# A PUSH FOR CLEANER INDUSTRIAL PRODUCTION

## A discussion of the issues surrounding the Commission's proposal for a Directive on Industrial Emissions

December 2008

EEB PUBLICATION NUMBER 2008/013

Editor responsible
John Hontelez

Edited by
Christian Schaible, EEB Chemicals and Industry Policy Officer and Doreen Fedrigo, EEB EU Policy Unit Coordinator

**European Environmental Bureau - EEB (aisbl)**
Boulevard de Waterloo 34 | B-1000 Brussels | Belgium
Tel.: +32 2 289 1090 | Fax: +32 2 289 1099
E-mail: eeb@eeb.org
Website: www.eeb.org

AN INTERNATIONAL NON-PROFIT ASSOCIATION

EEB also gratefully acknowledges former EEB staff member Catherine Ganzleben for preparing this report. The sole responsibility for the content of this document lies with EEB. This publication reflects the authors' views and does not commit the donors.

The EEB gratefully acknowledges financial support from the European Commission.

Printed on 100% recycled chlorine-free paper using soy based inks.

# A PUSH FOR CLEANER INDUSTRIAL PRODUCTION

## A discussion of the issues surrounding the Commission's proposal for a Directive on Industrial Emissions

## KEY ACRONYMS USED IN THIS DOCUMENT

| | |
|---|---|
| BAT | Best Available Techniques |
| BATAEL | Best Available Technique Associated Emission Level |
| BREF | BAT Reference Document |
| ELVs | Emission Limit Values |
| IPPC | Integrated Pollution Prevention and Control |
| LCPs | Large Combustion Plants |
| NEC | National Emissions Ceiling |
| VOC | Volatile Organic Compounds |

# Contents

# Background to the Revision of the IPPC Directive and the Aim of this Brief

This paper provides background information for discussions in the European Parliament during the 2007-2009 revision process of the Integrated Pollution Prevention and Control (IPPC) Directive which will be integrated into the Directive on Industrial Emissions.

Since 1996, emissions from 52,000 industrial installations ranging from steel works to tanneries to pig farms have progressively been regulated under IPPC. However, by the time the deadline for full implementation arrived on 30 October 2007, many Member States had fallen well behind schedule, with only half of IPPC plants permitted in some Member States. Furthermore, sharp differences were evident in the stringency of implementation, while vague language in the existing Directive left little scope for the Commission to pursue infringement procedures.

The revision incorporated separate sectoral Directives into IPPC, as part of the better regulation initiative of the European Commission and as a means of achieving more effective, comprehensive and even implementation. The separate Directives on Large Combustion Plants, Solvents, Waste Incineration and Titanium Dioxide were introduced into the Directive on Industrial Emissions.

In general, EEB welcomes the proposal as a targeted attempt to address gaps in the provisions of the existing IPPC Directive, which paved the way for weak and divergent implementation across the EU.

The Industrial Emissions Directive[1] needs teeth to address industrial pollution and to play its role in delivering on European objectives to protect our air, water and soils from further degradation. The EEB urges Members of European Parliament to take an objective look at the costs and benefits of implementing technologies to prevent and control industrial pollution, and to vote on the side of human health and the environment.

In this document, we provide information on the key issues under discussion, including the use of the Best Available Technique Reference Documents (BREFs) in permitting, the safety net, emission limit values for large combustion plants and cement installations, inspection regimes, protecting soils and intensive farming. We provide key information on the associated environmental impacts, and where available, we present data on costs and benefits of the proposed changes.

The document opens with a reminder of the goals that the Industrial Emissions Directive must help us to reach.

1 COM (2007) 844 final; Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) RECAST

# The Goalposts

The proposed Directive on Industrial Emissions is designed to deliver protection of air, water and soil from industrial emissions, as well as limiting waste production and improving energy and resource efficiency in installations. Below are summaries of the key goals to which the Directive is intended to contribute, together with some statistics on progress towards achieving these goals.

## AIR

The Directive on Integrated Pollution Prevention and Control (IPPC) together with a number of sectoral directives on large combustions plants, waste incineration, solvents and titanium dioxide currently frame the setting of emission limit values (ELVs) designed to deliver reductions in anthropogenic emissions to air from industrial sources[2].

Currently, about 52,000 IPPC installations in the EU are responsible for[3]:

| Emission | Health impacts | Environmental impacts |
|---|---|---|
| 83% of $SO_2$ | Asthma, respiratory illness, aggravates heart disease | Acid rain, smog |
| 55% of Volatile Organic Compounds | Respiratory problems, suspected carcinogen | Global warming, formation of ground level ozone and formation of secondary particulate matter leading to eutrophication and acidification |
| 38% of ammonia (farming only) | Irritation of the eyes, nose and throat | Eutrophication, groundwater contamination |
| 34% of NOx | Respiratory illness, emphysema, bronchitis, increase in mortality | Acid rain, eutrophication, smog |
| 25% of dioxins | Development defects, cancer, hepatotoxicity, endocrine disruption, damage to immune system, death | Bioaccumulates in living tissues |
| 23% of mercury | Neurological damage, renal and gastrointestinal damage, death | Bioaccumulates in living tissues |

**Total annual damage cost estimate of €53-164 billion (relating to 5 key pollutants only and excluding wider environmental damages to ecosystems)**

Commission, 2007a, p. 11

[2] The list of polluting substances are to be found on Annex II of the proposal. Other polluting substances that because of their nature and potential to transfer pollution are also subject to measures

[3] Data on ammonia from Alterra, 2007, all other data from Commission, 2007a

| Thematic Strategy emission reduction targets for 2020 | | |
|---|---|---|
| Nitrogen Oxide, NOx | -60% | The Thematic Strategy on Air Pollution defines interim air quality objectives for 2020 that will lead to a reduction in negative impacts on human health and the environment. |
| Sulphur Dioxide, $SO_2$ | -82% | |
| Ammonia, $NH_3$ | -27% | |

| EU 27 NEC emission reduction targets for 2010 | | |
|---|---|---|
| Nitrogen Oxide, NOx | -51% | The National Emissions Ceilings Directive 2001/81/EC sets emission reduction targets for 2010 for each Member States, as well as for the EU-27. |
| Sulphur Dioxide, $SO_2$ | -77% | |
| Ammonia, $NH_3$ | -14% | |

Data on progress towards the interim 2006 NEC targets are now available. The data shows which countries are overshooting, and reveals a concerning trend with regards to NOx emissions. (see table in Annex 1 for a cost benefit analysis of two IPPC scenarios relative to the NEC baseline)

- 18 Member States reported that they were above their 2006 NOx ceiling
- 13 Member States are projected to miss their 2010 nitrogen oxide ceilings,
- EU emissions predicted to be 9% above the aggregated emission ceiling and 20% above the stricter EU-27 NECD ceiling for 2010
- 11 Member States exceeded their 2006 $SO_2$ ceilings
- The Netherlands is projected to exceed its 2010 $SO_2$ ceiling
- Germany and Spain are projected to exceed their 2010 $NH_3$ ceilings

**Europe is not on track to meet its air targets**

NOx emissions against 2006 NEC ceilings, top 10 worst performing Member States:

| | |
|---|---|
| Ireland | 74% |
| Austria | 68% |
| France | 68% |
| Spain | 61% |
| Belgium | 58% |
| Denmark | 46% |
| UK | 37% |
| Germany | 33% |
| Netherlands | 30% |
| Luxembourg | 28% |

*EEA, 2008b, p19*

## WATER

The Water Framework Directive 2000/60/EC aims to achieve both good chemical status and good ecological status in Europe's surface waters and groundwater. Environmental quality standards have been established for 33 priority substances with these thresholds intended to act as a trigger for additional point source controls under IPPC, should they be transgressed.

