

State of the art in metal extraction from Incinerator Bottom Ash

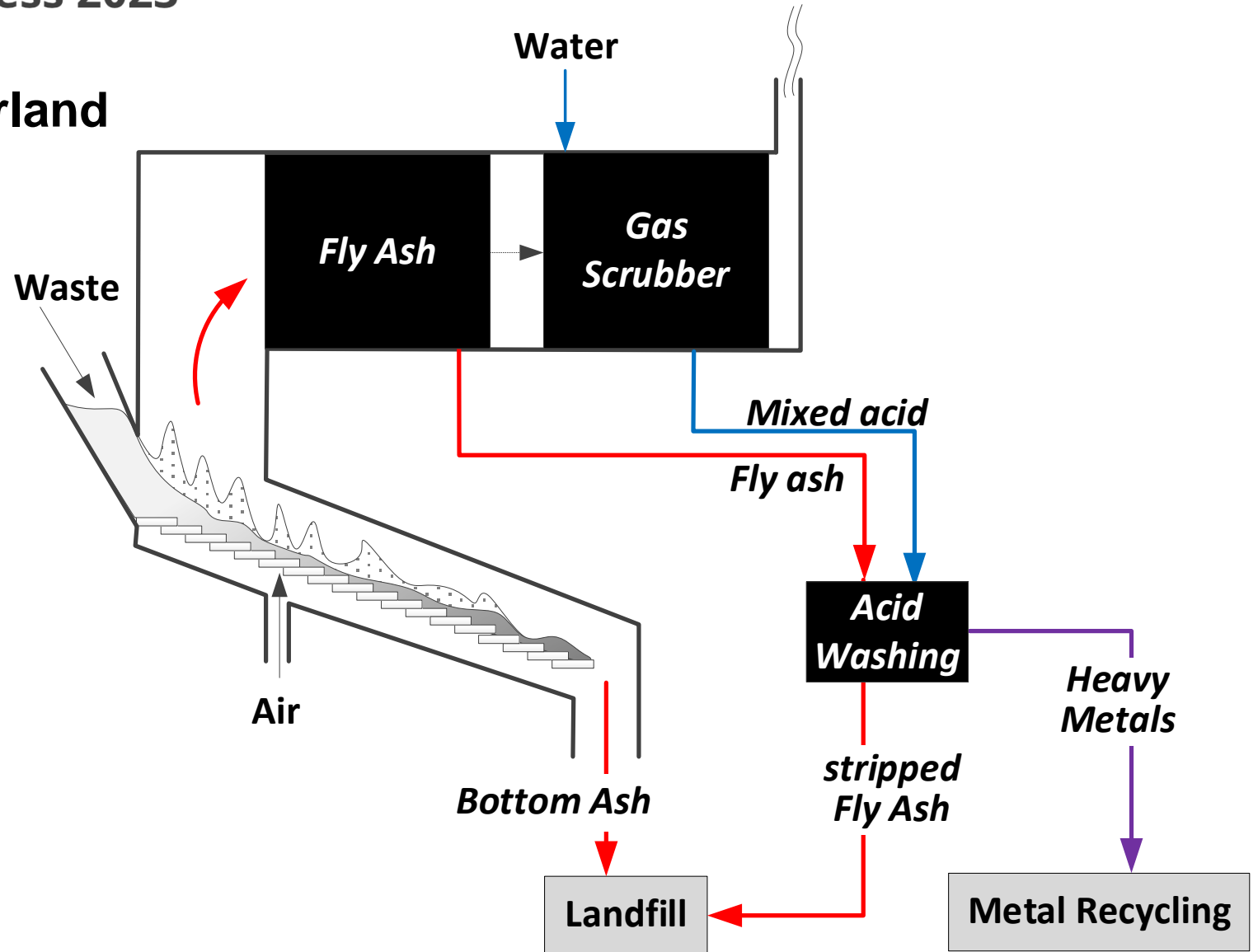
**Focus: transfer of metals from the bottom ash to fly ash
after the addition of PVC-sorting residues to the waste.**

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State of the art WtE in Switzerland

- Most WtE plants in CH use wet flue gas scrubbing (with water).
- When incinerated, PVC-waste is converted to HCl which is recovered as acid in the scrubber (chemical recycling*).
- The acid from the scrubber is being used for washing the fly ash (FLUWA process).
- The extracted heavy metals are recycled.
- The metal-stripped fly ash is mixed with the processed bottom ash and landfilled.



