

Recycling of Incinerator Bottom Ash

Resources & Recycling

5-7-2013

Resources & Recycling at Delft

Mission

Create innovations in recycling that
add value from all perspectives:
social, environmental and
industrial-economic

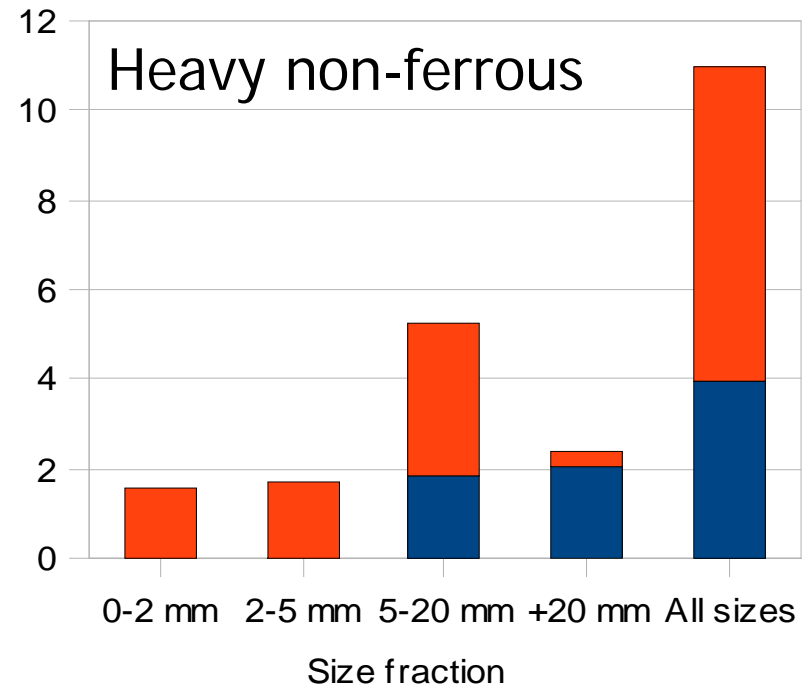
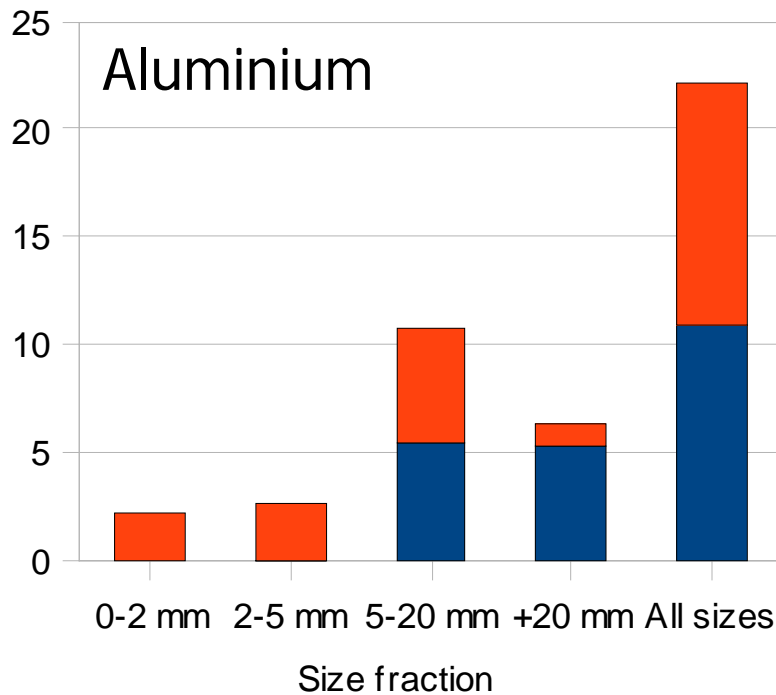
Recycling of IBA

Key issues

- Identifying metal and mineral value in IBA
- Innovative technologies for recovery
- Applications for products from IBA

Non-ferrous metal value

Non-ferrous metals in IBA in kg/dry ton after Fe-separation



Not recovered Recovered by standard technology (NL 2011)