- Many small waterways and some large rivers remain severely polluted

*(EEA, 2007a)*

IPPC is the key tool for controlling point source pollution to European waters by requiring the application of BAT to reduce the levels of contaminants in waste waters. Should environmental quality standards for priority substances be jeopardised, stricter controls are required.

The Drinking Water Directive 98/83/EC stipulates that nitrate concentrations in drinking water shall not exceed 50 mg/l. With groundwater serving a crucial source of drinking water in many Member States, the contamination of groundwater with nitrate is of high concern.

**Europe's waters are contaminated with high levels of nitrates**

- Nitrate concentration limits are exceeded in 1/3 of groundwater bodies tested. No substantial improvement has resulted from current practice

*(EEA, 2008c)*

## SOIL

The Thematic Strategy for Soil Protection[4] sets a framework for actions to protect further degradation of Europe's soils, and includes a proposed Framework Directive on Soil.

In terms of soil contamination at industrial sites, both the numbers of sites and the hazardous chemicals involved generate cause for concern.

- 3.5 million sites potentially contaminated
- Industrial production and commercial service responsible for 41.4% of contamination
- 0.5 million sites seriously contaminated and in need of remediation

*(EEA, 2007)*

**Europe's soils are not adequately protected and are continuing to degrade.**

[4] COM (2006) 23;1Thematic Strategy for Soil Protection

# Promoting Innovation

## The Problem: An Unlevel Playing Field

To date, implementation of the IPPC Directive has shown widespread divergence across the EU, both in the level of stringency of the permits and in the percentage of IPPC installations permitted. Standards in many permits show little relation to Best Available Techniques (BAT) in the BAT Reference Document (BREF) for the relevant sector[5].

Divergence means an unlevel playing field for industry and an uneven level of environmental protection for EU citizens. It means that a plant in one Member State can avoid investment in BAT in order to gain short term advantage over a competitor in another where permitting is more rigorous. That advantage comes at the cost of environmental protection, and Europe's citizens pay the price.

Aberthaw Coal-fired Power Station, Wales, UK

- Europe's 6th largest point source of NOx
- Granted a derogation from BAT and allowed to emit 1200 mg/Nm3 of NOx instead of 500 mg/Nm$^3$
- Current permit conditions only require the plant to reduce emissions to 200 mg/Nm$^3$ by 2018
- No plans to implement BAT for NOx removal (SCR)
- Friends of the Earth in the UK, was unable to pursue the case in court because the BREFs are for guidance only and standards set at the discretion of the local authority

Situation in the Netherlands

- NOx emissions of existing coal power plants have been reduced to 25 g/GJ by a combination of Low-Nox burners and installation of DeNox.
- E.ON Maasvlakte and NUON Amsterdam achieve 75 mg/Nm$^3$ NOx
- Amer-9, an old plant, achieves emissions of about 100mg/Nm$^3$
- there is not an existing coal power plant without DeNox anymore in the Netherlands

[5] for illustrations see COM, 2007a, p. 17

## The Solutions

The recast of the IPPC Directive presents a crucial opportunity to reduce that divergence and create a more level playing field for industrial operators across the EU. A permitting system that closely follows the BREFs can send clear, consistent messages to industrial operators across the EU about what they have to achieve as a sector. An operator who is certain that his competitor will be obliged to invest in environmental protection, will more easily earmark funds for his own plant. The suppliers of relevant techniques will see a stable market for their products and innovations, so boosting eco-industries.

The IPPC permitting system must be consistent, viable and based on BAT. In establishing BAT, technical experts, including industry, assess the economic and technical feasibility of techniques available on the market in commercially operating installations. BAT uptake represents an achievable goal since BAT are defined as *"available techniques developed on a scale which allow implementation under economically and technically viable conditions, taking into consideration the costs and advantages [...] and that are reasonably accessible to the operator"*[6]. The following new mechanisms are specifically designed to promote uptake:

- The emission limit values in the permit cannot exceed the BAT Associated Emission Levels that are laid out in the BREF, as set out in Article 16.2 of the Commission proposal.
- Publication of a new BREF must trigger a review of permits issued for that sector within two years instead of four. With BREFs revised every 8 years, the implicit deadline for permit review would be approximately 10 years.
- At least the essential parts of the BREFs, such as the BAT chapters, must be translated into all the official EU languages. This in order to make them accessible and understandable to competent authorities and operators on the ground and give them the necessary legal status.
- Each installation must provide an annual report that compares their environmental performance with that achievable using BAT. This key tool requires that the operator remains up to date with BREF requirements and reassesses the installation's performance.
- There must be clear links between permit conditions with environmental quality standards and emission ceilings such as the National Emissions Ceilings under the NEC Directive

### Potential Benefits

The European eco-industry (i.e. pollution prevention, control and management) has a turnover of €227 billion, contributing around 2.2% of total EU GDP. Between 1999-2004 it employed 1.85 million people, more than the European car industry[7]. Regulation is the main driver in the development of eco-industries, and an increased uptake of BAT would deliver a major boost to this sector while further consolidating Europe's position as world leader in environmental technologies.

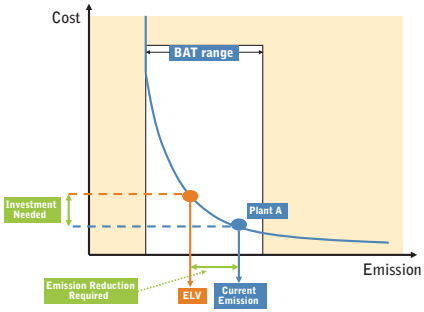
[6] see the unchanged definition in article 3(9) of the proposal
[7] Ernst and Young, 2006

## The Problem: Indiscriminate application of the Inherent Flexibility

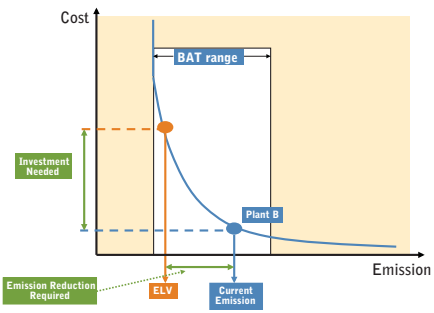
Even as these key mechanisms will work to generate a level playing field for industrial operators, a number of elements remain that serve to **retain much of the flexibility inherent in IPPC**.

*Range:* **The standards in the BREF, the BATAELs, are presented not as a single value but as a range**. In all cases, the range of BATAELs presented in the BREF accounts for the variation expected from commercially operating installations that install and operate BAT within different technological and environmental contexts. As shown by the figures below, installations with different performances can be accommodated by the BAT range.

Selection of BAT and ELV: Plant A (Spain)




Selection of BAT and ELV: Plant B (Italy)




Excerpt from case study of two aluminium plants operating according to BAT; ALCOA (Aluminium Industry) EP Lunch Debate May 14th, 2008

*Peaks:* BATAELs are presented as emission levels averaged over specific time periods and are drawn from commercial installations operating under normal conditions. Normal conditions inevitably include fluctuations in process factors such as input quality, and as such **the BATAELs already account for short term peaks in emissions** and are directly transferable to emission limit values in the permits.

*Compliance:* Member States have full freedom to determine the regime under which an installation's compliance with permit conditions is assessed. **Compliance regimes frequently allow actual emissions to exceed the emission limit values** in the permit under certain circumstances and for specific time limits. These regimes allow for some peaks, for instance under abnormal operating conditions, and so provide flexibility to the operator.

