Dutch Green Deal
Bottom Ash (IBA)

Status 2016

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On behalf of
Dutch Waste Management Association
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The Dutch Waste Management Association (DWMA) represents the national and international interests (via the membership of CEWEP) of waste companies active in the Netherlands. The (more than 50) members are active throughout the whole waste chain and account for about two-thirds of the Dutch waste market:

- Waste collection,
- Waste recycling and processing including composting and anaerobic digestion
- Waste-to-energy
- Landfill operation
Market IBA, nearly 100% application

Applied (Dutch) IBA in the Netherlands [kton/yr]

Current production
Level around 1800 kt/a
IBC: as built over the last 30 years

IBC is the Dutch abbreviation for ‘to Isolate, Constrain & Monitor’
IBC: example of an embankment
IBC: sense of urgency

The special ‘IBC’ category for IBA has several severe drawbacks:

- Everlasting aftercare of the embankment construction
- Risk of settlement of the embankment below ground water level
- The complicated ‘manual’ of IBA poses a risk for project time table during the construction phase

The national authorities, i.e.: ministry of Infrastructure and Environment, strive for abolishment of the ‘IBC’-class.

Hence: IBA in future has to comply with the regular emission standards for building materials (instead of IBC-category)
Green Deal bottom ash

Generally, a Green Deal is made between national government and Dutch stakeholder and/or companies.

In this case for IBA between:
- Ministry of Infrastructure and Environment
- Dutch Waste Management Association

The ministry of I&E:
- sets the minimum standards for application
- orders the construction of embankments for highways etc.
Green Deal: highlights

Make the ‘IBC’ category obsolete:

- **By January 1\textsuperscript{st}, 2017:**
  
  50% of IBA has to find useful application, other than ‘IBC’

- **By 2020:**
  
  100% of the IBA finds other applications than ‘IBC’

Enhance the recovery of NF metals:

- **By January 1\textsuperscript{st}, 2017:**
  
  75% recovery of Non Ferrous metals fraction $>5.6$ mm

- **Before 2020:**
  
  Set goals for the recovery of Non Ferrous metals $<5.6$ mm
Green Deal: pathways to a solution

The Soil quality Decree sets environmental standards for the end products, hence several pathways exist to phase out the application as an IBC building material:

- **As a granular material (0-20) after cleaning**
  - By washing / fractionating based on soil cleaning technology
  - Drawback: a sludge (<63µm) fraction (± 15%) has to be landfilled
  - Or aeration with CO$_2$ enriched air, washing and natural ageing
  - Drawback: relative long treatment time, i.e.: large site required
- **As an additive in shaped end-products**
  - Gravel fraction (>3 mm) applied in concrete paving bricks
  - Drawback: solution for <50% of the IBA
Green Deal: Progress at mid 2014

- Application as shaped building material: 6 companies, 562 t/y (46%)
- Application as granular building material: 5 companies, 660 t/y (54%)

IBA, to be applied in 2017 (kton/y)
Green Deal: Economical impact (est. 2014)

Depending on the chosen technique, the additional costs for implementing the Green Deal vary from €0 till €10 per ton IBA, or €20M for the sector as a whole.

Based on 8 companies:
- 2.5
- 4.0
- 5.0
- 6.0
- 10.0
- 13.0
- 20.0
Green Deal: Implementation Sites (fall 2016)

- IBA Production (MSWI), treatment on site
- IBA Production (MSWI), treatment off site
- IBA treated according to Green Deal (realized)
- IBA treatment according to Green Deal (in operation in 2017)
- IBA treatment plant according to Green Deal (in operation)
Green Deal: Implementation by VGM

- Site located at Duiven, near Arnhem
- Formal opening happened on September 23rd, 2016
- Treatment capacity of 200 kt/a IBA

- Technique:
  - Dry separation into metals, minerals and organics
  - Washing and stabilization of minerals; classification in 0/4 and 2/11 aggregates
  - Aggregates are commercialized as FORZ® and used as natural aggregate replacement in earth-moist concrete
- The application of FORZ® fraction of the IBA fulfils the Green Deal
Green Deal: Implementation by VGM

FORZ® site at Duiven
Green Deal: Implementation by VGM

Endproducts containing FORZ®

van Gansewinkel Minerals
Green Deal: Implementation by wASH

- Site located at Alkmaar
- Formal opening happened on October 10th, 2016
- Treatment capacity of 300 kt/a IBA

- Technique:
  - wet separation into granulate, sand and sludge
  - Granulate and sand washed and combined as aggregate
  - Aggregate commercialized as a freely applicable IBA

- The application of the washed IBA fulfils the Green Deal
Green Deal: Implementation by wASH

wASH® site at HVC, Alkmaar
Green Deal: Implementation by wASH

Granulate, 3 - 20 mm

Sand, 63 µm - 3 mm
GD: Implementation by BKE-Inashco

- Powered by Boskalis Environmental and INASHCO Incinerator Ash Company
- Site located at Nauerna, near Amsterdam at the North-sea canal
- Production planned for mid 2017
- Treatment capacity of 600 kt/a IBA (450 kt/a from Attero NL: IBA from Wijster & Moerdijk)
- Technique:
  - Metals: Wet density separation creating direct sellable heavy & light Non Ferrous metal fractions. Metal separation as of smaller than 1 mm.
  - Wet mineral cleaning, mineral fraction utilized by Boskalis in infrastructure projects
- The application of the washed IBA fulfils the Green Deal
GD: Implementation by BKE-Inashco

