

Ash is a useful chemical substance - It is registered in the European Chemical Register

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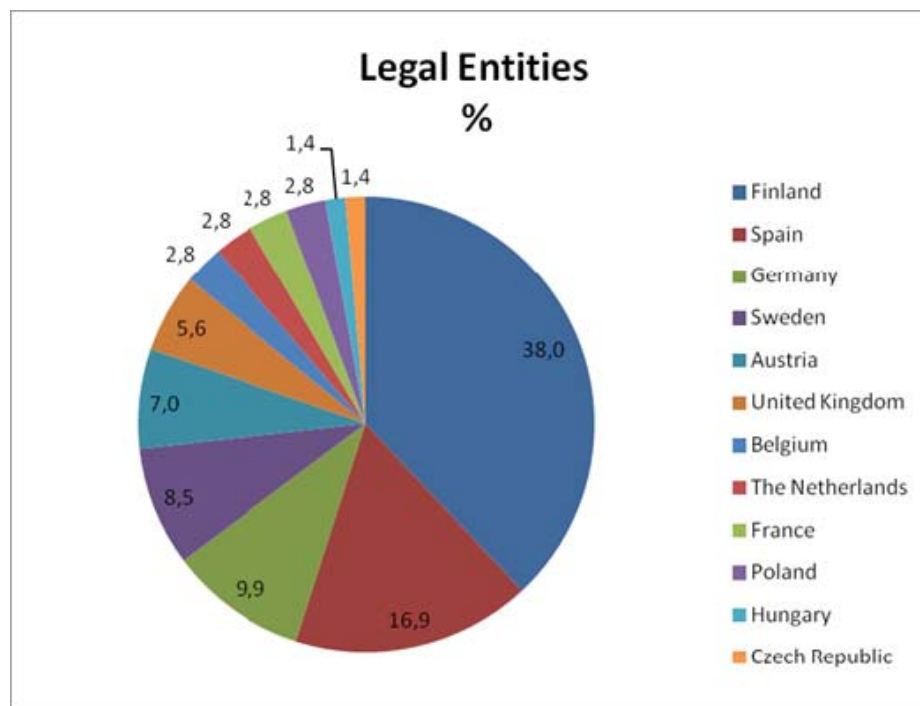
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Ash – a REACH-registered substance

Ash is within the scope of the European chemicals regulation, REACH¹, if it does not have a waste status. Ash is a chemical substance when some chemical modification has taken place, such as a reaction with water in pelletizing.

In November 2010, a Europe-wide consortium (Picture 1) of 71 companies made a joint registration of ash with the European Chemicals Agency (ECHA). The ash product is named according to REACH rules in the registration as “the product from the burning of a combination of carbonaceous materials”. An EC number is not available for this ash at the moment, but a listing number is given by ECHA. Pohjolan Voima Oy from Finland operates as the Lead Company and the Lead Registrant in the Mixed Ashes Consortium. The consortium is guided by a steering committee, in which 10 members are represented. The consortium is managed by the consulting company Linnunmaa Oy. There are also other consortia for ash products such as coal ash.



Picture 1. The distribution of legal entities which are members of the Mixed Ashes Consortium.

The registration costs for ash have been about 700 thousand Euros. If a new company wishes to register its own ash, this takes a few months' time and about 20 – 25 thousand

¹ Regulation (EC) No 1907/2006, of the European Parliament and of the Council, of 18 December 2006, concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, OJ L 396, 30.12.2006, p. 1-849.

Euros per legal entity. For registration, a company needs the chemical analysis of the ash, production and use information, and a letter of access for the joint registration dossier.

The substance is described as “The product from the burning of a combination of carbonaceous materials. The following elements may be present in ash as oxides: aluminum, calcium, iron, magnesium, potassium, and silicon.” Ash was registered as an UVCB substance (Unknown or Variable composition, Complex reaction products or Biological materials), which means that the main issues of substance identification are the fuel composition and the combustion technology, such as fluidized bed boiler or grate firing boiler. This REACH registration covers ash originating from gasification and combustion of biomass, biofuels, peat and sludge with coal, solid recovered fuel (SRF) and supplementary fuels as needed.

The composition and properties of ash vary depending on the type of fuel and the combustion and ash separation technologies used. The registration was based on laboratory analyses of several different ash samples, and variations were taken into consideration in the risk assessment. The typical composition of ash is presented in table 1. For the registration, a mixed sample as a combination of several ash samples was created and analyzed. Additionally, each registrant performed their own analytics on their own ash samples.