*Derogations:* Member States retain the flexibility to set permit standards that exceed the standards in the BREF in exceptional cases based on an assessment of the environmental and economic costs and benefits, and **taking into account the technical characteristics of the installation, its geographical location and the local environmental conditions (Article 16.3).**

## The Solution: Playing Fair According to Clear Criteria

The flexibility inherent in IPPC has been applied indiscriminately, leading to a situation where the innovative effects of BAT-based permitting have not been fully realised. In order to ensure fair play and guarantee the level playing field, it is essential that all derogations granted must be based on clear and common parameters and must be part of a transparent permitting process open to public scrutiny.

- The justification for the exceptional derogation must be included in the permit and available to the public that must be given early and effective opportunities to participate in decision-making.
- The criteria by which an exceptional derogation can be granted must be established at community level by the Commission in order to set clear and common parameters.

# The Environmental Safety Net

## The Problem

Annexes V, VI, VII and VIII of the Industrial Emissions Directive integrate binding minimal emission limit values (ELVs) for large combustion plants, waste incineration and co-incineration plants, installations and activities using organic solvents and installations producing titanium dioxide. Regulatory authorities can draw on the BATAEL in the BREF to set emission standards in the permit that are stricter than these binding ELV, but they cannot be less strict[8]. These standards act as a **safety net** to ensure that emission levels do not exceed a certain level.

Practice in permitting these types of installations has shown that the permit conditions are often based directly on the binding ELVs, with no reference to the BATAEL in the BREF.

In some of the new Member States, authorities rely on the binding standards to guide their permitting practice, as the case-by-case BAT-based permitting approach demands additional time, expertise and a philosophy with which they are unfamiliar.

## The Solution: A Safety Net extended to all IPPC sectors

The sectoral ELVs therefore represent a critical safety net, requiring a bottom line of environmental performance below which standards cannot slip. It is therefore essential that the level at which ELVs are set is strict enough to deliver a baseline of environmental protection.

Current practice, where standards in permits often drawn directly from the binding sectoral ELVs with no reference to BATAEL in the BREF, have led to a disconnection between levels of emissions and those achievable using BAT.

Setting sectoral ELVs within the BAT range will serve to ensure that permits deliver a level of pollution control that is achievable using techniques that are readily available on the European market and that have been successfully applied in commercially operating installations.

The sectoral ELVs have been instrumental in driving improvements in UK industry's environmental performance, after the implementation of IPPC.

- Implementation of the Waste Incineration Directive NOx ELV of 800 mg/Nm$^3$ drove uptake of SNCR at Lafarge's Hope Aberthaw and Cauldron cement works and at Castle Cement's Ketton works
- Rugby cement replaced upgraded dust control techniques to comply with Waste Incineration Directive ELVs
- Implementation of the Large Combustion Plant Directive forced UK power plants to retrofit flue gas desulphurisation techniques or operate at low loads to meet $SO_2$ emissions ELVs

[8] the Dutch administrative court has made clear that sectoral ELVs are only a bottom line, competent authorities have to refer to BATAEL in the BREF and take them into account. e.g. AB RvS 25 January 2006, 200409; AB RvS 20 April 2005,200405315/1233/1

BAT-based binding ELVs will deliver an additional push for environmental innovation, and will ensure that the Directive is consistent in the signals sent to operators. Derogations to standards below these levels will not be possible and a bottom line of environmental performance will be assured.

The following mechanisms will help to ensure that the sectoral ELVs contribute to achieving the long term objectives of the Thematic Strategy on Air Pollution and the Water Framework Directive:

- The binding sectoral ELVs should be based on BAT and set within the range of the BATAELs in the BREF.

  *This approach will ensure a coherent and consistent BAT-based framework for controlling industrial emissions to the environment.*

- Following the updating of a BREF, the minimum requirements should be adjusted to reflect scientific and technical progress within a 12-month period.

  *This is essential to ensure that the minimum requirements reflect what is technically and economically feasible in commercially operating installations.*

- The safety net should be extended to cover all IPPC sectors. In extending the binding minimal requirements to cover all sectors, emission limit values may be supplemented by equivalent parameters of technical measures provided that an equivalent or higher level of environmental protection can be achieved.

  *To deliver a baseline of protection to the environment and European citizens.*

- Measures designed to update or establish the binding minimum requirements should be adopted through comitology with scrutiny.

  *The comitology procedure is much faster than co-decision, geared towards technical decision-making, and more able to rapidly respond to technological progress.*

- Stakeholders representing the public interests should be consulted by the Commission before the final decision regarding such measures is made.

  *In order to make the decision making process open, transparent and increase the confidence of European citizens.*

# Combustion Plants

## The Problem: Dirty and Toxic Air

The latest EEA data clearly shows that we are not on track to deliver clean air by 2020. Figures for NOx emissions are particularly alarming, with IPPC installations responsible for 34% of the EU NOx emissions. In fact, only six Member States are responsible for 70% of these emissions, namely the UK (14.4%), Germany (12.6%), Spain (12.3%), France (12.3%), Italy (9.8%), and Poland (7.9%)[9].

Large combustion plants (LCPs) contribute over 90% of industrial emissions of NOx and $SO_2$[10]. However, BAT uptake is generally low and the emission limit values under the Large Combustion Plants Directive are well higher than those associated with BAT[11]. Many LCPs have emission levels that far exceed those achievable using BAT.

In 2006 more than 2 million tonnes of NOx were emitted by the electricity generating LCPs alone. The Member States featuring as the top 5 polluters for 2006 are: UK (19,32%), Poland (13,27%), Germany (12,33%), Spain (12,13%) and Italy (5,45%). The total average $SO_2$ emissions between 2004-2006 amount to 5.137 Million tonnes, of which the top five polluters were Spain (18.5%), Bulgaria (15.1%), Poland (14,7%), Romania (10,3%) and the UK (8,8%)[12]. The UK, Bulgaria, Spain, Poland, Greece and Romania also operate the ten highest emitters in public electricity generation[13]. See Annex 1 for tables outlining details of the EU's LCPs.

In order to meet the objectives of the Thematic Strategy on Air Pollution, emissions of $SO_2$ and NOx from industrial installations need to be cut by about 50% by 2020.

[9] EEA, 2008b
[10] COM2007 a, p 32
[11] Commission, 2007a
[12] ENTEC, 2008, table 4.12 and 4.15
[13] ibid, table 4.16 and 4.17

## The Solution: Applying BAT(Example of NOx)

Emissions reductions achieved through the application of BAT to LCPs will be the main element in achieving the objectives of the Thematic Strategy on Air Pollution. For coal-fired power plants BAT for reducing NOx emissions includes a number of primary and secondary measures (SCR and SNCR). SNCR and the more advanced SCR have been successfully applied to reduce NOx from industrial installations for over a decade and can reduce NOx emissions by 80-90% respectively.
BAT for $SO_2$ reduction includes using low-sulphur fuel coupled with the wet scrubber or the spray dry scrubber desulphurisation[14].

Typical costs for the installation and operation of SCR:
€ 0.5-1 per kg NOx
Yara, 2008
€1.5-2.5 per kg NOx
LCP BREF, 2006

Key mechanisms to promote BAT uptake by LCPs include:

- Setting the LCP ELVs at the lower end of BATAELs
- An implementation deadline of 2014 for sectoral emission limit values for LCPs
- Do away with the NERP since it results in lower emission reductions than plant by plant ELVs
- Rigorous enforcement
- A level playing field

National Emission Reduction Plans (NERP) allow for LCP Directive compliance across a whole sector or sub-sector within a Member State, rather than at the level of each individual plant. They have been applied to the LCP sector in the UK.

