

## ESPP proposal on “ash as an ingredient for fertiliser production”

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### 1) The problem and need for action

Certain ashes are suitable for **use directly as a fertiliser** after e.g. blending with other nutrients or granulation (nutrients are plant available, low contaminants). Tens of thousands of tonnes of ash from chicken litter combustion (for renewable energy production), of meat and bone meal ash and of biomass combustion ash are today commercialised as fertilisers/soil improvers in different Member States in Europe. This is addressed by the STRUBIAS Interim Report 24/5/17.

However, ash can be also **used as an input raw material for fertiliser production** (ash-as-an-ingredient), in processes where the ash is chemically reacted to generate a different product, see examples below.

JRC has clarified (email Hans Saveyn 9/6/17 in response to question from ESPP) that the May 2017 STRUBIAS proposals<sup>i</sup> are intended to address both of these two ash use routes with identical criteria = recovery rules (as proposed pages 111-114), and that the term “mixing” in the line on ‘Post-processing’ page 114 is intended to cover nearly all types of chemical reaction and thermal treatment (see line 1592 onwards page 41). We suggest that this be clarified in the final report<sup>ii</sup>.

However, ESPP considers **the JRC May 2017 STRUBIAS proposed ash criteria are inappropriate for ash used as a fertiliser process ingredient<sup>iii</sup>**:

- nutrient solubility and nutrient content criteria are not relevant, because the chemical process can solubilise or concentrate nutrients
  - contaminant limits are not appropriate, because the process can reduce these by extraction processes, in order to achieve the PFC requirements (see further discussion below)
    - if specific contaminant criteria are considered necessary for ash-based products in addition to those in PFCs<sup>iv</sup> then these should be applied at the ‘final fertiliser product’ stage, not at the ash-as-an-ingredient stage
- For comparison, the Fertiliser Regulation proposes to limit cadmium in fertilisers, but not to limit cadmium in the phosphate rock being used to produce fertilisers (because

the process could include decadmiation)

See also specific proposals for the specific incineration-generated contaminants (dioxins, PAH) below

- similarly, limits to respirable particles or particulate contaminants (lumps of metal or other) or respirable silica are not appropriate, or should be applied at the final product not the ash-ingredient stage, because these can be removed/modified in processing

If a new and different set of criteria are not proposed for ash-as-an-ingredient, then **the use of major ash sources for recycling to CE fertilisers will be excluded<sup>v</sup>, in particular sewage sludge incineration ash**. For such as ashes, nutrient content, nutrient plant availability and/or contaminant limits do not respect the proposed criteria in the JRC STRUBIAS Interim Report – but this is irrelevant if processing ensures concentration of nutrients, modification of their plant availability and/or removal of contaminants.

This is particularly problematic as the new **German (and Swiss) legislation will render obligatory recovery of phosphorus from important volumes of sewage sludge incineration ash<sup>vi</sup>**, which should not be excluded from use in CE Fertilisers. This immediately concerns recovery from sewage sludge ash in these countries, but is likely also (by leading to large-scale implementation of technology, demonstration, new technologies, improved economics) to facilitate P-recycling from sewage sludge ash and other ashes elsewhere.

Therefore:

- **ESPP asks that DG GROW specifically request to JRC to start development of an additional STRUBIAS criteria proposal for ash-as-an-ingredient**, including clarifying the distinction between ash-used-directly (after blending, granulation, etc) = existing May 2017 STRUBIAS criteria proposals (subject to consultation)  
This JRC additional criteria development can be to a large extent based on information JRC has already received concerning different ashes and processes. ESPP is fully willing to facilitate collection of any further information needed by JRC from concerned companies and stakeholders.
- ESPP proposes below, for discussion, an initial proposal for structure / outline of such criteria for ash-as-an-ingredient
- ESPP asks that DG GROW support JRC in addressing the questions of : how these new criteria function at the different stages of CMC / PFC in the proposed Fertilisers Regulation ; interactions with End-of-Waste and REACH status ; compatibility with Art. 42(1)<sup>vii</sup>

## 2) Discussion history

The need for two different criteria approaches for ash-as-a-fertiliser and ash-as-an-ingredient was clearly raised at the first STRUBIAS working group meeting, Seville, July 2016. The minutes state *“some, but not all, ash types have good product quality properties without the need for a specific nutrient recovery treatment ... Specific other production processes to recover nutrients in ashes were mentioned by sub-group members. ... There was an*

