ESPP proposals for secondary materials for consideration as new CMCs in the EU Fertilising Products Regulation

Conditions Material	**Origin / process**	**Technology status & potential**	**Current FPR status**	**Safety**
Mineral nutrient products from gas scrubbing			*N-salts, sulphur and sulphate salts (inter alia) covered in CMC15*	
Calcium carbonate recovered from drinking water treatment			*Specifically included already in CMC6 (food industry byproducts)* *Eligible for CMC11 – drinking water treatment is a "production process"*	
Fertilisers produced by chemical processes from mining tailings	*Example: Phosphate salts from phosphogypsum waste stacks*		*Covered by CMC1 if produced as part of the mining process.* *Covered by CMC15 art. 2a (subject to purity conditions) if the fertilising material is recovered from waste, where the waste has resulted from a production process (e.g. production of fertiliser or production of rock concentrate from phosphate rock)*	

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Derivates of used mineral acids (e.g. sulfuric, phosphoric, nitric …) or other minerals where these have waste status.	*Inputs are spent acids or other minerals from the following production processes or offgas purification:* • *Oil and gas refining* • *Caprolactum* • *Titanium dioxide* • *Steel, copper, zinc …* • *Methyl methacrylate* • *Acrylonitrile* • *Nitrates, urea …* • *Melamine* • *…*	*Such acids and minerals can be used as precursors in production of CMC1 materials, but only if they have "by-product" status, and not if they have (or have had) "waste" status. This classification is inconsistent between Member States.* *Widely used today in the production of mineral fertilisers.* *Source: Fertilizers Europe "Circular Economy & the European fertilizer sector" 2019.*	*If such acids and mineral are directly used in fertilisers, they are covered by CMC15 (subject to conditions).* *If they are used as precursors in fertiliser production then – in ESPP's opinion – the resulting fertiliser chemical may be covered by CMC15 (2)a, because the its production is a "recovery" process.- see ESPP submitted FAQ.*	

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Potassium, calcium and other salts recovered from (non CMC13) ashes	Chemical re-processing of the fly ash from municipal solid waste (MSW) or from other waste incinerators or waste-to-energy plants or from cement production. Potassium is c. 2% of coal power plant ash, c. 3% of MSW incinerator fly ash (as K).	7 000 t/y of potassium (K) in Sweden from MSW incinerator fly-ash alone (15 incinerators) → nearly 200 000 tK/y in Europe (410 incinerators). Full scale plant under construction in Sweden (130 000 ty/y fly ash) EasyMining Ash2Salt NOAH (Norway) is currently operating a pilot plant with planned 80 000 t/y of salts (KCl, NaCl and CaCl2) Langøya, ReSalt, CarbonTech (see IEA Biotechnologies 10/2020) and NOAH). Holcim 100 kg/day pilot installation, ReduDust Process, Rohoznik, Poland.	Excluded from STRUBIAS "thermal oxidation derivates" because MSW excluded from input list. MSW and other ashes are a waste, so excluded from CMC1. Excluded from CMC11 and CMC15 because not from a "production process" and not from offgas.	Heavy metals should be removed. Incineration contaminants (dioxins etc) are not expected in fly ash, but should nonetheless be verified. PFC heavy metal limits plus STRUBIAS CMC14 "thermal oxidation" contaminant limits could be applied.
Ammonium salts from powder fire extinguisher refurbishment	During regular fire extinguisher maintenance, all the powder is removed and replaced. The part which cannot be re-used is cleaned using solvents (to remove additives used in extinguishers, such as silicone which improve spraying) to deliver clean ammonium salts (ammonium phosphate, ammonium sulphate).	The EU potential for this recycled material is estimated at c. 100 000 t/y. Process demonstrated in Horizon Europe PHOSave project. Demonstrated in "FIRECOMPOST" project, funded by the Calabria Region POR FESR-FSE 2014-2020	Spent material is waste -> excluded from CMC1. Not covered by CMC11 because not "produced as an integral part of a production process" Not covered by CMC15 because not "recovered from waste generated from a production process"	Solvent cleaning ensures contaminant removal. Resulting product (ammonium phosphate) can be used directly as a fertiliser, after granulation or blending.