The Commission's IED proposal removes the option for using a NERP based on evidence of a lack of success in reducing emissions.

A UK study investigating future scenarios found that the use of a NERP in the UK would result in significantly lower emissions reductions for NOx, $SO_2$ and dust. (ENTEC 2008,DEFRA study).

Brindisi Federico II plant, Puglia, Italy

- SCR installed in 1998
- World largest coal, fuel and orimulsion power plant
- Consumes 6 million tons of coal every year
- NOx emissions 170 mg/$m^3$

Enel, 2006

Electrabel plant, Ruien, Belgium

- Was one of Europe's worst polluters
- SCR installed in 2004
- NOx emissions down by 70%

Electrabel, 2006

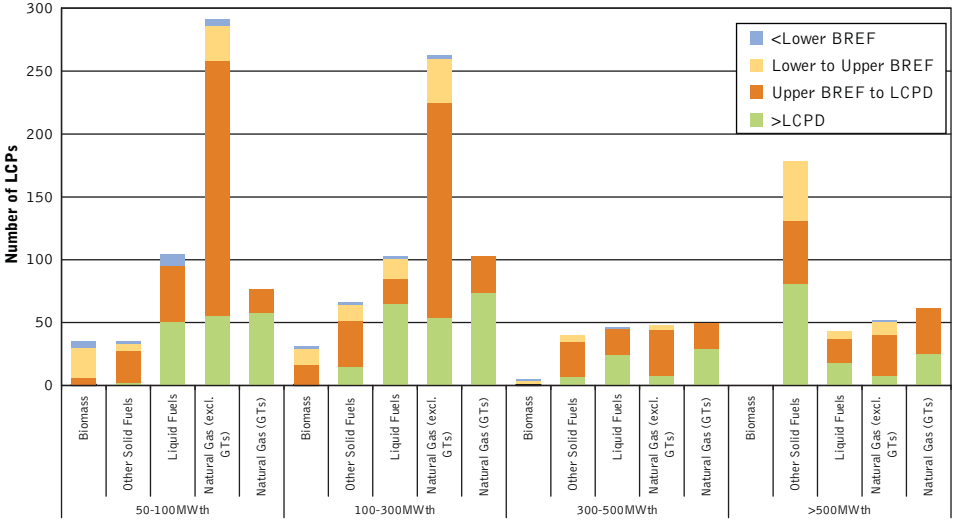
[14] Large Combustion Plants BREF, 2006

## Top 20 NOx producing point sources in the EU-27

| Country | Site | Capacity (MWe) | Current emissions estimate (kilotonnes) | Emissions estimate using BAT (kt) |
|---|---|---|---|---|
| UK | Drax | 3960 | 58 | 7 |
| Poland | Belchatow | 4,340 | 40 | 2 |
| Bulgaria | Maritsa II | 1,450 | 39 | 2 |
| Spain | Compostilla | 1,312 | 35 | 2 |
| Spain | Teruel | 1,050 | 31 | 2 |
| UK | Aberthaw | 1,425 | 24 | 1 |
| Portugal | Sines | 1,256 | 23 | 2 |
| UK | Ratcliffe | 2,000 | 23 | 3 |
| UK | West Burton | 2,000 | 23 | 2 |
| Bulgaria | Maritsa III | 840 | 23 | 2 |
| Spain | La Robla | 620 | 23 | 1 |
| UK | Cottam | 2,008 | 22 | 3 |
| Greece | Dimitrios | 1,570 | 22 | 3 |
| Spain | Velilla | - | 21 | - |
| UK | Kingsnorth | 1,455 | 20 | 2 |
| Ireland | Moneypoint | 915 | 20 | 2 |
| Greece | Kardia | 1,200 | 20 | 1 |
| UK | Ferrybridge | 1,470 | 20 | 2 |
| Romania | Turceni | 2,310 | 20 | 1 |
| UK | Longannet | 2,400 | 19 | 2 |

*Source: The Swedish NGO Secretariat on Acid Rain/European Environmental Bureau, 2008*

## Overview of 2006 LCP performance vs. LCP Directive ELV and BATAELs for NOx




*Source: ENTEC, 2008, Evaluation of the Member States' emission inventories 2004-2006 for LCPs under the LCP Directive (2001780/EC), September 2008, Figure 4.27*

## Potential Benefits

The benefits of applying BAT to Europe's LCPs outweigh the costs from at least three-to-one (low estimate) and ten-to-one (high estimate). This evaluation does not include damages to ecosystems because it is not possible at this time to adequately calculate an economic value for them. The European Environment Agency has found that applying the stricter end of the BATAELs to the top 450 large combustion plants would reduce industrial emissions of NOx by 87% and $SO_2$ by 97%[15]. The greatest potential for reduction lies with coal-fired power plants. The table below gives an indication of the emissions reduction potential and the associated health benefits and costs to industry if the uptake of BAT by large coal-fired power plants increased by 40%:

| | NOx | Dust |
|---|---|---|
| Annual emissions reductions | 260,000 tonnes of NOx p/a | 8,000 tonnes of NOx p/a |
| Health benefits | € 2.2 billion p/a | € 600 million p/a |
| Costs of implementing BAT | € 600 million p/a | € 160 million p/a |
| *Net benefit of installing BAT* | *€ 1.6 billion p/a* | *€ 440 million p/a* |

*EU mercury emissions would fall by 2 tonnes per year*

**The health benefits to citizens from cleaner air are at least three to ten times greater than the costs to polluters of implementing BAT.**

*ENTEC, 2007*

### Commission estimates of total benefits:

- **Net environmental and health benefits of €7–28 billion per year for least strict level of BAT and € 14-59 billion per year for stricter BAT range[16]**
- **Reduction in acute mortality deaths by 21,000 chronic mortality by 243,000 and infant mortality by 360**
- **Reduce years of life lost by 125,000 and 270,000 from impact of PM[17]**

[15] EEA, 2008a
[16] AEAT 2007a,p.6
[17] Commission, 2007b, AEAT 2007a,p.20

## The Solution: Small Combustion Installations under IPPC

Another solution to current high levels of NOx is to broaden the scope of IPPC to capture small combustion installations with a capacity of less than 50 MW. This will bring IPPC in line with the EU Greenhouse Gas Emissions Trading Directive and require these installations to apply for BAT-based permits. Many of these installations are already covered by permitting regimes at the national level, thus competent authorities are already engaged and additional administrative costs would be limited. The extension would serve to level the playing field for industrial actors relying on on-site energy generation.

| | NOx | $SO_2$ | PM |
|---|---|---|---|
| Contribution to total industrial emissions | 25% | 10% | 15% |
| Potential reductions with application of best performing abatement measures | 83% | 95% | 95% |

*AEAT, 2007a, Table 5.3, Table 5.2*

### Potential Benefits

In a scenario where small combustion installations implement best performing abatement measures, potential benefits include significant reductions in key pollutants. Estimated health benefits could then be in the range of € 2.6 billion per year (without including environmental benefits), at an estimated cost to industry of € 989 million (AEAT, 2007a).

**Estimated net benefit is €1.6 billion per year.**

# Co-Incinerating Waste

*"..the pursuit of profit in waste management should under no circumstances lead to compromises on the environmental profile of waste treatment."*

*IPTS, 1999*

## The Problem: Perverse Incentives and Impacts on Health

The playing field for industrial installations incinerating waste is uneven, and generates perverse incentives that lead to higher emissions of nitrogen oxides to the air. Weaker standards for cement kilns make it cheaper for a cement kiln to burn waste. This generates a perverse incentive to incinerate waste in poorly performing cement kilns and results in higher emissions of nitrogen oxides.

