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RESOURCE EFFICIENT MANAGEMENT OF MSW INCINERATION FLY ASH – THE CASE OF VIENNA

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Introduction:

Pursuant to the commission decision (2000/532/EC) municipal solid waste (msw) incineration fly ash (19.01.13) and boiler dust (19.01.15) containing dangerous substances are classified as hazardous waste. In respect to the council directive (1999/31/EC) on the landfill of waste these materials have to be landfilled on a landfill for hazardous waste or on a landfill for non – hazardous waste if the matter is stable, non – reactive and has equivalent leaching behaviour to non-hazardous waste (e.g. solidified, vitrified). Criteria regarding the leaching behaviour are general described in Annex II of directive (1999/31/EC) and specified in detail in council decision (2003/33/EC), which contains requirements with respect to the eluate quality as well as proposals for the leaching test.The described legal framework is implemented into Austrian law (AWG, 2002), (DVO, 2008) and (AbfallverzeichnisVO, 2003). Additionally to the Austrian eluate requirements criteria on the total content of the elements As (5.000mg/kg), Hg (20 mg/kg) and Cd (5000 mg/kg) are given for non-hazardous waste landfills (Reststoffdeponie).In (Quina M., 2007) the maximum content of As detected in an APC residue was 960 mg/kg and 1660 mg/kg for Cd. For Hg a maximum amount of 51 mg/kg was given. Maximum values given in (IAWG, et al., 1997) are lower than the ones given in (Quina M., 2007). This means that according to the Austrian law beside eluate quality only total Hg contents in the fly ash have to be considered regarding landfilling at non-hazardous waste landfills.

Without any preliminary treatment (solidification/stabilization) the generated fly ashes (filter ash, boiler ash) do not fulfil criteria to be landfilled at non-hazardous waste landfills, neglecting fly ashes from fluidized bed incinerators. Reasons why a fly ash cannot be disposed without prior treatment are the content of total dissolved solids as well as the leachability of certain elements like Pb, Cd and Zn (Purgar A., 2013). Also the total content of Hg might be exceeding limit values for waste acceptance at non-hazardous waste landfills. In Vienna fly ashes that cannot be disposed of on a landfill for non-hazardous waste are stabilized with Portland cement prior to their disposal or are exported to be stored at hazardous waste landfills. The main aim of the ongoing project is to investigate alternative treatment methods to the stabilization process under consideration of the existing infrastructure in Vienna regarding waste incineration and residue disposal.

Methods:

In cooperation with the plant operators, detailed information about the waste incineration cluster of Vienna including the infrastructure for the disposal of the residues (cement stabilization facility and residue landfill) is acquired. Based on information about the operational concept of the incinerators together with data about the residue composition (total contents and leachability), determined by the obligate basic characterisation of waste, the basis for the decision whether a literature proposed technology is suitable or not is gained. Treatment methods for MSW fly ash have been investigated for decades and a variety of different concepts can be found in (Thome-Kozmienky, 2013) or (Astrup, 2008). Within this work it is investigated whether fly ashes can be used as secondary resource in the cement industry (Lederer, Rechberger, & Fellner, 2015) or for phosphorus based fertilizer production (Egle, Rechbergerh, & Zessner, 2014). Additionally the possibility of Zn recycling with the FLUREC process is investigated (Schlumberger & Bühler, 2013). Wet chemical treatments as well as thermal treatments, similar to the MR or 3R process, described in (IAWG, et al., 1997), are considered.