Table 1. Typical composition of ash from combustion of mixed fuels.

Constituent	EC number	Typical concentration mg/kg	Min mg/kg	Max mg/kg
aluminum	231-072-3	68900	4500	100000
Calcium	231-179-5	240000	20000	420000
iron	231-096-4	21900	2500	180000
magnesium	231-104-6	18400	3000	150000
phosphorus	231-768-7	4190	400	30000
potassium	231-119-8	13500	500	100000
Sodium	231-132-9	5690	500	25000
Silicon	231-130-8	148000	28000	450000

The registration dossier includes information on the registrant (company information, process description), chemical composition, physicochemical information, toxicological data, ecotoxicological data, exposure data, risk assessment and guidance on safe use (Picture 2). The main and common part of the dossier is covered by the joint dossier submitted by the Lead Registrant.

According to the REACH requirements, several laboratory tests concerning the physico-chemical, toxicological and environmental fate properties of the ash, were conducted by European laboratories on the assignment of the Mixed Ashes Consortium.

The risk assessment based on the study results pointed out that the key hazardous constituents of ash are alkaline compounds and heavy metals. The health risks are mainly related to alkalinity. Alkalinity is in a high degree derived from the content of oxides like calcium oxide. The calcium oxide content varied between 0 and 20 weight % among ash samples from the consortium members (Picture 6) and the analyzed mixed sample had a free calcium oxide content of 8 weight %.



Picture 2. The structure of the REACH dossier in the IUCLID5 format.

Ash is a useful multi-purpose product

The chief asset of ash is its high content of various useful minerals for different uses. Due to its properties, ash is a good fertilizer, stabilizer and filler material. The end uses of ash covered in the REACH registration are:

- Production of Ash (industrial)
- Distribution of Ash (industrial and professional)
- Formulation and repacking of Ash (industrial and professional)
- Use in Ash containing construction materials and castings (industrial and professional)
- Use of Ash in hot aggregates (professional)
- Use of Ash as fertilizer (professional)
- Use of Ash in soil construction (industrial and professional)
- Use of Ash in stabilization, disinfection and animal bedding (industrial and professional)
- Use of Ash in flue gas treatment (industrial)
- Use in paper production (industrial)
- Use in secondary steel process (industrial)

Human and environmental exposures are estimated for all these uses. In some cases, exposure is estimated for professional uses only, such as for farmers, and in some cases only for industrial uses. Some use restrictions are listed in the exposure scenarios. An exposure scenario is documentation of circumstances under which the use of ash is safe. When dealing with ash as a chemical substance, only the registered uses of ash are allowed. A supplier of ash shall provide the recipient of the ash product with a safety data sheet according to REACH (Picture 3, Picture 4). The safety data sheet must include the appropriate exposure scenarios.



Picture 3. Life cycle of ash and safety information (SDS and ES) flow sheet.