The recast process offers the opportunity to correct this imbalance. The emission limit values in Annex VI are to be revised and it is critical that they be brought in line with the BAT Associated Emission Limit Values in the BREF.

## The Solution: SNCR and SCR

Technologies that enable cement installations to reduce their nitrogen oxide emissions are readily available on the market and have been successfully installed in commercially operating installations.

### Industry cost estimates for the installation of NOx abatement techniques

| | |
|---|---|
| SNCR | € 358 per tonne NOx removed |
| SCR | € 946 per tonne NOx removed |

*Scur and Hoppe, 2006*

The most commonly used abatement technique, selective non-catalytic reduction techniques (SNCR) can reduce emissions by 75% to 200-500mg/Nm$^3$.

### BREF NOx emission limit values for cement installations:

| | |
|---|---|
| Installations with SNCR | 200-500mg/Nm$^3$ |
| Installations with SCR | 100-200mg/Nm$^3$ |

*Cement and Lime BREF, 2001*

The more advanced selective catalytic reduction techniques (SCR) can bring emissions down to 50mg/Nm$^3$[18], achieving emissions reductions of 90% or more. SCR techniques also serve to reduce emissions of other key pollutants, namely carbon monoxide, VOC, dioxins and furans.

**SCR is more cost-effective than SNCR in delivering a multi-pollutant control strategy**[19].

**ELVs for NOx for the cement sector should be set at the lower end of the BATAELs, 200 mg/Nm$^3$**

[18] Revised lime BREF
[19] Neuffer and Laney, 2007

**Cementa AB Sweden achieves 80-85% NOx emission reductions with SNCR in two installations, Skövde and Slite**

- Nitrogen oxide emissions less than 200mg/Nm³
- Stable functioning over a prolonger period
- Total cost of NOx abatement: 250 €/t of NOx.

*Junker and Lynberg, 2007*

**Cementeria di Sarche di Calavino successfully installs SCR technique in 2007**

**Reductions in nitrogen oxide foreseen**

*Italcementi Group, 2008*

Progressive Member States have already acted to protect their citizens by imposing stricter emissions standards for nitrogen oxides through establishing general binding rules. There are cement installations successfully operating with emissions below 200 mg/Nm³ in Italy and Sweden. Germany has set 200 mg/Nm³ for new and substantially changed co-incineration cement kilns after 2012 as well as for existing kilns when combustion is based on 100% waste.

**NOx Emission Limits for Cement Installations in Progressive Member States**

| | |
|---|---|
| Germany<br>>60% waste incineration<br>100% waste incineration | 500 mg/Nm³<br>200 mg/Nm³ |
| Sweden | 200 mg/Nm³ |

**Cementeria di Monselice cuts nitrogen oxide emissions with SCR**

- Nitrogen oxide emissions less than 200mg/Nm³
- Nitrogen oxide removal efficiencies of 97%
- SCR is a "cost effective multi-pollutant control strategy"

*Linero, Bellin and Lieibacher, 2006 and Linero, Leibacher and Bellin, 2007*

The application of SCR to NOx emission reduction in the cement industry has been successfully tested in Austria, Italy, Sweden and Germany.

Results of a successful pilot plant trails in Kirchdorf,
Upper Austria resulted in NOx emission levels of 100-200 mg/Nm³.

*Kossina, 2001*

Solnhofen Portland Zementwerke AG (SPZ) conducted trials with SCR

- NOx emissions reduced to 200 mg/Nm³
- 90% NOx reduction rates achieved
- additional reductions in ammonia
- Cost effective and economical

*Stuttgart, 2007*
*Bolwerk et al., 2006*

## Potential Benefits

Implementing SCR techniques in the cement industry is a low-hanging fruit that can deliver significant environmental and health benefits. Setting NOx emission limit values at 200mg/Nm$^3$ will promote uptake of the more advanced SCR techniques and in doing so maximize reductions in nitrogen oxide emissions. Additional environmental benefits include reductions in emissions of volatile organic compounds, dioxins and furans.

If just 40% of cement plants implement BAT as defined in the BREF:

| | High end of BATAELs | Low end of BATAELs |
|---|---|---|
| Annual emissions reductions | 29,000 tonnes of NOx p/a | 57,000 tonnes of NOx p/a |
| Health benefits of NOx reduction | € 330 million p/a | € 660 million p/a |
| Costs of implementing BAT | € 15 million p/a | € 30 million p/a |
| *Net benefit of installing BAT* | *€ 315 million p/a* | *€ 630 million p/a* |

*ENTEC, 2007*

**Estimated net benefits € 630 million per year**

# Enforcement

## The Problem

Site inspections are key tools for ensuring compliance with IPPC. However, the current IPPC Directive contains no concrete obligations with regards to inspections and as a result there is a wide divergence across Member States in terms of the policies and practices in inspecting industrial sites and ensuring compliance[20]. In particular, in some of the new Member States planning is only now underway for the establishment of inspection systems. Although Recommendation 2001/331 provides minimum criteria for environmental inspections (RMCEI)[21], it is not legally binding and not specific to IPPC installations.

Inspections are a prerequisite in order to assess compliance and enable competent authorities to detect leaks or malfunctions of abatement equipment. Where non-compliance goes undetected at an industrial site, the consequences can be devastating.

Potential cost of non-compliance:

- 10% exceedence of $SO_2$ ELVs for 1 year
- additional 100 tonnes of $SO_2$
- € 0.6-1.6 million

*Commission, 2007a*

## The Solution

In order to minimise administrative cost and encourage compliance, inspection frequencies should be tailored to reflect the compliance record of the installation, the implementation of environmental management systems (EMAS), and the risks associated with the activities.

| Annual inspections | Compliant low-risk installations with EMAS |
|---|---|
| 2 random inspections per year | General case |
| 3 random inspections per year | Installations where a breach has been detected |

Additional costs for a minimum frequency of 1 inspection per year for all installations are estimated at about €18 million per year. Considering that currently 52.000 installations are covered by IPPC that would represent about € 350 per year per installation.

In addition, industrial operators should provide an annual report on their compliance with permit conditions and their performance against the range of BAT in the BREF. This will provide valuable information to the authorities on how the performance of the installation compares with other similar installations. Such a report can be streamlined with other reporting obligations, for example for the European Pollutant Release and Transfer Register (E-PRTR) and under EMAS. In addition, this information can then be brought into the Sevilla Process when updating the BREFs.

[20] IMPEL, 2007

[21] Recommendation of the European Parliament and of the Council of 4 April 2001 providing for minimum criteria for environmental inspection in the Member States, 2001/331/EC

**Sevilla Process and BREFs:**

The BREFs are high quality technical documents developed by technical experts in a multi-stakeholder group

- Participants include representatives from Member States, industry and non-governmental organisations promoting environmental protection
- Much of the data upon which decisions are based is submitted by industry, which has significant influence over the final BREF document and the BATAELs therein
- The BREF set the European benchmark for environmental performance and are used worldwide
- Developing one BREF costs €5-10 million, about €150-300 million over 1997-2007 (Commission, 2007a)

## The Benefits

Such a system will ensure that breaches are quickly detected and that impacts on the environment and human health are minimised. It enhances the prevention of pollution and is based on the polluter pays principle. It will also serve to foster an ongoing dialogue between operators and permitting authorities on BAT.

In addition, public confidence in the safety of industrial installations will be bolstered.