Aggregates

Infrastructure

Fine metals
Green Deal: Implementation by Heros

- Site located at Sluiskil Harbour, close to the Belgian border
- Treatment capacity of 850 kt/a IBA
  - Dry separation into granulates and fines
  - Dry production granulate, commercialized as Granova®, a gravel additive for concrete products (not reinforced) (100 kt/a in 2016, aiming at 200 kt/a in the near future),
  - Wet process for production of Granova® Combimix and Granova® Hydromix: granular products that are freely applicable (350 – 400 kt/a in the near future)
- The application of these products fulfils the Green Deal
Green Deal: Implementation by Heros
Green Deal: Implementation by Heros

Overview of the site of Heros at Sluiskil
Green Deal: Implementation by AEB-Inashco

- Urbanite® powered by [INASHCO](http://www.inashco.com) and [aeb amsterdam](http://www.aeb-amsterdam.nl)
- Site located in Amsterdam harbor area (AEB Amsterdam)
- Formal opening planned for Q3-2017
- Treatment capacity of 400 kt/a IBA
- Technique:
  - Aeration with CO₂-enriched air, extensive washing and natural ageing
  - Maximum recovery of NF through ADR® integration
  - Granulate commercialized as Urbanite®
- The application of the treated IBA fulfils the Green Deal
Green Deal: Implementation by AEB-Inashco

Urbanite®
Green Deal: Implementation by RS-AZ

- Site located at Nauerna, near Amsterdam at the North-sea canal
- Starting at January 1\textsuperscript{st}, 2017
- Treatment capacity of 150 kt/a expandable to 400 kt/a IBA

- Technique:
  - Wet separation into granulate, sand and sludge
  - Aggregate commercialized as a freely applicable IBA
  - Sand and gravel for the use in concrete and asphalt
- The application of the washed IBA fulfils the Green Deal
Green Deal: Implementation by RS-AZ
Recovery of (Non) Ferrous metals

Recovery of metals from Dutch IBA [kton/yr]

- Ferrous Metals
- NF Metals (excl. Stainless Steel)
Non Ferrous metals and the Green Deal

The Green Deal formulates targets for enhancement of recovery of Non Ferrous metals.

Possible pathways to fulfil the NF targets of the Green Deal:

• **Add-on NF separation techniques**
  • Enhanced Dry Recovery (Inashco) processes as an add-on to the classical dry treatment of IBA
  • Or density separation as an add-on to wet treatment

• **Improvement of the ballistics of NF particles**
  • Washing / fractionating based on wet soil cleaning technology purifies the NF particles en enhances the effectiveness of classical Eddy Current techniques.
GD, (NF): Implemented by Inashco

- Sites located at various IBA treatment plants in the Netherlands
- Formal opening AEB site happened on June 11th, 2013
- Treatment capacity of (at AEB) 300 kt/a IBA

- Technique:
  - Enhanced Dry Recovery (ADR)
  - Dry separation into different coarse fractions
  - Different NF separation techniques per coarse fraction

- NF particles as small as 1 mm are recovered
GD, (NF): Implemented by Inashco
GD (NF): Implementation by VGM

- Site located at Duiven, near Arnhem
- Treatment capacity of 200 kt/a IBA

- Technique:
  - Dry separation into metals, minerals and organics
  - NF fractions of 12-40, 2-12 and 0-3 mm are incorporated
GD (NF): Implementation by VGM

NF separation

Extended separation of 0-3 mm NF
GD, (NF): Implemented by wASH

- Site located at Alkmaar
- Treatment capacity of 300 kt/a IBA

**Technique:**
- Wet separation into (rinsed) granulate, sand and sludge
- Classical Eddy Currents applied on rinsed granulate
- NF particles removed from sand by wet density separation (Mainly heavy Non Ferrous particles removed)
- Yield >3,2 % NF recovered from granulate
GD, (NF): Implemented by wASH
GD, (NF): Implemented by Heros

- Site located at Sluiskil, at the Belgian border near Antwerp
- Treatment capacity of 650 kt/a IBA

- Technique:
  - Enhanced Dry Recovery (ADR)
  - Dry separation into different coarse fractions
  - Different NF separation techniques per coarse fraction

- Recovery of 50 kt/a of (Non) Ferrous metals
GD, (NF): Implemented by Heros
Concluding remarks (1)

The implementation of the Dutch Green Deal unfolds, with several installations already opened, in construction, or in development.

The cumulative capacity of these initiatives mounts to some 1.9 Mton/year input of IBA at mid 2017.

This roughly equals the annual production of IBA in the Netherlands, and is well above the required 50% in 2017 according to the GD.
Concluding remarks (2)

The two pathways to achieve application other than IBC enroll in the ratio:

- 70% by (integral) washing, or ageing using CO$_2$, to produce a granular end product for embankment and foundations
- 30% by (dry) fractionating (and optionally washing) to produce an aggregate for concrete products

New technologies emerge to recover fine (heavy) NF particles, for instance by applying density separation.
Thank you for your attention!

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