Fine non-ferrous metals

Fraction -6 mm from ECS



Fine non-ferrous metals

Analysis

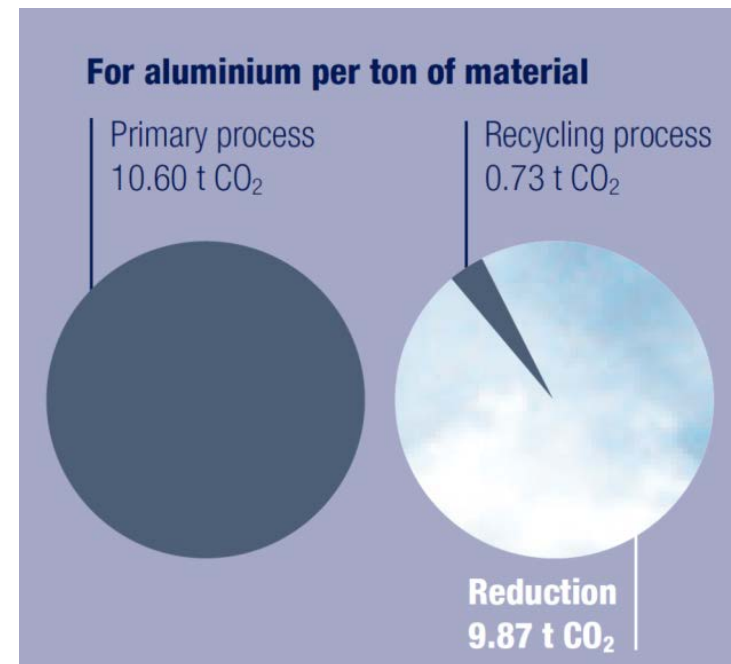
- Fine aluminium has low smelt recovery (50%)
 - Mainly low-alloyed (wrought Al)
- Complex but valuable heavy non-ferrous:
 - 60-70% copper
 - 20-25% zinc
 - 5-10% lead
 - Traces of dozens of other metals

Environmental gain fine metal recovery

Depletion and CO₂-emission

Non-ferrous scrap	kg/ton of ash
Aluminium	6
Copper	1.5
Zinc	0.3
Lead	0.2
Silver	0.006

Recovering fine non-ferrous metals from 1 ton of IBA saves 40 kg of CO₂-emission (EU emission pro capita: 7.5 t/y)