* "Chemical (or feedstock) recycling refers to the conversion of plastic polymers into their monomers or basic chemicals..."

Problem: the looming «acid supply gap»

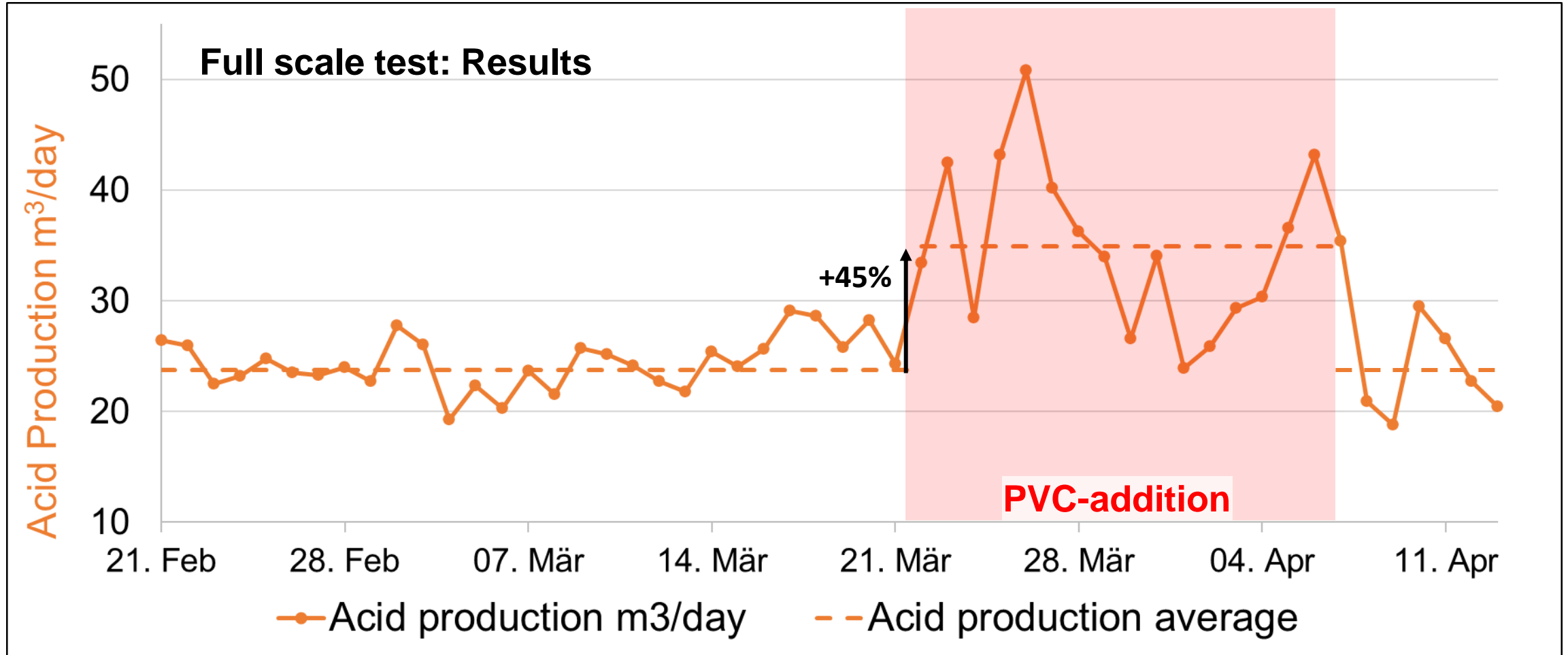
In 2026 acid washing of all fly ashes will become mandatory in Switzerland.