# Soil and Groundwater

## The Problem: Contamination

In 2004, contaminated soil made up 45% of hazardous waste treated in Ireland due to redevelopment of brownfield sites

There are an estimated 3.5 million industrial sites in the EU that are potentially contaminated, 500,000 of which are thought to be seriously contaminated and in need of remediation[22]. The estimated annual social cost of soil contamination is between €2.4 and €17.3 billion, with most of these costs borne by tax payers, rather than by the polluters. Industrial activities, including waste management, are the most significant cause of soil contamination in the EU. At industrial and commercial sites handling losses, leakages from tanks, pipelines, on-site landfills and accidents are the most frequent causes of soil and groundwater contamination, with the chemical and metal working industries, energy production, and the oil industry being the greatest contributors[23].

As a result of soil contamination, people may be exposed to hazardous substances at the workplace, as neighbours to industrial sites through wind dispersion of contaminated soil particles, and at redeveloped sites that have not been adequately remediated. While is it positive that brownfield sites are redeveloped to reduce urban sprawl, it is critical that all contamination is addressed. Groundwater is contaminated through leaching and leakages leading to degradation in the chemical status of European groundwater. Groundwater is a key source of drinking water in many European countries, and its contamination requires costly treatment to make the water fit for human consumption.

The latest Presidency's proposal for a Soil Framework Directive does not propose remedies to this problem. There is no obligation to de-pollute the soil, nor is there any frequency requirement for monitoring. The outcome of this piece of legislation is uncertain, however it is not expected that it will set specific requirements on the cessation of activities from IPPC installations or on the monitoring of soil and groundwater (also because of the legal nature of Framework Directives).

[22] Commission, 2006
[23] EEA, 2007

## The Solution: Baseline Reports

The remediation of contaminated soil begins with the identification of sites posing dangers to human health and the environment. In addition, where contamination is found, industrial operators must take action to identify the source and prevent emissions. Where soil is only tested at site closure, severe contamination of soil and groundwater and associated impacts on human health may already have occurred. Requirements under the Industrial Emissions Directive should complement the aims of the proposed Soil Directive by generating an information baseline on the levels of contamination at industrial sites. Key mechanisms include:

- A baseline report on soil and groundwater, including quantified information
- Monitoring of groundwater and soil quality at least every five years respectively
- Upon cessation of activities, operators must return the site to the state established in the baseline report

Estimated costs per sites
Soil monitoring:€1,300 to 4,900
Baseline report:€ 5,000-10,000
*Commission, 2007a*

### The Benefits

- The baseline report will clarify the status of soil and groundwater and, in the case of contamination, serve as an information basis for identifying liability
- Periodic monitoring will allow for the early detection of contamination, reducing remediation costs and associated impacts on human health and the environment
- Industrial operators will be obliged to clean up and pay for the soil and groundwater pollution that has resulted from their activities

# Intensive Farming

*Eutrophication due to excessive nutrient loads leads to algal growth, low oxygen, fish kills, and eventually a major decline in biodiversity.*

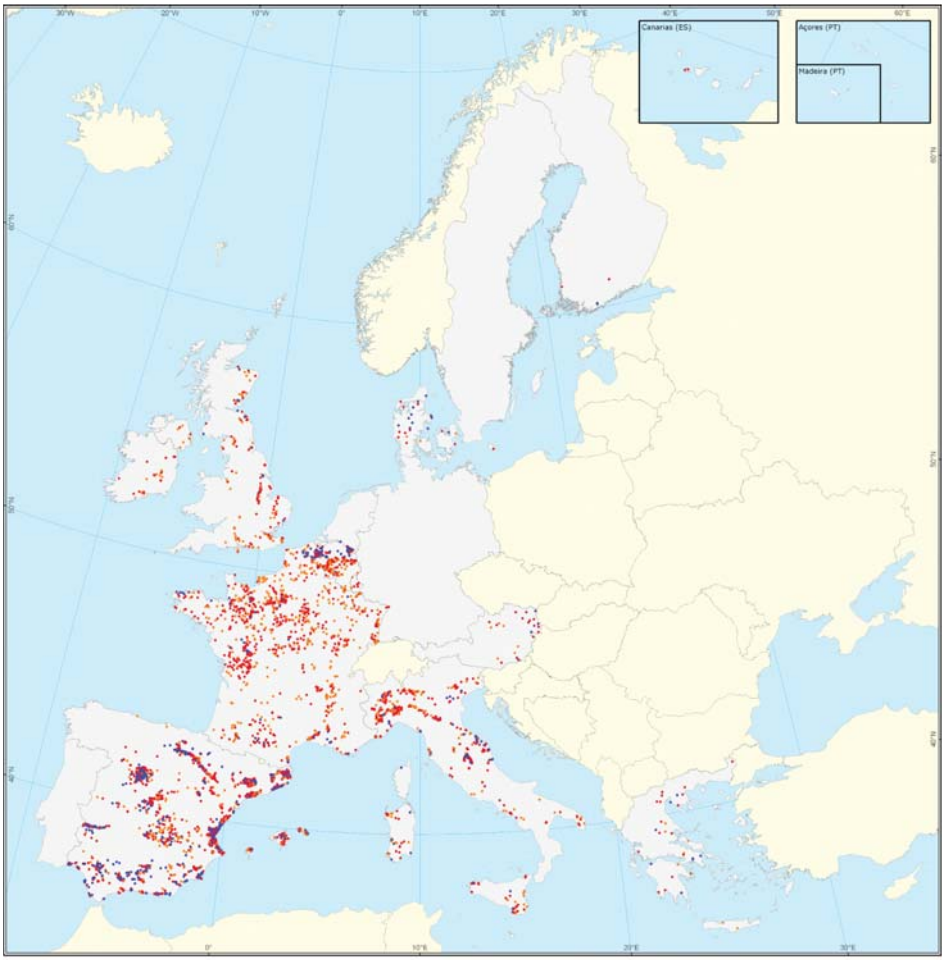
## The Problem: Excess Nutrient Loads

Pig and poultry farming continues to expand, with a trend towards concentrated farming generating high volumes of manure on a daily basis. Spreading manure on land without adequate techniques causes negative environmental impacts on the quality of nearby waters, soil and air. The impact relates to the high nutrient load of manure, and the loss of nitrogen and phosphorous through evaporation, leaching and conversion.

Agriculture contributes to approximately 64% of the nitrogen load to surface waters[24]. Nutrient leaching causes eutrophication of waters and is common on lands that have been agriculturally employed for decades, since the soil is already saturated with nutrients. Excessive application of manure reduces soil quality and increases run-off, so exacerbating eutrophication. Nitrogen seriously degrades the quality of surface and groundwater, making it unfit for use as drinking water.

The Drinking Water Directive 98/83/EC stipulates that nitrate concentrations in drinking water should not exceed 50 mg/l. However, results from the European Environment Agency indicate that concentration limits are exceeded in 1/3 of groundwater bodies, with trends towards a continued degradation of our water resources[25]. In Western Europe the mean nitrate concentrations in groundwater are above the Drinking Water Guide level (> 25 mg/l). There is a high and stagnant level of nitrate in European groundwater, with levels described as stable to increasing[26]. The map below identifies those areas where the maximum nitrate concentrations are exceeded in groundwater.

[24] Commission, 2007c
[25] EEA, 2003
[26] EEA, 2008c




**NITRATES DIRECTIVE EU-15**

**MAXIMUM NITRATE CONCENTRATIONS GROUNDWATER, RP3 (2000-2003)**

**max NO3 mg/l**

- 40 - 50
- 50.1 - 100
- > 100

**NL, DE, PT, SE : no data on Maximum NO3 delivered**

*Source: Commission, 2007, "Report from the Commission to the Council and the European Parliament On implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources for the period 2000-2003," COM (2007) 120 Final*

The nitrogen application rate of 170 ka/ha is exceeded in Belgium, the Netherlands, Italy, France, Spain and Portugal[27]. As a result of high domestic nitrogen emissions and input from rivers draining agricultural lands in other countries, the Netherlands has the highest nitrogen surplus in the EU, at 319 kg/ha[28]. Concentrations of nitrogen and phosphorous in Dutch coastal waters exceed natural values by a factor of 5-10, causing frequent algae blooms, and covering North Sea Beaches with foam[29].

