

Test of the EGTEI methodology for refineries by Belgium

10th EGTEI MEETING

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Previously

- **February 2004** : draft background document for refineries (BGD)
- **September 2005** : WGSR meeting - more input needed from NE
- **November 2005** : synopsis sheets for refineries
- **November 2005** : comments from Belgium on background document
- **March 2006** : comments from the Netherlands and Industry
- **July 2006** : comments from CONCAWE
- **July 2006** : meeting between CONCAWE, EGTEI and NE (BE, NL)
- **September 2006** : meeting between EGTEI expert and NE from Belgium: work on combustion units and FCCU (in addition, specific sets of cost data for the Belgian refinery sector were submitted)

Future work

- Revision of background document and synopsis sheets
- Further testing and validation of methodology by BE (sulphur plants,...)



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Scope of the background document

- The BGD covers SO₂, NO_x and PM emissions from 3 main sources:
 - (1) Combustion units (not including gas turbines: will be treated in draft “combustion”)
 - (2) FCC units
 - (3) Sulphur recovery units
- The BGD covers about 90 % of SO₂ and PM emissions and about 70 to 80 % of NO_x emissions of Belgian refinery sector (period 2000 – 2005)

Emission sources of Belgian refinery sector:

(with indication of RAINS sectors currently covering Belgian refinery emissions in baselines)

- (1) Boilers and furnaces (RAINS sectors: IN_BO / CON_COMB) (combustion units)
- (2) FCC units (RAINS Sector: PR_REF)
- (3) Sulphur recovery units (RAINS sector: PR_REF)
- (4) Flares (RAINS sector: WASTE_FLR)
- (5) Other process emissions (bitumen, ...) (RAINS sector PR_REF)
- (6) Naphtha cracking (RAINS sector IN)
- (7) Gas turbines (CHP plants) (RAINS sector PP): increasingly replacing boilers



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SO₂, NO_x and PM emissions of Belgian refinery sector

Emissions sources (tons / year)	2000			2005		
	SO ₂	NO _x	PM	SO ₂	NO _x	PM
Boilers and furnaces	15796	5222	1008	9636	3922	735
FCC units	3791	1394	424	6326	1461	100
S recovery units	4082	41	15	3910	291	2
Flares	2547	76	128	1446	34	45
Other process	13	1	0	3	1	0
Naphtha cracking	0	1017	50	0	1101	34
Gas turbines CHP	2	767	8	69	1361	31
Total	26231	8518	1633	21390	8171	947



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Some general comments on the BGD

- Not all potentially significant emissions sources (flares, ...) are covered by the BGD: to ensure full coverage an additional category ('other') should / could be included into ECODAT.
- CLE should reflect NEC, LCP and IPPC demands (for member states). The BGD currently proposes emission factors and reduction measures which are not fully in compliance with European directives.
- The filling-in of the ECODAT database according to the proposed EGTEI methodology (with detailed information on activity levels, implementation rates of measures, etc) requires additional data and assumptions (not provided in Primes or national projections) and considerable extra work.

*Less detailed methodology for non-European countries necessary?
Priority?*



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Some comments on combustion units (1)

- BGD: reference installations for combustion units (boilers and furnaces)
 - RI burning gas (50 MW)
 - RI burning heavy fuel (50MW)
- Belgian refinery sector
 - combustion units with **gas** burners (refinery gas, natural gas)
 - combustion units with **oil** boilers (heavy fuel oil, other liquid fuels)
 - combustion units with **dual** burners
(to fit DUAL into RI gas and RI oil requires additional assumptions)

Combustion units = boilers (10 %) + furnaces (90 %) (year 2000)

Not included: gas turbines / boilers and furnaces of naphtha cracking
(boilers replaced by CHP gas turbine installations)



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Some comments on combustion units (2)

- PM emisisions

The BGD proposes an uncontrolled EF TSP for HF of 56 to 280 g/GJ and no abatement measures.

The LCP EF TSP for HF = 15 g/GJ.

The current (uncontrolled) EF TSP for HF for Belgian refineries = 50 to 60 g/GJ.

Abatement measures are necessary to reduce PM emissions (BAT):

- using liquid fuels with low ash content
- steam atomisation on the liquid fuels
- ESP or filters

- NO_x emisisions

Proposed uncontrolled EF NO_x for gas in BGD is too low (54 g/GJ)

The uncontrolled EF NO_x for gas for Belgian refineries is estimated at 66 g/GJ (RAINS = 70 g/GJ)



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Some comments on combustion units (3)

- SO₂ emissions

The BGD proposes an uncontrolled EF SO₂ for HF of 950 g/GJ (2 % S) and fuel switch to gas and wet scrubber as abatement measures.

The current (uncontrolled) EF SO₂ HF for Belgian refineries = 850 g/GJ (1,7% S).

This EF will drop to about 400 g/GJ in 2010 due to replacement of boilers (furnaces) on HF by gas turbines. Since HF with highest S-content is being replaced, the average S-content of remaining HF is reduced.

How can this reduction in S-content (fuel switch) be accounted for as measure?

Additional measure: fuel switch to low-sulphur liquid fuels?



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Some comments on FCCU (1)

- BGD: reference installations for FCCU
 - RI: capacity of 2000 kt/a feed
- Belgian refinery sector (3 FCC units)
 - Total feed in 2005: 5800 kt (on average \approx RI)
 - Two units use light deS-feed and one unit uses deep deS-feed
- SO₂ emissions
 - Proposed uncontrolled EF SO₂ in BGD = 2,1 to 2,4 kg/t feed
 - Current uncontrolled EF SO₂ for Belgian FCC units (2000 – 2005)
 - Two units using light deS-feed = 0,86 - 1,52 kg/t
 - One unit using deep deS-feed = 0,041 - 0,074 kg/t
 - ⇒ distinction between light and deep deS-feed is necessary
 - ⇒ proposed measures (Desox catalyst and wet scrubber): not suited for deep deS-feed (SO₂ emission concentrations < 250 mg/Nm³)



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Some comments on FCCU (2)

- NO_x emissions
Proposed uncontrolled EF NO_x in BGD = 0,3 to 0,48 kg/t feed
Current uncontrolled EF NO_x for Belgian FCC units (2000 – 2005)
 - Two units using light deS-feed = 0,24 – 0,30 kg/t
 - One unit using deep deS-feed = 0,16 – 0,27 kg/t⇒ distinction between light and deep deS-feed is necessary
(lower N-content in deep deS-feed)
η SCR = 80% according to BGD and 85 - 90 % according to BREF,...
- PM emissions
Proposed uncontrolled EF PM in BGD = 0,36 kg/t feed
Current (partially controlled) EF PM for Belgian FCC units (2000 – 2005)
 - Two units using light deS-feed = 0,019 – 0,190 kg/t
 - One unit using deep deS-feed = 0,014 – 0,071 kg/tη ESP according to refinery reporting is < 97,5 %
Indirect impact of wet scrubber on PM?

