



Developments in management of solid waste incineration ashes

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Overview

- Main conclusions
- Waste incineration ashes description
- Ash management situation in EUR Countries
- “Quality of MSWI bottom ashes”
- Upgrading possibilities and developments
- Some conclusions

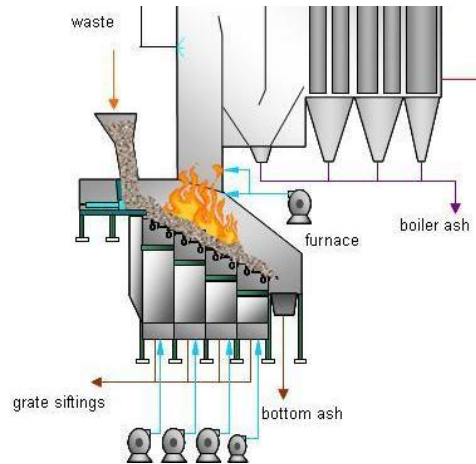
Main conclusions

- Legislative framework on utilisation / landfill of bottom ashes completely different per country and not developing parallel
 - Therefore no drivers for upgrading utilization Europe wide (challenge NGBW: > 70%)
 - European Union should promote harmonization
- Ferro / non ferro removal to be promoted
- Dry ash discharge from the MSWI is a challenging new development that will increase utilization possibilities
- Aging and wet treatment both increase the quality of BA and support improved utilization

Waste → incinerator ashes



1000 kg



Fly ash 15 kg



Non ferro 2 kg

Ash management practices



(Sound barrier wall along Dutch motorway)

Bottom ash management options

- Landfill (untreated)
- Challenge NGBW: improve bottom ash utilization up to avg 70%

Treatment options

- Standard upgrading and
 - Removal of iron and non ferro → landfill
 - Use in roads and embankments
 - Use as a cement raw material
- Further upgrading and
 - use as an aggregate

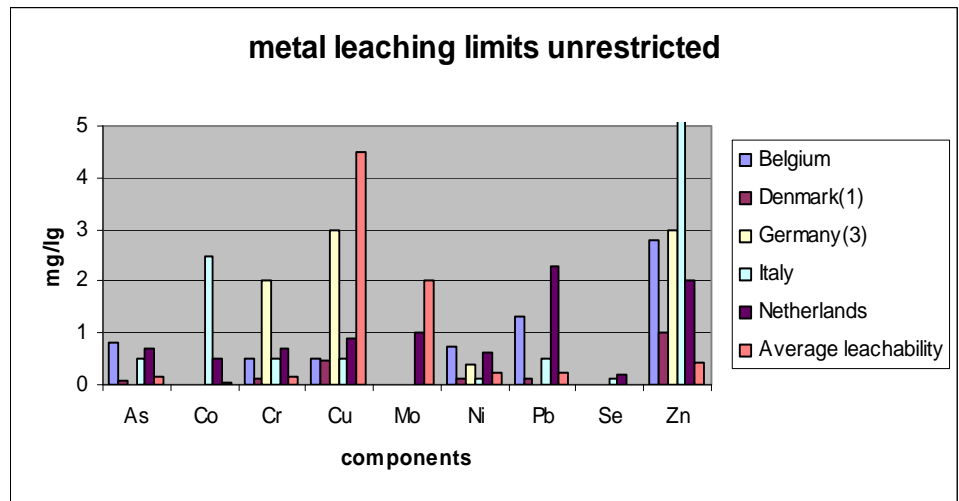
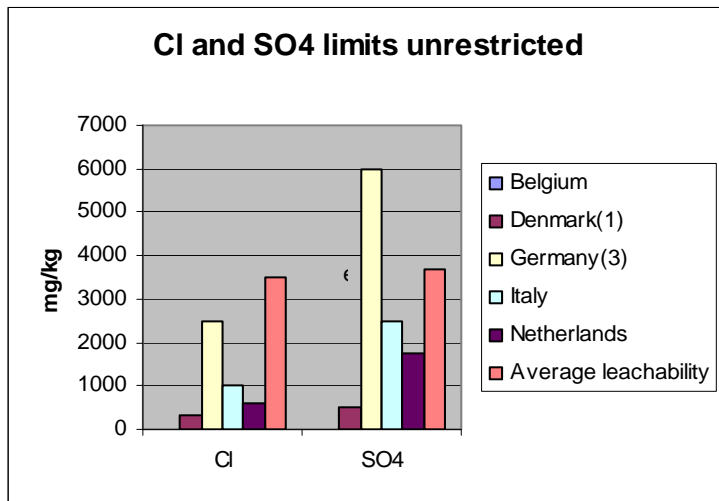
Drivers for utilization

- Ferro non ferro profits pay for upgrading
- Landfill costs
- Quality of bottom ashes
- Taxes