Up to 65% of available nitrogen can be lost to the air as ammonia from farm yard manure left on the soil surface following application.

*MAFF, 1999*

Gaseous ammonia causes considerable nuisance to local residents and upsets the nutritional balance of surrounding ecosystems. $NH_3$ is also a greenhouse gas contributing to climate change.

## The Solution: Applying BAT to Spreading of Manure

BAT for the spreading of manure involves following management principles, as well as using particular equipment (injection or band-spreading and incorporation within 4 hours for pig manure and incorporation within 12 hours for poultry manure).

Management principles for spreading manure:

- Balance volume applied with plant needs
- Consider soil characteristics
- Apply to dry land
- Do not apply to slops
- Do not apply close to watercourses
- Time application with plant growth

Denmark has successfully introduced controls on manure application and significantly reduced nitrogen losses from agriculture.

- 31% reduction in the nitrogen surplus, 1990-2003

Kronvang *et al.*, 2008

[27] Commission, 2007c
[28] BREF for Intensive Rearing of Poultry and Pigs, 2003
[29] Erisman *et al,* 2005

## The Solution: A Differentiated Threshold for Inclusion under IPPC

Current IPPC thresholds for the inclusion of intensive farming installations exclude 80% of pigs and 40% of poultry. There is a huge difference in the volumes of manure produced by different species of poultry. The more intensive the production, the more risk of negative impacts from the manure. The Alterra 2007 study calculated thresholds for poultry using those for production pigs (>30kg) as a basis with an assumed mean N excretion rate of 11 kg per animal per year. Therefore the IPPC threshold is fixed at 22,000 kg N p.a. per installation, leading to following poultry thresholds:

| | | | |
|---|---|---|---|
| Broilers | 36,000 | Production pigs | 2,000 (reference threshold) |
| Laying hens | 37,000 | Turkeys | 10,000 |
| Ducks | 22,000 | | |

### Benefits

Reducing the nutrient load and applying BAT to spreading manure will:

- reduce $NH_3$ emissions by 50-60 kt per year at a cost of € 6,000 per tonne and provide for appropriate management of nitrogen

Differentiated thresholds for poultry would

- reduce $NH_3$ emissions by at least 10kt per year at cost of € 1,000 per tonne[30]
- will also ensure that all poultry installations having similar environmental impacts are regulated under IPPC, whatever the species being reared

[30] Commission, 2007a

# Summary of Solutions

| | |
|---|---|
| Problem: | Unlevel playing field and inadequate progress towards environmental objectives in the Thematic Strategies on Air Pollution and on Soil Protection and the Water Framework Directive |
| Solutions: | • ELVs in the permit within the BAT range in the BREF<br>• Derogation only in exceptional case and publicly justified. The public must be involved in the decision making process<br>• Criteria for derogations established by the Commission<br>• BREF publication triggers permit review within 2 years<br>• clear link between permits and environmental quality standards such as NEC<br>• Translate at least the BAT chapters of the BREFs into all European languages<br>• Annual report comparing performance with BAT |

| | |
|---|---|
| Problem: | Sectoral ELVs are not linked to BAT in the BREF leading to inconsistent permitting |
| Solutions: | • Sectoral ELVs are providing a bottom line environmental protection, but must be in the BAT range<br>• ELVs to be updated through comitology following BREF review and require public consultation before final decision is reached<br>• Extend safety net within 12 months of adoption of relevant BREF with the aim of covering all IPPC sectors |

| | |
|---|---|
| Problem: | Nitrogen oxide emissions over emission ceilings in 18 Member States |
| Solutions: | • ELVs for combustion plants must be fixed at the stricter BAT range<br>• Implementation deadline of 2014<br>• No more NERPs<br>• Include smaller combustions plants |

| | |
|---|---|
| Problem: | Unlevel playing field for waste incinerators and perverse incentives to emit more nitrogen oxide |
| Solution: | • Implement SCR techniques and set ELVs for the cement sector at 200mg/Nm$^3$ |

| | |
|---|---|
| Problem: | Lack of systematic and targeted inspections in all Member States |
| Solutions: | • Implement minimum of one annual inspection<br>• Risk and performance-based inspection frequency<br>• Annual operator report on compliance |

| | |
|---|---|
| Problem: | Contaminated soil and groundwater |
| Solutions: | • Require detailed baseline report on soils and groundwater<br>• 5 yearly monitoring of soil and groundwater quality<br>• Upon cessation of activities, operators must return site in baseline condition |

| | |
|---|---|
| Problem: | Eutrophication of lakes and nitrate thresholds exceeded in drinking water sources |
| Solutions: | • Apply BAT to manure and slurry off-site spreading<br>• Lower and differentiated thresholds for poultry installations according to N excretion factor |

# References


AEAT, 2004, "Costs and environmental effectiveness of options for reducing air pollution from small-scale combustion installations," Final report to the European Commission, AEA Technology, November 2004

AEAT, 2007a, Assessment of the benefits and costs of the potential application of the IPPC Directive (96/61/EC) to industrial combustion installations with 20-50 MW rated thermal input, Final report for the European Commission, AEA Technology, October 2007

AEAT, 2007b, Evaluation of the costs and benefits of the implementation of the IPPC Directive on Large Combustion Plant, AEA Technology, July 2007

Alterra, 2007, Impact assessment of a possible modification of the IPPC Directive as regards intensive livestock rearing (part of a project on integrated measures in agriculture to reduce ammonia emissions carried out by the consortium Alterra, Wageningen UR, EuroCare, University of Bonn and A&F, Wageningen UR), June 2007

IPTS, 1999, "The incineration of waste in Europe: issues and perspectives," Institute for Prospective Technological Studies, Sevilla

Commission, 2006, "Impact Assessment of the Thematic Strategy on Soil Protection," Commission Staff Working Document, SEC(2006) 620

Commission, 2007a, " Impact Assessment of the Proposal for a Directive of the European Parliament and of the Council on industrial emissions," Commission Staff Working Document, SEC(2007) 1679

Commission, 2007b, "Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, Towards an improved policy on industrial emissions," Commission, COM(2007) 843 final

Commission, 2007c, "Report from the Commission to the Council and the European Parliament On implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources for the period 2000-2003," Commission, SEC(2007)339

EEA, 2003, "Europe's Environment: the third assessment," Environmental assessment report No. 10, European Environment Agency, Copenhagen, Denmark

EEA, 2007a, "Europe's Environment: the fourth assessment," State of the environment report No 1/2007, European Environment Agency, Copenhagen, Denmark

EEA, 2007b, "Progress in the management of contaminated sites," EEA core-set indicator no 15., European Environment Agency, Copenhagen, Denmark

EEA, 2008a, "NEC Directive status report 2007 Reporting by the Member States under Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants," EEA Technical report No. 9/2008, European Environment Agency, Copenhagen, Denmark

EEA, 2008b, "Indicator Fact Sheet, WEU1 Nitrate in groundwater," European Environment Agency, Copenhagen, Denmark

EEA, 2008c, "Air pollution from electricity-generating large combustion plants: An assessment of the theoretical emission reduction of $SO_2$ and NOX through implementation of BAT as set in the BREFs," EEA Technical report No. 4/2008, European Environment Agency, Copenhagen