*extensive debate on the need to separate (1) ashes produced with the objective for their direct use as a fertiliser, either without (so-called "premium ashes") or with (i.e. ash-based products obtained after nutrient recovery) treatment, from (2) ash-based products that can be used as a raw material to produce fertilisers (e.g. phosphoric acid, H<sub>3</sub>PO<sub>4</sub>). The reasoning behind this proposal is that for ash based products as a raw material to produce fertilisers, no criteria should be set on agronomic value as only the end-materials should be evaluated for its agricultural value."*

Despite the ambiguities in these minutes<sup>viii</sup> the conclusion is clear: need to address the two different routes for ash

→ use directly as fertiliser

→ use as a fertiliser production process ingredient

This need for two different criteria was already underlined and justified in ESPP's proposed criteria for ashes submitted to the European Commission in 2015 and submitted to the JRC STRUBIAS process "*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*"

However, this is not done in the STRUBIAS report which only proposes one set of criteria for ashes, with the consequence that these criteria are not appropriate for ash as a fertiliser production process ingredient.

An example of this incompatibility of the current STRUBIAS draft criteria with ash as a fertiliser production process ingredient is the confusion over proposed limits on additives included in the incineration process: the current exclusion of additives<sup>ix</sup>, because it applies to both incineration and "post-processing", effectively excludes all of the example routes below which imply use of reactants to process the ash into other chemical forms. This is comparable to excluding the use of sulphuric acid to process phosphate rock, or the exclusion of use of chemicals in possible decadmiation processes.

### 3) Examples of ash-as-an-ingredient for fertiliser production

- ICL have demonstrated the feasibility and plan to invest to replace by ashes (meat and bone meal ash, sewage sludge incineration ash) part of phosphate rock used in two of their fertiliser factories. The ash will be added into the process at a stage where residual acid is present from the factory chemical process, and this reacts with the ash. See [www.phosphorusplatform.eu/scope115](http://www.phosphorusplatform.eu/scope115)
- Ecophos are constructing a factory in Dunkerque France to produce 220 000 t/y of phosphate products from low-grade phosphate rock and sewage sludge incineration ash (contract already signed to take 60 000 t/y of ash from the Netherlands). Contaminants from rock and ash are extracted. Products will be standard animal feed phosphate (e.g. DCP) but could also be fertiliser phosphates. See [www.phosphorusplatform.eu/scope120](http://www.phosphorusplatform.eu/scope120)
- Outotec (Ashdec) and Mephrec [www.phosphorusplatform.eu/scope119](http://www.phosphorusplatform.eu/scope119) and AWEL (Zurich Canton, Phos4life) [www.phosphorusplatform.eu/eNews12](http://www.phosphorusplatform.eu/eNews12) and others have

already demonstrated full scale processes to attach sewage sludge incineration ash with combinations of acids / alkalis / heat / pressure / solvents to modify the ash (make phosphorus plant available) and to extract contaminants, in order to produce directly a fertiliser product (modified ash) or phosphoric acid from which standard fertiliser products (TSP, MAP, DAP ...) can be produced.

- ICL have the Recophos Thermal process which can extract elemental P<sub>4</sub> (white phosphorus) from ash (see [www.phosphorusplatform.eu/scope120](http://www.phosphorusplatform.eu/scope120)). It is probable that the resulting product will go to chemical industry uses other than fertilisers, but it should also be possible for these processes to lead to CE-label fertilisers.

Such processes will inevitably develop considerably in the near future as a consequence of the Swiss and German legislations requiring phosphorus recycling from sewage<sup>x</sup>. All Swiss sewage sludge and most sewage sludge from the larger plants concerned by the German legislation (around 2/3 of Germany's sewage) is incinerated, so that recovery from sludge ash will necessarily develop at an industrial scale. Some of the recovered phosphorus may go to chemical industry applications, but its recycling in fertilisers should not be excluded from CE-labelled fertilisers. For example, if phosphoric acid is produced, its use by a fertiliser producer to replace imported phosphoric acid made from rock should not prevent the company's products obtaining the CE-fertiliser label.

#### 4) Outline ESPP proposal for criteria for ash-as-an-ingredient

The following is ESPP's outline proposal for criteria for ash-as-an-ingredient. This proposes general principles: we request input from the technical and legal competence of JRC and DG GROW to develop precise wording appropriate for implementation into a Fertilisers Regulation CMC:

- **input materials, combustion conditions** (for ashes types A or B depending on input material): as for ash-for-direct-use (as per JRC May 2017 STRUBIAS proposals with any adjustments resulting from the consultation underway)
- **nutrient content and availability (agronomic effectiveness), particle size/respirability**: should not be specified for the ash itself, because these can be improved and modified by processing. The final product will in any case have to respect PFC criteria.
- **contaminants – general approach**: contaminants should not generally be limited in the ash itself, because these properties can be removed by processing (the final product will in any case have to respect PFC criteria). However:
  - **dioxins/PAH**: for administrative simplicity, the same limits on specific “incineration contaminants” (PCDD/F, PAH) could be applied as for ash-for-direct-use (as suggested in ESPP's 2015 proposal), in order to prevent these specific and problematic contaminants entering the fertiliser processing chain, and in order to contribute to farmer and consumer confidence. Possibly an exemption could be made where it is demonstrated that these are handled safely and completely destroyed by the processing (e.g. 99% removed or

broken down to non hazardous chemicals)

- **Remove not dilute:** the process must REMOVE and not simply DILUTE<sup>xi</sup> contaminants to achieve PFC limits (dilution would be contrary to the Waste Framework Directive principles)<sup>xii</sup>. See example of criteria for removal and calculation/verification below. This removal obligation must be applicable to a clearly defined and limited list of contaminants to enable implementation: we propose that it should be applicable (only) to :
  - contaminants listed in PFC1(C)
  - other contaminants listed by STRUBIAS (finalised list) for ash-for-direct-use
  - organic contaminants are not relevant for ash
  - possibly exemption for some heavy metal contaminants which it can be justified will not be found in input materials (cf. May 2017 STRUBIAS proposals for ash type A)

**ESPP underlines that it can also be argued that the obligation to ‘remove not dilute’ is not necessary or justified**, because if dilution ensures that the final fertiliser product is below the PFC contaminant levels, then (by definition of the Fertilisers Regulation) the final product does not endanger human health nor harm the environment, so Art. 13 of the Waste Framework Directive is respected.

## 5) Possible calculation and monitoring of contaminant removal

The following obligation should be specified as applicable to (and only to)

- Contaminants for which limits are specified in PFC1(C)
- Contaminants for which limits are specified for ash-used-directly (CMCxx)
- Other than organic contaminants which are destroyed by incineration/combustion

It is our understanding that the above identification of contaminants means that the contaminants identified above are all elements, and therefore conserved (not destroyed) in any processing<sup>xiii</sup>.

Calculation of contaminant removal (“proportional removal”)

- The following is applicable only for each of the above contaminants for which the level is higher than the PFC1(C) limit or the specific limit for ash-used-directly (CMCxx) in one or more of any ashes being used as input materials (if the contaminant level is already below required levels for all input ashes, then there is no obligation to demonstrate removal).
- Inflow quantification: the amount (kg) of the contaminant in ALL inflow materials<sup>xiv</sup> to the fertiliser production process (total in ash(es) but also total in virgin materials and other CMC inputs) must be quantified by sampling each different ash and other input used and then multiplying by tonnage of each material used as an ingredient
- The company must demonstrate “**proportional removal**”, defined as follows: If a company uses ash-n°-1 with contaminant Hg at 300 mg/kg to produce a “mineral fertiliser” for which the PFC1(C) specifies Hg < 100 mg/kg, then the company should demonstrate that their process removes at least 2/3 of the Hg – even if the company

is mixing 1 part ash-n°-1 with for example 3 parts ash-n°2 which has a low Hg level, or with 20 parts phosphate rock with a near-zero Hg content. If a company uses more than one different ash, then the required “proportional removal” rate for each contaminant is that of the most polluted ash.

- The company has two options ([i] or [ii]) to demonstrate “proportional removal”
  - [i] - Calculate the total amount (kg) of contaminant transferred to output streams which either (a) go to waste disposal or (b) fix the contaminant in a safe and stable form (e.g. stable building products such as concrete or bricks).  
To do this, the contaminant concentration and tonnage of these output streams must be measured.  
Example: if a company is using two ashes, containing respectively 23 and 7 kg Hg per month, and the required proportional removal rate<sup>xv</sup> is 2/3, then the company would have to demonstrate that >20 kg Hg/month is being transferred to waste or safe outputs
  - or
  - [ii] - Calculate the total amount (kg) of contaminant present in all “relevant” products produced, again by tonnage x concentration. “Relevant” products are all: fertilisers and soil improvers (CE mark, national or exported outside the EU) or intermediates transferred to other companies for use in production of CE mark fertiliser products (see discussion under “Intermediate products” below)  
In the above example (23 plus 7 kg Hg/month inputs, 2/3 required removal rate) the total in output fertiliser and soil products would have to be < 10 kg Hg/month.

In both methods [i] and [ii], the company must take for calculations the most “pessimistic” outcomes in terms of sampling and measurement errors.