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Nitrogen recovery from liquid phase of wastewaters	Nitrogen is recovered from municipal wastewater (in sewage or sludge treatment) or other wastewaters (e.g. food industry, landfill leachate) by some combination of membrane separation, ion exchange, adsorption - regeneration, the processing to ammonia salts.	EasyMining process: 4 m^3/h pilot operating. In some cases, this functions via a Precipitated Phosphate Salt, in which case covered by CMC12. Cetaqua process under development using commercially available membranes, 1 m^3/h pilot tested, LIFE ENRICH, at ESTE wwtp, Murcia, Spain, producing 45l ammonium nitrate per week. For potential, see Eureau Fact Sheet. https://www.eureau.org/ (publication pending).	Recovery from offgases from wastewater treatment is covered under CMC15 2(b)iii but NOT recovery from the liquid flows in wastewater treatment. Excluded from CMC11 because wastewater treatment is not a "production process". Excluded from CMC1 because the initial substrate is a waste.	Need to verify heavy metals, organic contaminants, pathogens. Proposal: use the same limits for organic carbon (<0.5%) and for contaminants and pathogens as in CMC15.
Biomass grown in sewage and in other waste waters: i) mechanically processed, ii) chemical extracts.	Algae production can be "fed" with wastes, including nutrients in manure, sewage, digestates, or in biofuel processing discharge, or offgas from cement production (CO_2 or NO_X mitigation); Includes algae, micro-algae, duckweed, other photosynthetic aquatic plants. Can be used either as fertiliser (nutrient content), soil improver (organic carbon) or in biostimulants.	Operational full scale For potential see Eureau Fact Sheet See ESPP – Eureau - EABA letter to DG ENVI and DG GROW of 17th November 2021 at www.phosphorusplatform.eu/regulatory	Both (i) and (ii) excluded from CMC1 because waste derived? (i) included in CMC2 (plant materials) but only if processing is mechanical only (not e.g. extracts), and if blue-greens not detectable, and if free from foreign materials (plastics, litter, …).	Such waste-fed materials are generally excluded from use as animal feed or in human food, so fertilisers are optimal use. May accumulate contaminants from the waste?
Biomass collected as waste, after processing	E.g. seaweed from beach cleaning or canal clearing	Propose to consider with waste-fed algae etc. above		

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Fish excreta	Fish excreta are excluded from "manure" under the ABP	Estimated currently c.20 processors in Norway and others starting up. For one example see here Total fish sludge in Norway alone is > 800 000 tDM/y. Only land or closed-pen based is available for recycling, but this part is increasing, see here p14. Disposal costs and nutrient content make recycling to fertiliser potentially attractive.	Currently not listed for use in FRP CMC3 compost, CMC5 digestate, CMC10 animal by-products, CMC12 precipitated phosphates, CMC13 pyrolysis/biochars, CMC 14 ash-based products.	Maybe high Zn content because of Zn in fish feed. Proposal: for FPR, accept same requirements as for other "manures" (sterilisation in some cases) Possibly accept also specific national sterilisation processes (e.g. for Norway, see here pp31-32). Norway report concludes use is safe for humans and farm animals (untreated use near water could pose risks for fish, but this is not relevant for FPR products). Pertinent to request EFSA Opinion?
Fish and seafood processing residues & fish bones	Certain by-products from processing fish and shellfish for production of human food or animal feed. In particular, acid-treated fish bones, which have high phosphorus and nitrogen content.	"Effect of fish bones and algae fibre as fertilisers for ryegrass", Norsok 2019 "Valorisation of fish bones ….", A-K. Loes et al., 2021. "Harvesting our fertilisers from the sea… A-K. Loes et al 2021.	Not currently covered by EFSA Opinion of 20 October 2021. Fish bones, treated with formic acid to render nutrients better plant available, are authorised as a fertiliser in Organic Farming in Norway. "Fish meal" is included in the list of Authorised Fertilisers under the EU Organic Farming Regulation (2021/1165, Annex II). Fish meal is not addressed in the EFSA Opinion of 20/10/2021 concerning ABPs for fertiliser materials.	When leaving the storage, the material is ABP Cat. 3. The material is permitted for use in certified Organic Farming by the Norwegian Food Safety Authority Material not yet commercially available For contact to industry: runar.fjellgaard@pelagia.no; andreas.nordgreen@pelagia.com Request EFSA Opinion?