Fraunhofer Institute

Use of minerals in concrete/cement

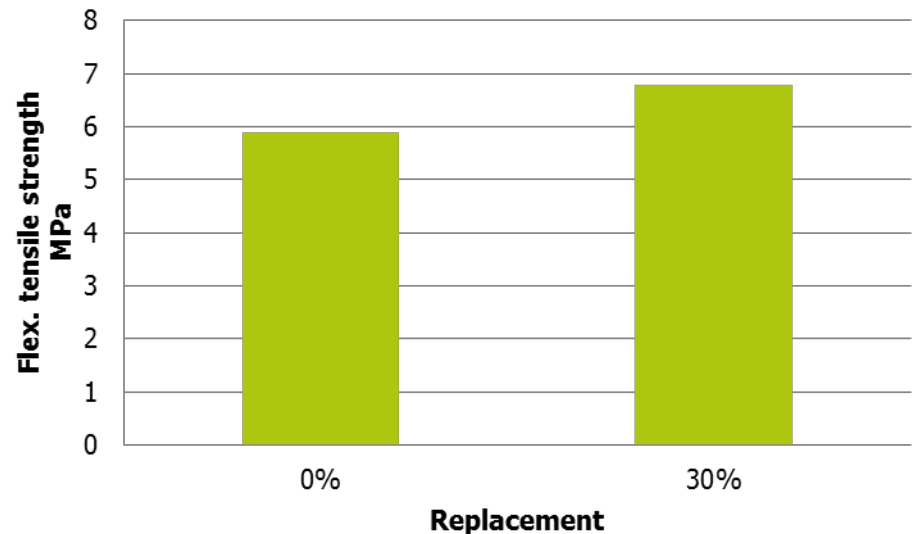


Use of minerals in concrete/cement

30% replacement by IBA minerals increases FTS



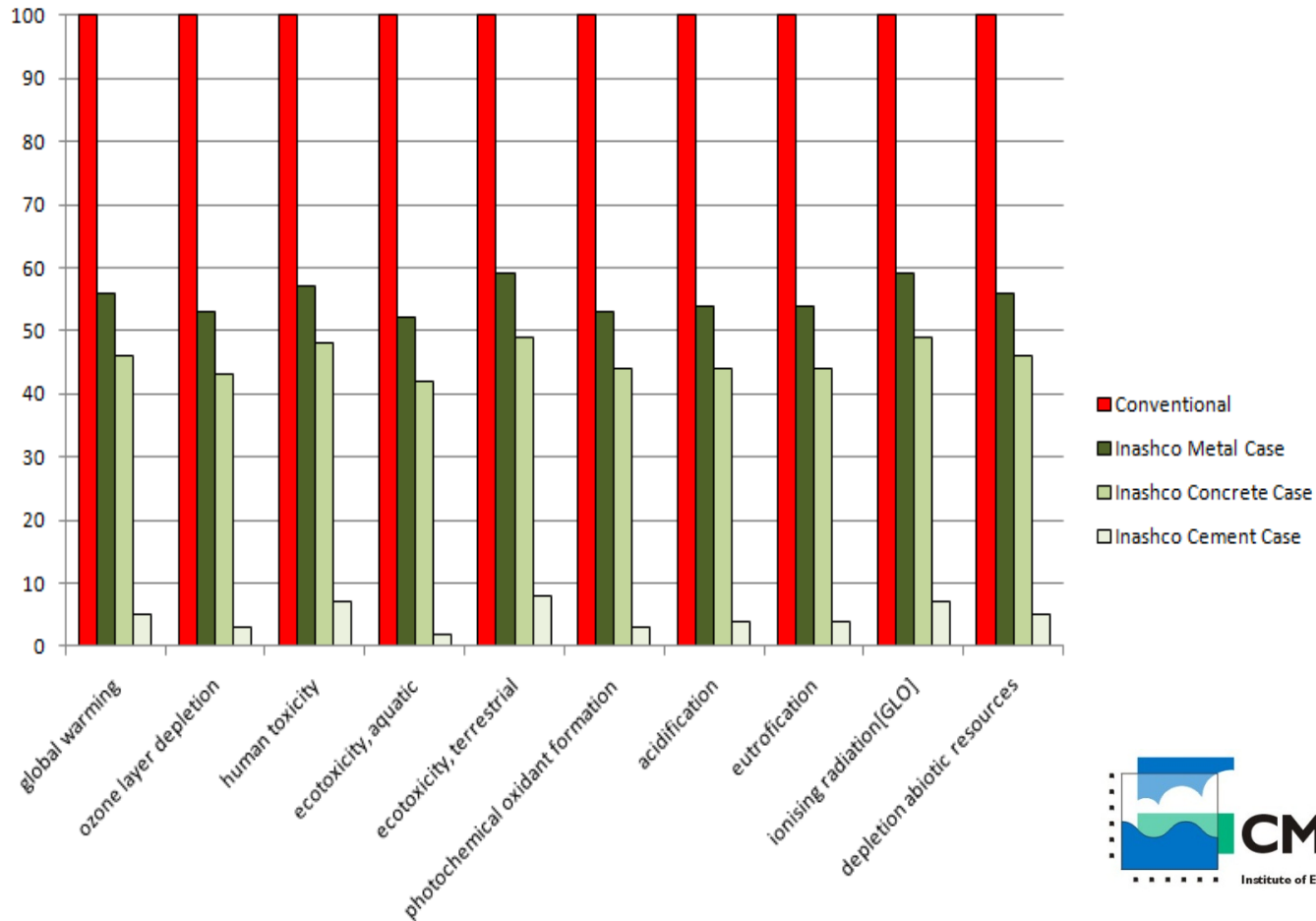
Concrete tiles



Min. Flexural tensile strength (KIWA)

Use of minerals in concrete/cement

Environmental gain: LCA



Innovative technologies for IBA

Overview

- Deep metal recovery (**ADR**, Wet, Martin process)
- Steel scrap upgrading
- Cement from IBA minerals
- **Concrete from IBA minerals**

Aging

Reducing free moisture content

- ✓ Increased heavy non-ferrous metal recovery (+6 mm)
- ✓ Low cost treatment if space is available
- Storage needed for 6-12 weeks of production
- Ca 6 kg Al/ton of IBA is consumed

Wet process

Socio-environmental versus industrial-economic



- ✓ Clean mineral > 80%
- ✓ High NF recovery
- ✓ No dust
- Process costs > 16 €/t
- Water treatment



ADR
Technology

ADR

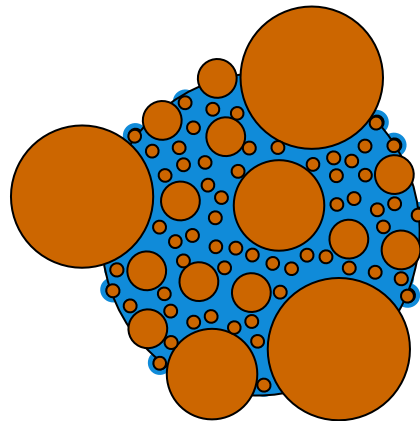
Dry removal of fines from the IBA in a jet stream

- ✓ Low cost compared to washing (2.5 €/ton of IBA)
- ✓ No aging required: no storage/no degradation of Al
- ✓ High recovery of non-ferrous metals in downstream ECS operation (down to 1-2 mm particle size)
- ✓ Simple/robust process (max. input 120 ton/h)

Why remove fines?