Note 1: the above proposals might be complex or inappropriate if the ash is somehow combined with organic materials. To ESPP’s knowledge today (see examples provided), ash-as-an-ingredient is used to produce mineral fertilisers PFC1(C). It may therefore be appropriate to explicitly specify this, unless stakeholders indicate processes leading to organic or organo-mineral products.

Note 2: industry stakeholders should be consulted to define appropriate sampling regimes for the calculation of “proportional” contaminant removal above (input ashes and other input materials, output fertiliser products, output wastes and safe removal of contaminants), depending on production unit size and type (continuous, batch).

## 6) Intermediate products

Example: a company may process ashes to produce phosphoric acid, which is then sold to other company(ies) which use this as an ingredient for fertiliser production. We suggest that **the CMCxx ash-as-an-ingredient should also include these intermediate products** under the following conditions:

- the proportional contaminant removal obligation (above) should be applied to the company processing the ash, who would then produce a phosphoric acid. Technically, the contaminants could be removed by the downstream company, during in the processing of the phosphoric acid to fertiliser, however this would mean that responsibility for verification of the contaminant removal would become unclearly defined in the processing chain
- the intermediate contaminant would have Fertilisers Regulation CMCxx status (but not CE-mark fertiliser status, because it would presumably not correspond to PFC criteria)
- the obligation to prove that the final product is CE-mark eligible would lie with the downstream company (the producer of the final fertiliser product – which is logical), by proving that the intermediate used was indeed conform to CMCxx<sup>xvi</sup>

## 7) Interactions with End-of-Waste status (EoW), ABP status, REACH

The proposed Fertilisers Regulation bestows EU End-of-Waste status (EoW) on any product which obtains the CE-label.

Ashes destined to be used as **ash-as-an-ingredient are clearly a “waste”** (such as sewage sludge incineration ash). ESPP supports that they retain their “waste” status during transport to and within a processing site using them as a fertiliser ingredient, up until their entry into the process, in order to ensure safety documentation, traceability, producer responsibility.

Fertiliser products resulting from the production process and conform to the above requirements concerning ash-as-an-ingredient and concerning the process (proportional contaminant removal) and **these fertiliser products would have End-of-Waste status if they receive the CE-mark** (conform to PFC, monitoring, labelling criteria).

The case of intermediate products is more complex (where these are used for fertiliser production, as above). These would not benefit from End-of-Waste status by the Fertiliser Regulation, because they are not a CE-mark product. Their End-of-Waste status would therefore (as at present) be given by national regulators or company self-declaration.

**Ash will not have Animal By-Product status** because the incineration or combustion conditions are sufficient to ensure recognised ABP end-point and complete safety (no need for ABP traceability and paperwork). If there is any possible doubt about this, then we suggest that ash should only be eligible for CMC status (for both ash-used-directly and ash-as-an-ingredient) if the ABP end point has been achieved in the combustion process<sup>xvii</sup>.

**REACH:** ESPP suggests that

- ash used as ash-as-an-ingredient remains a waste (see above), so not subject to REACH
- products produced using this ash-as-an-ingredient (and intermediates as above, if they have End-of-Waste status) should be subject to REACH
- Art 2(7)d (“recovered substances”)

- should apply (as suggested in line 3411 onwards of the JRC May 2017 STRUBIAS Interim Report) to ash-used-directly (ash is “recovered” from the combustion process)
- should also apply intermediates (as discussed above) recovered from ash-as-an-ingredient
- but should NOT apply to products produced using ash-as-an-ingredient because by definition the ash is being processed to generate a new product, not simply “recovered”