Barriers for utilization

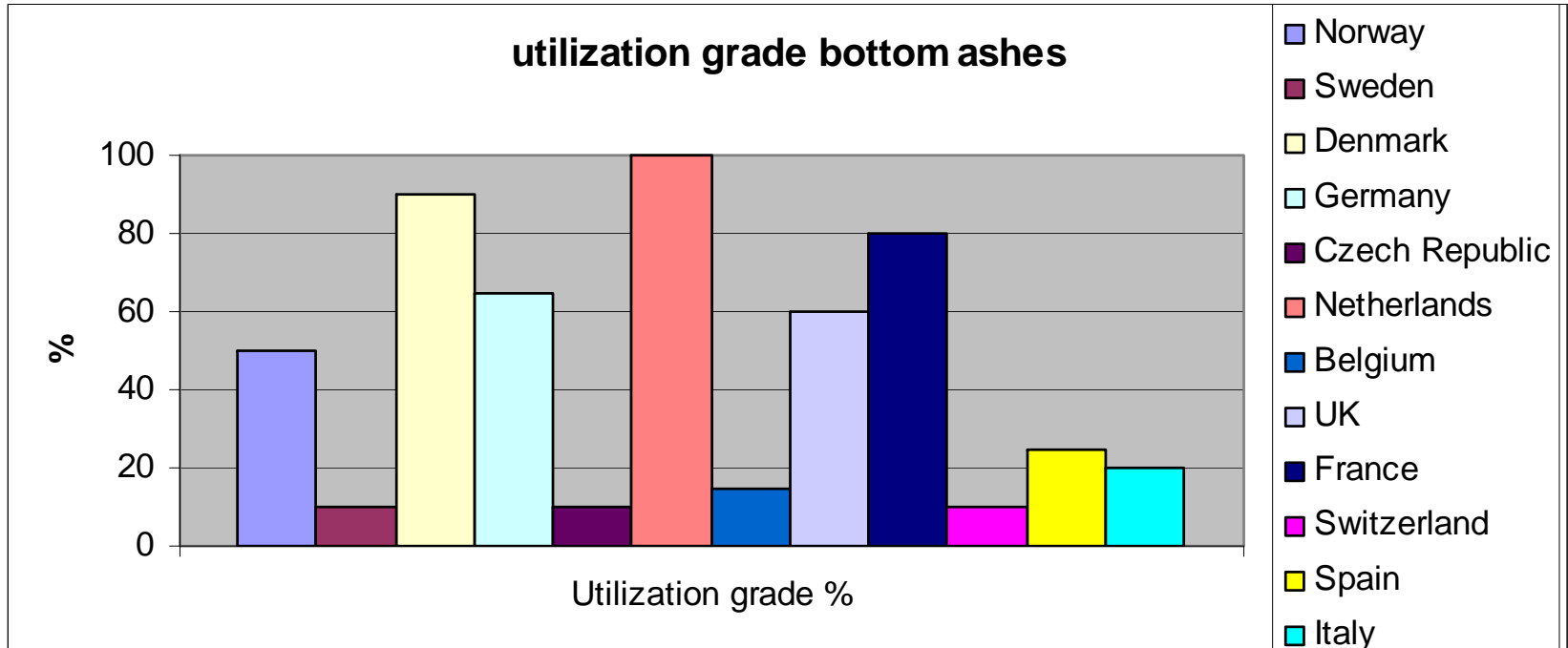
- Legislative and testing differences
- Restrictive legislation It, Be, Sw, No
- Lacking legislation UK, Sp
- Lack of experience
- Unclearness on toxicity demands

Leaching limits for unrestricted utilization compared



- Conclusions:**
- impossible to meet leaching limits without upgrading (even very difficult with upgrading)
 - large differences per country

Utilization percentages



Improving utilisation

- Clear and pragmatic regulation
- Good quality control
- Specifications for use
- Experience through demo projects
- Increase confidence through better utilisations

Quality of bottom ashes



Quality of MSWI bottom ashes

- The quality (leachability and LOI) of MSWI bottom ashes is regularly determined in GE, NL, Dk, Fr, No, and to a less extent It.
- Testing methods and legislative framework are different so that quality is a relative concept
- Furthermore quality is also dependent on the moment of analysis. In the Netherlands the leaching behaviour is partly measured quickly after ash generation from the MSWI, partly after temporary storage. This heavily influences the “quality”
- Furthermore changing legislation influences quality
- Therefore lets take leaching behaviour as an indication for quality

Basic parameters to decide quality

- Loss on Ignition (should be $< 5\%$ according to WID)
- Leachability of:
 - Cu, SO₄, Cl
 - Mo, Sb (only NL)
 - Pb, As (Dk)
 - Ni (Dk, It)
- Composition decides on yes / no hazardous material
- Quality is dependent on the local federal legislative framework on ash utilization and on federally decided market possibilities: No market → no quality incentives!