Moist materials cannot be processed at mm-size

- Moist fines act as a glue on entire 0-16 mm fraction
- Classification of 0-16 mm is problematic at typical free moisture levels (5-10%)
- Removal of 0-0.5 mm and associated moisture greatly improves workability

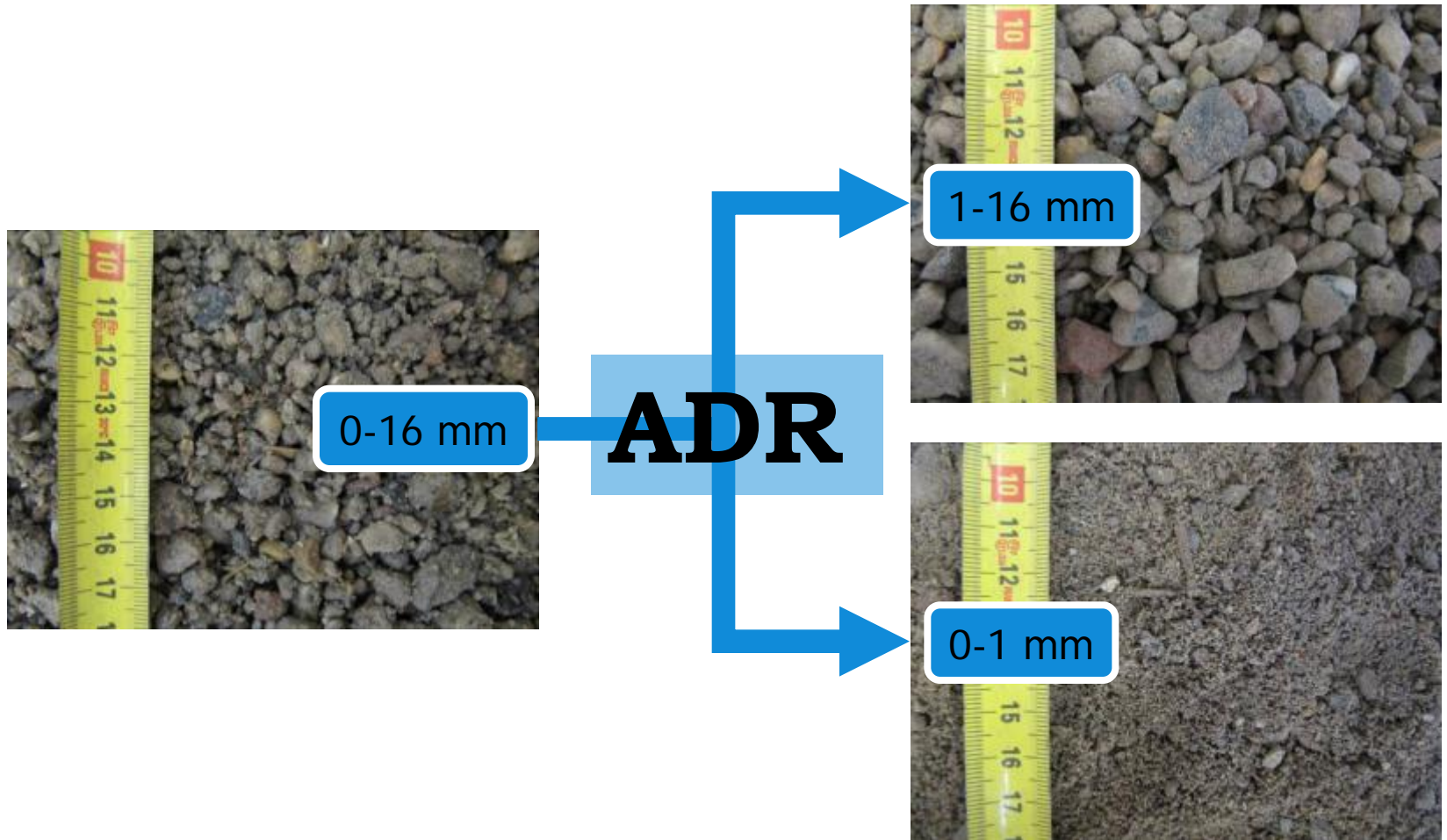


Opening size [mm]	Limiting free moisture
1.0	0%
2.5	1%
5.0	2%
10	4%
20	6%
>25	No limit