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- <sup>i</sup> JRC Interim Report “DRAFT STRUBIAS Technical Proposals. DRAFT nutrient recovery rules for recovered phosphate salts, ash-based materials and pyrolysis materials in view of their possible inclusion as Component Material Categories in the Revised Fertiliser Regulation” circulated to the STRUBIAS group 24<sup>th</sup> May 2017
- <sup>ii</sup> Clarification is needed at : page 114, line 4022 under “post-processing” - clarify the term “mixing” , line 44 “STRUBIAS materials should meet quality requirements so that they can be used directly without any further processing other than normal industrial practice” – clarify the term “normal industrial practice”, refer to page 41 line 1592 onwards.
- <sup>iii</sup> The STRUBIAS report proposes for phosphate salts to apply the same criteria where these are reprocessed chemically (to produce another fertiliser product) as when they are used directly on the field. ESPP supports this for these products, because reprocessing will probably be a minor route (in terms of quantities and economic value) and for simplicity it is easier to apply the same criteria. Also, these salts are very similar to fertiliser products, so two sets of criteria would lead to ambiguity. This is not the case for ashes, where different ashes are completely different in agronomic properties (sewage sludge incineration ash, meat and bone meal ash) and where chemical reprocessing will probably be the only route for some types of ash (sewage sludge incineration ash).
- <sup>iv</sup> the JRC May 2017 STRUBIAS proposals suggest limits for B, Ba, Co, Mn, Mo, Sb and V. ESPP is currently consulting stakeholders and may propose justification that some of these limits be removed, adjusted or only applicable in case of certain input materials – however we do accept the principle that some such specific heavy metal limits may be appropriate for elements not limited in the PFC annexes and susceptible to be found at significant and potentially concern-raising levels in ashes
- <sup>v</sup> a fertiliser product manufactured using ash as a main ingredient, or even ash as a small part of ingredients (e.g. alongside phosphate rock), cannot be CE labelled under CMC1 (because ashes are a waste), even if the final product produced is a standard mineral fertiliser (such as DAP or TSP ...) which would be covered by CMC1 if produced entirely from virgin materials (phosphate rock). The currently proposed “industrial by-products” amendment to CMC1 – if adopted - will not and is not intended to resolve this because ash is a waste, not a by-product.
- <sup>vi</sup> The German regulation is expected to require at least 80% recovery of phosphorus from some 300 000 tonnes/year of sewage sludge incineration ash
- <sup>vii</sup> Art. 42.1 (if not amended) effectively defines the conditions for adding new CMCs: (a) which are likely to be subject of significant trade on the internal market, and (b) for which there is scientific evidence that the they do not present an unacceptable risk to human, animal or plant health, to safety or to the environment, and that they are sufficiently effective. It needs to be clarified how the criteria in (b) are applicable for “ash as an ingredient” in that the ash itself does not need to be safe or effective, if the chemical processing it undergoes renders it so in the final product placed on the market.
- <sup>viii</sup> What is “*nutrient recovery treatment*” vs. “nutrient recovery rules” or “mixing” ? . No ash is “*produced with the objective for ... fertiliser*” – as is always a waste/by-product
- <sup>ix</sup> In the interim STRUBIAS report, line 1539ff it is stated “*any added materials during the thermochemical approach can be considered as input materials and additives to the combustion process*”. Thermochemical processing of ash to remove contaminants and render phosphorus



more plant available (such as AshDec, Phos4Life, Mephrec cited in examples above) use additives (e.g. alkali, acid, chlorides, sulphates ...) which are intended to achieve these functions and are not related to the incineration and gas cleaning process.

- <sup>x</sup> The interim STRUBIAS report line 1539ff states that “*thermal post-processing steps are only economically viable if they take place as an integral part of the combustion process*”. This ignores this regulatory context. It is comparable to stating that “decadmiation of phosphate rock is not economically viable”: today it is not, but that may change if the Fertiliser Regulation fixes cadmium limits for mineral fertilisers.
- <sup>xi</sup> Indicative example of calculation of contaminant “removal”: If a company uses sewage sludge incineration ash with Hg 300 mg/kg to produce a “mineral fertiliser” for which the PFC specifies Hg < 100 mg/kg, then the company should demonstrate that their process removes at least 2/3 of the Hg – even if the company is mixing 1 part ash with 9 parts phosphate rock and the rock has Hg content zero.
- <sup>xii</sup> The EU Waste Framework Directive 2008/98, art. 4(7) states “The reclassification of hazardous waste as non-hazardous waste may not be achieved by diluting or mixing the waste with the aim of lowering the initial concentrations of hazardous substances to a level below the thresholds for defining waste as hazardous.”. Art. 13 of this Directive states “Member States shall take the necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment ...” and Commission Guidance (June 2012) states that this should be interpreted as follows: “For example, diluting hazardous substances in recycled products (for example diluting pesticides in recycled plastics products) would increase adverse environmental impacts.”
- <sup>xiii</sup> Note : if PFC criteria finally defined limit  $C_{rVI}$  rather than total chromium, then this may require a specific approach
- <sup>xiv</sup> This will result in a higher required removal rate (more conservative) than strictly “proportional”
- <sup>xv</sup> based on the ash with the highest concentration of Hg, not the ash bringing the highest tonnage per month. Note that pre-mixing of ash to reduce the highest concentration and so reduce the required proportional removal rate is not acceptable, as this would contradict the Waste Framework Directive principle of non-dilution.
- <sup>xvi</sup> This is the same as for a company using digestate CMC4 or CMC5 as an input and processing it by e.g. drying and granulation, blending with other nutrient products, to produce a CE-Fertiliser.
- <sup>xvii</sup> As a function of the input ABP category and the combustion conditions