- **Problem:** Swiss waste incinerators cannot supply sufficient mixed acid to wash the fly ash from all Swiss WtE plants. This "acid supply gap" must be covered by technical grade HCl which needs to be purchased.
- **Solution:** Chemical recycling of PVC-sorting residues that are added on top of the “natural” PVC in the waste in order to boost HCl production (VinylAcid process).
 - Additional benefit: thermal mobilization as chlorides and transfer of the heavy metals contained in PVC into the fly ash and their recovery via FLUWA.

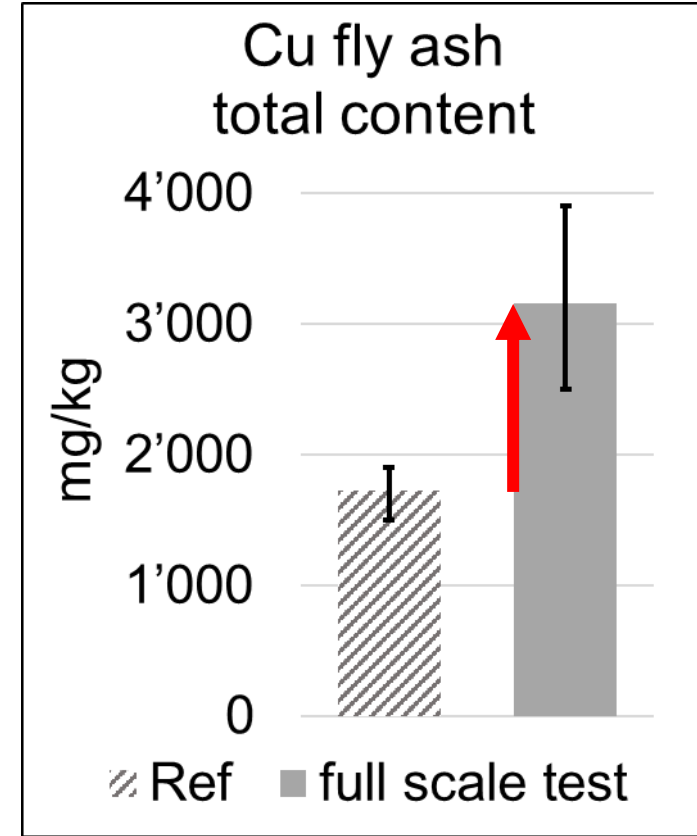
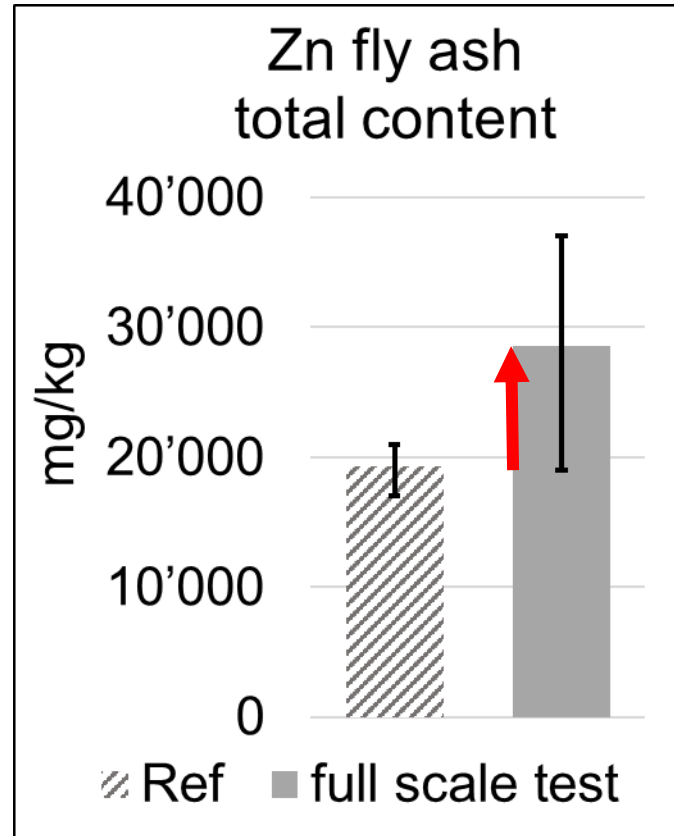
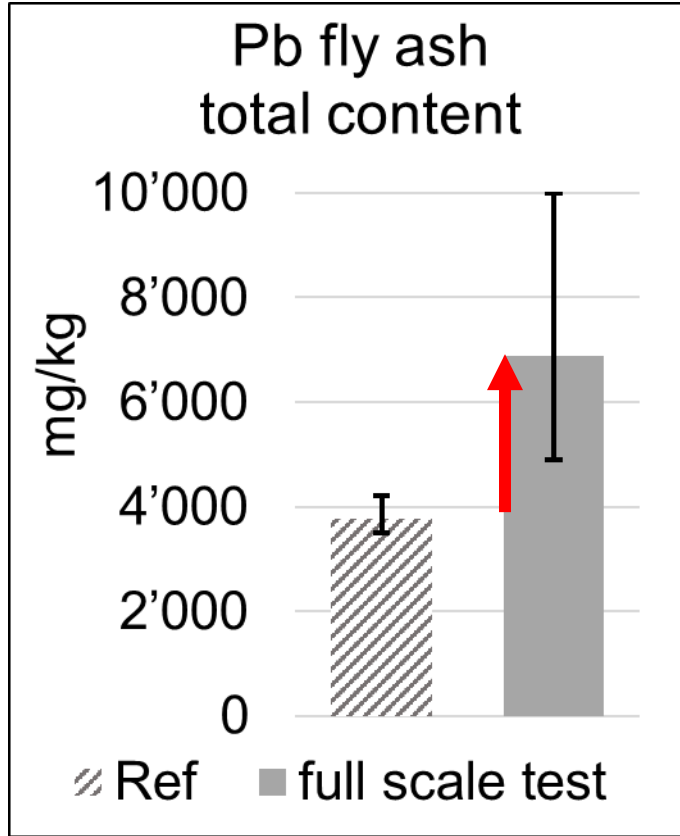