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Insect frass	Insect excreta, exoskeletons, un-eaten feed substrate	10 000 t/y in 2019 in Europe. Forecast 9Mt/y by 2030. Contains approx. 4%N, 1.3%P, 2.5%K. IPIFF statement 19th September 2019 info@ipiff.org ; christophe.derrien@ipiff.org	Excluded	Need for EFSA Opinion?: sieving out of larvae? Sterilisation? "Dejecta of insects" is authorised untreated (without sanitisation) in **Organic Farming** (see Regulation (EC) No 889/2008 Annex I page 79 - no conditions for use in the column on the right side. This dates from 1994 originating from the use of dejecta of bees or other insects used in biocontrol.
Separately recovered human urine and products processed therefrom.	Urine from separative toilets or urinals, then some form of stabilisation (e.g. chemical pH modification, filtration, fermentation) and/or other processing, then drying or concentration. Precipitated phosphates from urine. Products can be solid or liquid fertilisers or biostimulants.	Vuna / VunaNexus Aurin piloted and authorised as fertiliser in Switzerland (with activated carbon filtration to remove pharmaceuticals). Toopi Organics France (Paris OCAPI project). Sanitation360 AB (Sweden) https://sanitation360.se/ Blue Diversin Autarky EAWAG Switzerland. http://www.autarky.ch and Meyer et al., 2017 https://doi.org/10.1007/s11104-017-3545-x Hydrohm BV (Uridis), Belgium www.hydrohm.com/uridis.html DLR (German Aerospace Research Centre) https://www.dlr.de/content/en/articles/news/2021/04/20211007_biofilters-for-space-convert-manure-into-high-quality-fertilisers.html Overall, several companies have operated pilots, up to 200 m^3 urine /year. A number of full-scale installations are under construction in France, Switzerland, Germany.	Human urine is excluded from the Animal By-Product Regulation by 2009/1069 art. 2.2k Human urine is not included in the authorised input materials to CMC3 and CMC5 (composts and digestates). Phosphates precipitated from separately collected urine may be excluded from CMC12 ("Precipitated phosphates and derivates") by art. 1(a). **This needs to be clarified.** Authorised as fertiliser in Sweden. Authorised as fertiliser in Switzerland. Registration underway in France.	Need to define what conditions and treatments are required to ensure sanitary safety. Request EFSA Opinion. Pharmaceuticals will be present. Removal processes are possible. A number of studies show biologically safety, low contaminant levels. Tens of field-scale fertiliser trials.

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Processed solids from dry toilets	Human excreta and urine, paper and material added for operation (sawdust, …). After collection, processed by e.g. addition of organic acids, composting, fermentation and/or pyrolysis.	Pilots operational in Germany, Switzerland and elsewhere. Finizio - Future Sanitation GmbH – Germany. Kompotoi AG – Switzerland. Agronomic effectiveness of fertiliser products demonstrated in field trials. Risk analysis: Krause et al.,2021, IGZ project 2019-2020 and Bleuler et al., 2021 for pyrolysis	Human urine is excluded from the Animal By-Product Regulation by 2009/1069 art. 2.2k Dry toilet solids are excluded from CMC14 “Pyrolysis and gasification materials”. Human urine and faeces or dry toilet solids are not included in the authorised input materials to CMC3 and CMC5 (composts and digestates). See proposed FAQ question concerning whether or not precipitated phosphates recovered from human urine are eligible under CMC12.	Need to define what conditions and treatments are required to ensure sanitary safety. Request EFSA Opinion. Safety criteria are specified by German DIN SPEC 91421. Achievement of this specification is demonstrated for most of the companies cited.
Vivianite from sewage	Iron (II) (ferrous) phosphate is precipitated in municipal sewage sludge / digestate, then magnetically separated.	Technology for recovery from municipal sewage digestate is under development: WETSUS ViViMAG 1 m^3/h pilot. Will be upscaled and tested by KEMIRA at 3 sites in Germany, Denmark & The Netherlands in 2022. Vivianite is used as an iron fertiliser to treat Fe-chlorosis, see Diaz 2010, Eynard 1992, Rombola 2003, Rosado 2002, Santiago 2010, 2013. Vivianite recovery has potential for widespread development, because it is applicable to sewage works operating chemical P-removal (dosing iron salts) and this is the most widespread process for sewage works P-removal, with implementation increasing in response to tighter phosphorus discharge limits (EU Water Framework Directive water quality objectives for eutrophication control). WETSUS and KEMIRA estimate that roughly 100-200 kt/y of vivianite (DM) could be produced once the technology is mature and widely applied in EU countries.	Excluded from CMC12 “Precipitated phosphates” by 3(a) iron content.	Purity and contaminants levels are similar to recovered struvite. Proposal to apply the same contaminant limits as CMC12. Could be authorised as an iron fertiliser (micronutrient) but not a phosphate fertiliser, in order to avoid discussions about plant availability of the phosphorus.