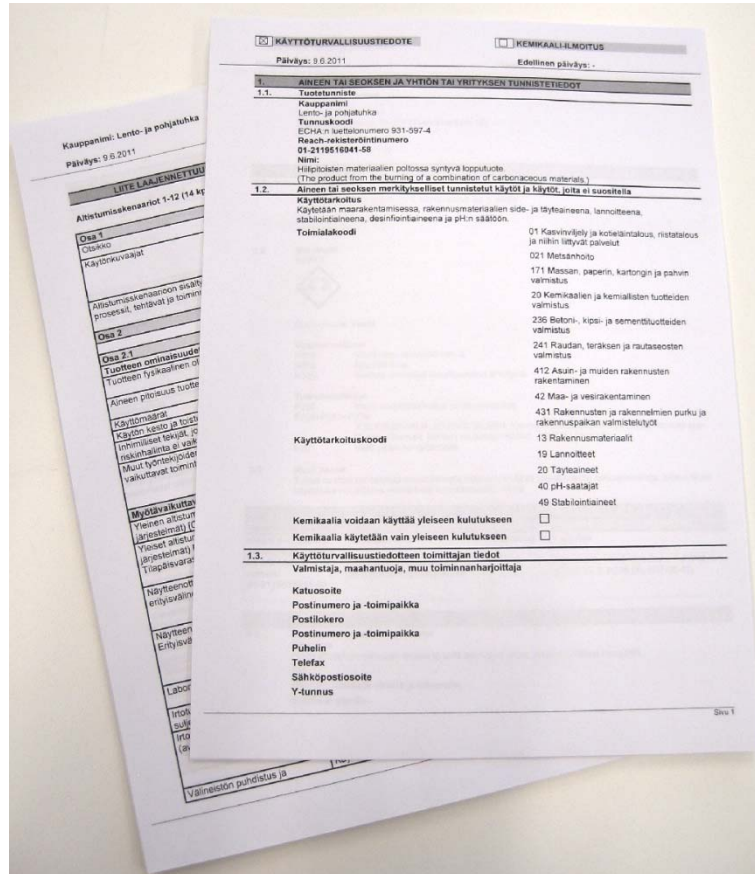
Safe use of ash

The use of ash is safe when the appropriate risk management measures are applied. When handling ash, it is important to use the recommended personal protective equipment to avoid hazards mainly caused by the alkalinity of the substance. If the ash is dusty, inhaling dust should be avoided and respiratory protection is needed. Alkalinity and dustiness are the main hazards of the ash for workers. If personal protective equipment is not used, ash may irritate skin and the respiratory tract and cause serious damage to eyes. The heavy metals which ash contains may be absorbed into the body via lungs or stomach. REACH requires the risk reduction measures to be applied.

Ash is not classified as hazardous to the environment. However, ash may contain compounds (e.g. aluminum, arsenic or heavy metals), which are toxic to aquatic and terrestrial organisms. If these compounds are present at high concentrations, ash may not be utilizable for purposes where the extent of contamination cannot be controlled (e.g. as a fertilizer). In general, uncontrolled releases of large amounts of ash to the environment, waterways or sewers must be avoided.

Safety data sheet and exposure scenario

Upon registration of ash, each registering company receives a company-specific registration number which is then to be added to the chemical safety data sheet of ash. The safety data sheet will also include the exposure scenarios for the identified uses of the chemical. The users of ash should check that their use is covered by the exposure scenarios presented. If his use is not included in the risk assessment made by his ash supplier he can either ask the ash supplier to update the registration to include his use, or make his own risk assessment and register his use by the European Chemicals Agency. Under the current chemical legislation it is not allowed to use a chemical substance without registering it, including making a chemical risk assessment report covering its use.



Picture 4. Safety Data Sheet and Exposure Scenario include the safety information for employees.

Classification

The registrants have prepared a harmonized classification for ash as a part of the REACH registration (Picture 5). The classification is based on the laboratory analyses and risk assessments performed within the registration process.

GHS05 Danger
 Skin Irrit. 2, H315: Causes skin irritation
 Eye Irrit. 1, H318: Causes serious eye damage
 STOT SE3 H335: May cause respiratory irritation.



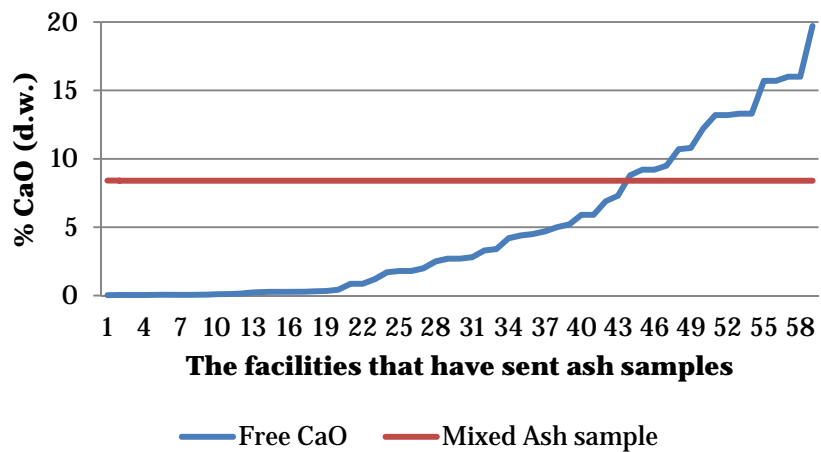
Picture 5. Classification on ash according CLP regulation².

Ash is classified as corrosive mainly due to the high content of calcium oxide which, however, in many uses is also the most useful property of ash. During the aging process, the calcium oxide content of ash decreases, which decreases the corrosivity and may also give the ash a higher value as a raw material for different purposes. Mixed ash is not

² Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006, OJ L 353, 31.12.2008, p. 1–1355

classified as hazardous to the environment according to rules of the chemical regulation REACH. Ash is not classified as dangerous goods for transportation.

Free CaO



Picture 6. Free calcium oxide content in different ash samples.