plants is much more effective than would be indicated by laboratory analysis alone. Application of Kalfos to arable soils is increasing in the UK. Kalfos is sold as 22% P<sub>2</sub>O<sub>5</sub> + 3.5% K<sub>2</sub>O. Mixing of Kalfos with other minerals or fertiliser compounds has not been necessary to date.

Fibrophos UK have also been successfully marketing MBM ash for direct use as a powder fertiliser in the UK for several years. Agronomic test data are already available<sup>xvii</sup> and longer term (5-year trial) results will be available after 2015 harvest.

- <sup>i</sup> We prefer the vocabulary “raw material” which is possibly less ambiguous than “ingredient” (which could be interpreted as concerning mixing)
- <sup>ii</sup> SARIA UK already use MBMA directly as a fertiliser in the UK, pelletising is not necessary, spread with conventional lime-spreader machinery. This is validated by UK Environment Agency End-of-Waste criteria.
- <sup>iii</sup> Ash from combustion of meat and bonemeal (abattoir wastes) plus small components from other biomass materials and possibly fuel additives used in combustion
- <sup>iv</sup> Finland Fertiliser regulation (539/2006), and ordinance (24/11). Minimum P+K concentration is 2%, minimum Ca concentration 6%. Also heavy metals are regulated, for example Cd 25 mg/kg, As 40 mg/kg. The ashes must be granulated or hardened. In granulation, also other nutrients can be added to the mix. This is an attractive option for Finland where the forest soils are typically acidic, and P & K are needed. See (in Finnish) <http://www.metla.fi/hanke/7464/pdf/Metla-Tuhkaopas-esite-2012.pdf> However, wood combustion ash is landfilled in Switzerland.
- <sup>v</sup> ADEME France “Etat de l’art de la réglementation européenne sur la valorisation des déchets de bois et des cendres de bois », nov. 2007 (32 pages, in French), compares regulation in 10 EU Member States  
[http://www.ademe.fr/sites/default/files/assets/documents/52295\\_synthese\\_regl\\_val\\_dechetsbois.pdf](http://www.ademe.fr/sites/default/files/assets/documents/52295_synthese_regl_val_dechetsbois.pdf)
- <sup>vi</sup> Total P in EU poultry manure 2009 was c. 204 000 tonnes P. We estimate c. 50% potential for P-recovery through fertiliser use of ash after combustion, but implementation will depend on regulation, logistics, economics ...
- <sup>vii</sup> Approx. 100 000 tonnes of ash in Wallonia part of Belgium alone, B. Annicaert, BioRefine conference Ghent 2/9/15
- <sup>viii</sup> The European paper industry produces approximately 8 million tonnes (dry) paper sludge and 5 million tonnes bio-ash. This ash is estimated to contain around 25 000 tonnes, of which maybe around 20% would be bio-available as fertiliser, and remainder could be made available in a fertiliser process. These streams also contain significant levels of other nutrients, J. Ringman, CEPI, DONUTSS Ghent 4/9/15
- <sup>ix</sup> See also Staaf, H. Fosforflöden inom skogsbruket och skogsindustrin. PM, Naturvårdsverket, Stockholm, 2013 <http://www.naturvardsverket.se/upload/miljoarbete-i-samhallet/miljoarbete-i-sverige/regeringsuppdrag/2013/fosfor/underlagsrapporter/fosforfloden-inom-skogsbruket-och-skogsindustrin-2013.pdf>
- <sup>x</sup> E.g. Recophos Germany <http://www.recophos.de/>
- <sup>xi</sup> Note “Bone Ash” is registered under REACH as EINECS 270-423-5 under the same Registration as hydroxylapatite / hydroxyapatite (EINECS 215-145-7 = Pentacalcium hydroxide tris(orthophosphate) EINECS 235-330-6)
- <sup>xii</sup> See also Directive 2001/80/EC “limitation of emissions of certain pollutants into the air from large combustion plants” and now the Industrial Emissions Directive 2010/75/EU (IED)
- <sup>xiii</sup> Fibrophos indicate that MBMA (Meat and Bone Meal Ash) is already authorised for use as a fertiliser (Animal ByProduct Regulations do not apply) if it has undergone an End-of-Waste procedure, with specified treatments.
- <sup>xiv</sup> “Plant availability” remains to be defined. By this, we do not mean “soluble” but rather that the product must be demonstrated to provide nutrients usefully to crops in relevant conditions and time scale.
- <sup>xv</sup> Except some specific cases, e.g. slow growing forests
- <sup>xvi</sup> Preliminary report of KalFos grass trials by Harper Adams University UK, May 2015, available on request
- <sup>xvii</sup> See on [www.fibrophos.co.uk](http://www.fibrophos.co.uk) and “Equal Poultry litter ash field trials, Summary report, February 2015, LIFE10 ENV/UK/176” (EU Commission LIFE, UK Environment Agency, Equal) available on request