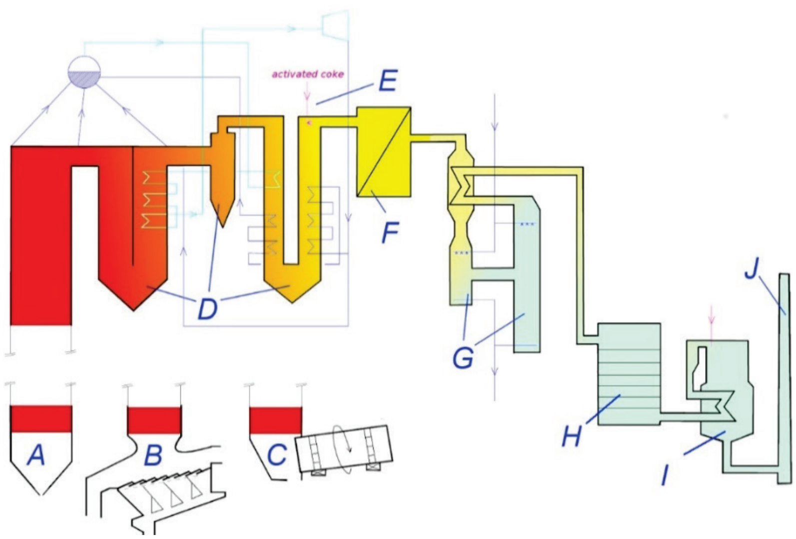

Figure 3 A) fluidized bed combustor, B) grate furnace, C) rotary kiln, D) heat recovery zone E) activated coke injection (optionally) F) electrostatic precipitator or fabric filter G) wet scrubbers H) fixed bed coke adsorption (optionally) I) selective catalytic reduction J) chimney

Results:

About 1 million tons of waste, derived from 13 combustion lines in Vienna, are incinerated annually, whereby 45,000 tons of fly ash are produced. As combustion technology rotary kilns, fluidized bed combustors or grate furnaces are used. All the incinerators are equipped with a heat recovery system followed by the flue gas cleaning system. The flue gas cleaning system consists out of electrostatic precipitators or fabric filters optionally with the injection of activated coke prior to the filtration. All the incinerators are additionally equipped with a wet flue gas cleaning system. Incinerators without activated coke injection use a fixed bed coke adsorber. As a final step of the flue gas cleaning process a selective catalytic reduction system (SCR) is installed. A simplified scheme can be found in Figure 3.

Fly ashes investigated from fluidized bed combustors fulfil criteria for landfilling at a non-hazardous waste landfills. Only fly ashes resulting from mono combustion of sewage sludge may be used for the production of phosphorous based fertilizer. Neglecting heavy metal contents, other fly ashes investigated do not show phosphorus concentrations high enough to be potentially classified as fertilizer according to (DüngemittelVO, 2004).Untreated fly ashes from grate furnaces and rotary kilns exceed the limits for a disposal on a non-hazardous waste landfill. They can also not be used as substitute for marlstone in the cement industry, though the composition of the Matrix elements (Ca, Al, Fe) is similar. The main reasons are the increased chlorine and heavy metal contents (Lederer, Rechberger, & Fellner, 2015).Zn recycling, based on (Schlumberger & Bühler, 2013), is not economically reasonable due to low concentrations of Zn in the investigated fly ashes and the high alkalinity according to (Fellner, et al., 2014).

Considering that the investigated fly ashes meant to be disposed of at a non-hazardous waste landfill ("Reststoffdeponie" in Austria), a contamination or stabilization process is necessary. As a cement stabilization process is in operation currently, the focus is on thermal and wet chemical treatments or a combination. All fly ashes, except for those from fluidized bed combustors, show an increased content of total dissolved solids. A "pH-neutral" fly ash washing might reduce the content below the threshold parameter of 100 g/kg. Several fly ashes show increased leachability of Pb, Cd or Zn. Fly ash washing may improve these values not considering other elements. If the flue gas cleaning system of an incinerator is equipped with coke injection upstream the baghouse filter, the total content of mercury might exceed the threshold parameter of 20 mg/kg. Fly ash washing (acidic or neutral leaching) is not appropriate to reduce the Hg concentration decisively from fly ashes investigated (Purgar, et al., 2014), therefore an additional thermal treatment is envisaged and investigated.

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