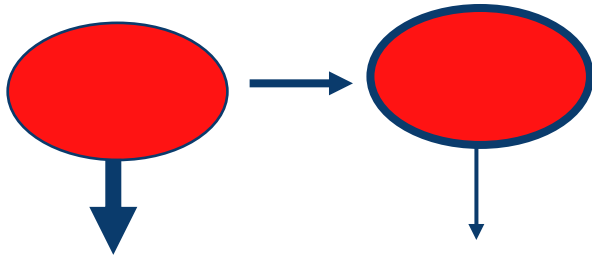
Bottom ashes, quality influences

- The quality of bottom ashes is dependent on the following aspects:
 - **Quality of feed material / input**
 - Type and process parameters in the incineration process (a.o. oxidizing / reducing conditions)
 - Type and process parameters of ash discharge (quench parameters, **water surplus and -recirculation**, type of ash transporter)
 - **Length and type of maturation / storage**
 - **Possible upgrading effects**

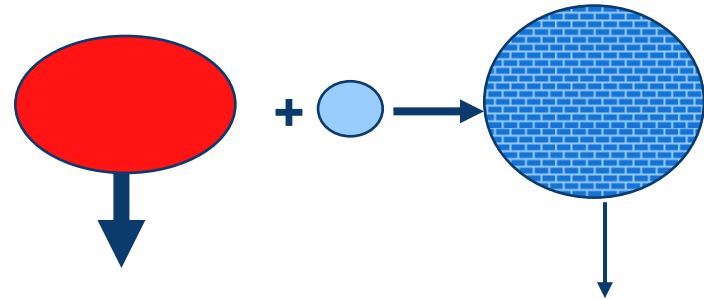
Known quality relations

- Relation pH – Cu / Pb / As / Mo leachability
- Relation DOC – Cu leachability
- Relation age - SO₄ leachability

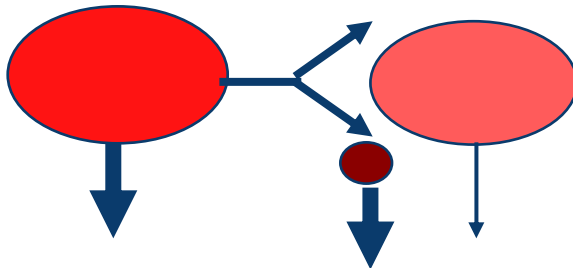
Techniques recovery



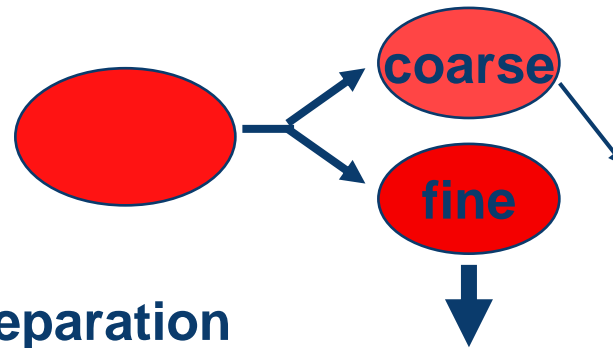
Upgrading



Solidification / stabilization



Removal



Separation

Recovery options

- Metal separation
- Dry ash discharge
- For ashes that have been in a conventional wet ash discharge the following options are open:
 - Aging and maturing (both natural and extended)
 - Washing and separation of selected grain size classes
 - Solidification and stabilization (construction materials route)

Short overview dry ash removal

- Dry ash removal to change the ash properties:
 - Lower leaching
 - Optimal ferro and non ferro removal
 - Optimal classification possibilities because of dry and not agglomerated ashes
- Demonstrated in Switzerland; Martin also has its own development
- Dry ash removal to reduce heat losses through quenching

Wet treatment systems

- Process integrated wet treatment
 - Applied commercially in Germany (Hamburg)
 - High reductions in chlorine and salt leachability
 - Effects on metals variable
 - Effect by washing and sludge separation
- Wet particle separation
 - Applied in pilot / development phase in Amsterdam
 - Applied in Belgium Indaver
 - High reductions in leachability – high enough?
 - Several commercially interesting fractions
 - High potential metal separation

Aging

- Natural aging
 - 3 months normal in Germany
 - Effects dependent on type of ash
 - Often good effects on metals
 - Increase in sulphate leachability
- Extended aging (carbonization)
 - Test phase executed at several Dutch plants
 - Good results, but the strictest level was not reached
 - Stopped mostly after adjustments of regulations –
apart from one Dutch plant who needs to upgrade in
winter

Solidification and stabilization

- Melting techniques only used in Japan – very energy unfriendly
- Both in France, Belgium, Netherlands, stabilization with cement and utilization as a soil improvement
 - Utilization can meet strict leaching criteria
 - Use of fractions in building materials in development

Conclusions on recovery / utilization

- Quality control for leaching and legislative framework on utilisation / landfill completely different per country
- Therefore no rules of thumb for utilisation
- No drivers for upgrading utilization Europe wide
- Export of bottom ash is difficult
- Utilisation to prevent unnecessary landfill
- Ferro non ferro separation is a must
- Recovery options are therefore dependent on utilization possibilities and leaching limits; as a rule of thumb aging and grain size separation are most promising;
- dry ash discharge is an interesting new option