SME Mineral processing Handbook

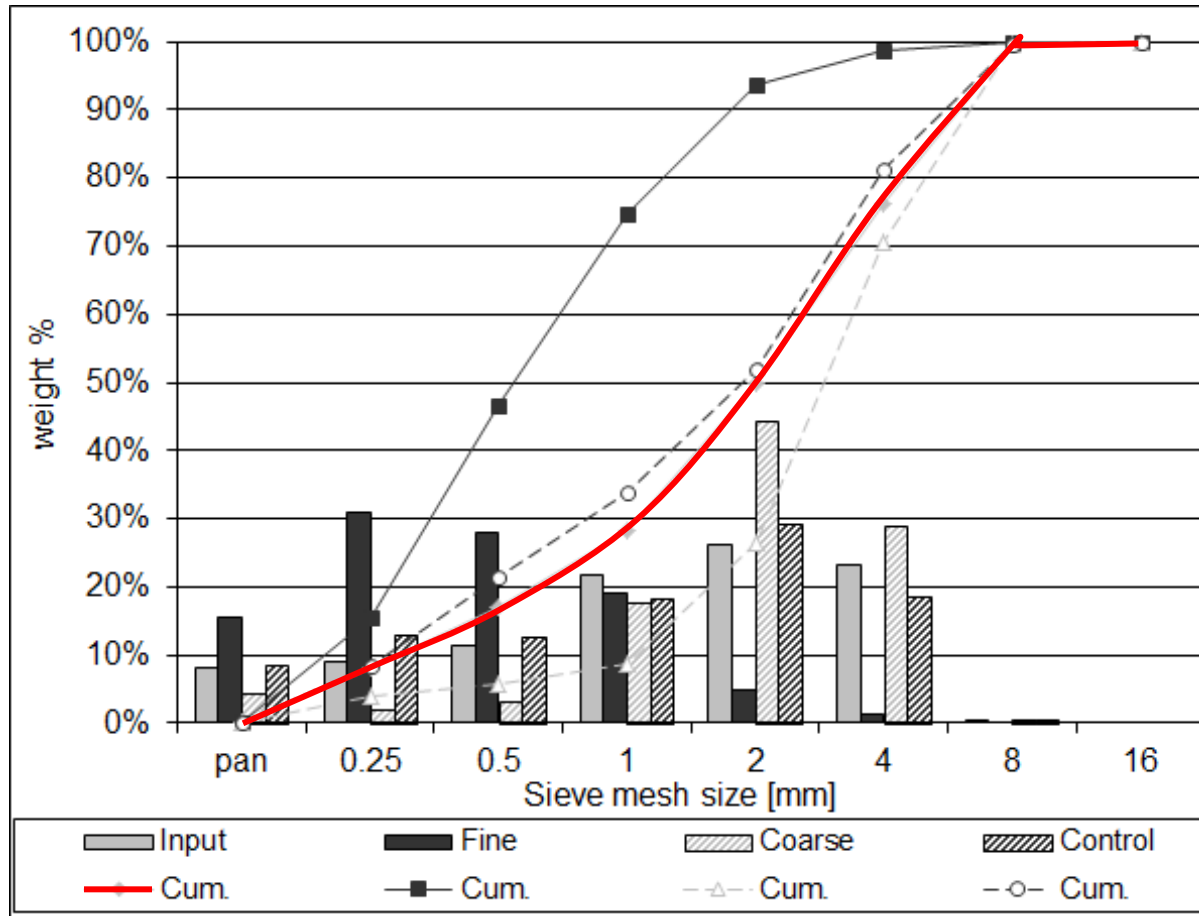
ADR

Principle of ADR technology



ADR

Cumulative size distribution of feed and products



ADR

Economics: example

Extra non-ferrous product per ton IBA:			11.0 €
6 kg Aluminium 1-12 mm	0.5 €/kg	3.0 €	
2 kg Heavy non-ferrous 1-12 mm	4 €/kg	8.0 €	
ADR cost per ton IBA			-2.5 €
Net profit per ton IBA			8.5 €

Thank You