Full scale test: March 2023 in pictures...





Full scale test: Results



➤ Increased transfer of heavy metals to the fly ash from which they are recovered by acid washing and then recycled.

Full scale test: Conclusions

■ Proof of concept

- The chlorine in the PVC material was converted to HCl and the amount of acid was increased in proportion to the increased PVC content => Proof of concept successful.
- No negative effects on plant components registered (corrosion).
- Observed collateral-benefit: Transfer of recoverable heavy metals from the bottom ash into the fly ash!

■ Follow up project: VinylMet (sponsored by VinylPlus)

- Investigation into the mechanisms of the heavy metal transfer from bottom ash to fly ash.
- Optimization of this transfer process.
- Investigation in the improved quality of the bottom ash.
- Assessment of the VinylAcid concept in the European context: economics, ecology, politics.

Benefits of the VinylAcid process

- The acquisition of PVC sorting residues is a source of revenue for WtE plants.
- Using the additional HCl will cover the «acid supply gap», thus avoiding the purchase of acid tech-grade when the FLUWA process becomes mandatory in 2026.
- Heavy metals contained in the PVC are recycled.
- Heavy metals (zinc, lead, copper) are transferred from the bottom ash into the fly ash and recycled. Note that copper has recently been identified as critical or strategic raw material by the EU.
- The bottom ash is depleted of disperse heavy metals which results in an improved quality of the bottom ash.
- The process is «Chemical Recycling», thus removing the PVC producers from the crosshairs of public criticism. WtE plays a pivotal role in this clever solution.

VinylAcid is good for:

- the environment
- your wallet
- and your reputation!