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Humous from tree bark	Composting process not CMC3 conform.	Bark considered "waste" by some MS, "by-products" by others. Source: Growing Media Europe.	Not CMC3 Not CMC2 Not CMC1 because not a "substance or mixture" and under CMC1 would require REACH registration, which is unrealistic: compost is exempted from REACH registration in Annex V – BUT CMC1 specifies the exemption from REACH Registration ONLY for substances in points 6 to 9 of Annex V	Tree bark can concentrate heavy metals but these are limited in PFCs 3 and 4
Lime mud ($CaCO_3$), lime dust ($CaCO_3$) and burnt lime (CaO) from the pulp & paper industry.	Lime mud and burnt lime are side streams from paper and pulp mills. Lime dust originates from paper and pulp mills' flue gas cleaning.	Commonly used as liming materials in agriculture in Finland and in Sweden, generally "as is" without reprocessing or hygienisation. Company example: Soilfood sells over 40 000 t/y pulp & paper side stream limes to agriculture https://soilfood.fi/	Excluded from CMC1 since because considered waste or by-product within the meaning of Directive 2008/98/EC. Covered by CMC11 art. 1.1(a) if classified as a "By-Product" (subject to modification of 1(b) to include plants as inputs, and subject to purity and contaminant criteria). However, not covered if classified as "Waste" by local Member State or if reprocessed.	Heavy metals are regulated in PFC2.
Organic-containing sludges from pulp & paper industries	Primary and secondary sludges with > 0.5% organic carbon.	Primary sludge consists of wood fibres too short for use, and is used as a soil improver without reprocessing. Secondary sludge is process wastewater biological treatment sludge, and is composted, stabiliser and/or hygienised before use as a soil improver.		Hygienisation for secondary sludges. Heavy metals content will depend on the mill process and should be verified.
Digestate from biorefineries processing biomass to produce biofuels			Not covered by CMC4 "Fresh crop digestate". Not covered by CMC5 (other digestate) 2c "living or dead organisms or parts thereof which are unprocessed or processed only by manual, mechanical or gravitational means …."	
Minerals recovered from batteries	Recovery of purified mineral products from end-of-life consumer or industrial batteries	Micronutrients: e.g. TraceGrow, see ESPP eNews n°62 Phosphorus from end-of-life lithium iron phosphate (LFP) batteries used for electric vehicles, energy storage see ESPP eNews n°60	CMC15 ????	Contaminant requirements

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Phosphoric acid leached from sewage sludge	Acid leaching from sewage sludge (not from ash, so not CMC13) or from biochars. The phosphoric acid is then used to produce a fertilising product, e.g. by precipitation.	Currently being researched by several companies or institutes. See Tasca in ESPP's SCOPE Newsletter n°141, Shariff in SCOPE Newsletter n°134	CMC12 does not include precipitation from phosphoric acid leached from sewage sludge	Safety will be "better" than precipitation directly from sewage sludge = CMC12.
Plasma treatment of manure, digestates etc	Derivates of pyrolysis gasification materials.	R&D	CMC14 does not cover derivates	Safety will depend on gasification temperature/conditions.