Electrabel, 2006, "Annual Report," Electrabel, Belgium, http://www.electrabel.com/finance/annual_report/documents/mmvi_ac5vi5esreport_en.pdf#page_1

Enel, 2006, "Sustainability Report," ENEL, Italy, hip://www.enel.it/azienda_en/Sostenibilita/bilanci_sostenibilita/doc/2006_BdS.pdf

ENDs, 2005, Environmental Data Services Ltd., UK, ENDS Report, No. 370, pp.15-16,

ENTEC, 2007, Assessment of options to streamline legislation on industrial emissions and analysis of the interactions between the IPPC Directive and possible emission trading schemes for NOx and $SO_2$, June 2007

ENTEC, 2008, Evaluation of the Member States' emission inventories 2004-2006 for LCPs under the LCP Directive (2001780/EC), September 2008

ENTEC/DEFRA 2008 "Phase 1 of the impact Assessment of Proposals for a Revised IPPC Directive, Part 1: Combustion plants" DEFRA, May 2008

Erisman, J.W., Domburg, P., de Haan, B.J., de Vries, W., Kros, J. and Sanders, K., "The Dutch Nitrogen Cascade in the European Perspective," 2005, VROM

Ernst and Young, 2006, "Eco-industry, its size, employment and barriers to growth in an enlarged EU," Final report to the European Commission, August 2006

Bolwerk, R., Ebertsch, G., Heinrich, M., Plickert, S. and Oerter, M., "German Contribution to the Review of the Reference Document on Best Available Techniques in the Cement and Lime Manufacturing Industries," June 1, 2006

IMPEL, 2007, "IMPEL Project on review of Compliance promotion, Inspection practices and Enforcement for IPPC installations," Final report, November 2007

Intalicementi, 2008, Prezentazione della cementeria dei Sarchi di Calavino, May 2008, http://www.italcementi.it/NR/rdonlyres/000EED87-6C80-41AB-97E0-1398D3B37953/0/Sarche_presentazioneaprile2007.pdf

Junker, P. and Lyberg, A., 2006, "Swedish Contribution to European Best Available Techniques Reference (BREF) for the cement industry," May 30, 2006

Kossina, I., 2001, "Reduction of NOx Emissions from Exhaust Gases of Cement Kilns by Selective Catalytic Reduction," Proceedings of NOx Conference, Paris March 2001

Kronvang, B., Andersen, H.E., Børgesen, C., Dalgaard, T., Larsen, S.E., Bøgestrand, J. and Blicher-Mathiasen, G., 2008, "Effects of policy measures implemented in Denmark on nitrogen pollution of the aquatic environment," Environmental Science and Policy, Vol. 11, pp. 144-152

Leibacher, U., Bellin, C., Linero, A.A., 2006, "High Dust SCR Solution," International Cement Review. No. 12/2006

Linero, A.A., Leibacher, U., Bellin, C., 2007, "High Dust SCR Succeeds at Cementeria di Monselice". AWMA Annual Conference, June 2007.

MAFF, 1999, "Making better use of livestock manures on arable land," Ministry for Agriculture Food and Fisheries, UK

Neuffer, B. and Laney, M., "Alternative Control Techniques Document Update - NOx Emissions from New Cement Kilns," 2007, EPA-453/R-07-006, Environmental Protection Agency, pp. 88

Scur, P., Hoppe, H., 2006, "The Present State of NOX Abatement with the SNCR Process," Cement International, No. 2/2006

Stuttgart, 2006, "Regierungspräsidium und Firma Schwenk Zement KG vereinbaren Projekt zur katalytischen Stickstoffoxidminderung - Andriof: Fortschritt für den Umweltschutz in der Zement-industrie," Pressmitteilung, 22.11.2007

Yara, 2008, Industrial Solutions to reduce NOx emissions, presentation provided to EEB upon request from Yara representatives

# Annex 1: Technical Tables

## AEAT B ,2007

**Table i) Comparison of annual costs and benefits for the EU27 under the two IPPC scenarios relative to the NEC baseline (€billion/year) in 2020**

| | Upper end of BAT AEL range | Lower end of BAT AEL range |
|---|---|---|
| **EU27 Annual monetised benefits (health only)** | | |
| Low estimate | 9.4 | 20.4 |
| High estimate | 29.7 | 65.2 |
| **EU27 Annual Total Costs** | | |
| Total | 2.1 | 6.5 |
| **Net benefits (Monetised Benefits minus Total Costs)** | | |
| Low estimate | 7.3 | 13.9 |
| High estimate | 27.5 | 58.7 |
| **Benefit to Cost Ratio** | | |
| Low estimate | 4.4 | 3.2 |
| High estimate | 13.9 | 10.1 |

**Table 4.15 The five highest emitting MS for annual emissions of $SO_2$, $NO_X$ and dust, showing average annual emissions (in kt), the fraction of EU LCP emissions this MS emits and an indicative 2004-2006 trend.**

| Member State | Average total annual (2004-2006) $SO_2$ emissions | | | Member State | Average total annual (2004-2006) $NO_X$ emissions | | | Member State | Average total annual (2004-2006) dust emissions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | % of EU | % change '04-'06 | | kt | % of EU | % change '04-'06 | | kt | % of EU | % change '04-'06 |
| 1. Spain | 949 | 18.5% | -13.0% | 1. UK | 385 | 17.9% | +8.4% | 1. Poland | 43.4 | 17.2% | -10.4% |
| 2. Bulgaria | 776 | 15.1% | -2.5% | 2. Spain | 287 | 13.3% | fluctuates | 2. Greece | 39.1 | 15.5% | -43.8% |
| 3. Poland | 754 | 14.7% | fluctuates | 3. Germany | 271 | 12.6% | -5.3% | 3. Spain | 30.4 | 12.0% | -22.7% |
| 4. Romania | 526 | 10.3% | +14.6% | 4. Poland | 266 | 12.3% | +4.8% | 4. Romania | 25.8 | 10.2% | fluctuates |
| 5. UK | 450 | 8.8% | -28.2% | 5. Italy | 128 | 5.9% | -3.4% (Note 1) | 5. Bulgaria | 22.0 | 8.7% | -3.9% |

**Table 4.16 The ten LCPs with highest average annual emissions of $SO_2$.**

| Number | Member State | LCP Name | LCP Location | Thermal capacity (MWth) | Average annual $SO_2$ emissions 2004-2006 (kt) | Remarks |
|---|---|---|---|---|---|---|
| 1. | Bulgaria | TPP "Maritsa Iztok 2" | Kovachevo | 4,312 | 310.2 | |
| 2. | Spain | CT AS Pontes | La Coruña (Galicia) | 3800 | 295.0 | |
| 3. | Bulgaria | TPP "Maritsa Iztok 3" | Mednikarovo | 2,420 | 183.7 | |
| 4. | Spain | CT Teruel I-II-III | Andorra-Teruel (Aragon) | 3300 | 156.2 | |
| 5. | Poland | BOT Elektrownia Bełchatów S.A. | Rogowiec, ul. Energetyczna 7, 97-406 Bełchatów | 11,892 | 128.2 | Note 1 |
| 6. | Greece | Megalopoli III | Megalopoli, Arcadia | 839 | 112.4 | |
| 7. | Poland | Elektrownia Pątnów | ul. Kazimierska 45, 62-510 Konin | 3,624 | 100.0 | |
| 8. | Bulgaria | TPP "Bobov dol" | Golemo selo | 1,950 | 84.5 | Note 2 |
| 9. | Bulgaria | TPP "Brikel" | Galabovo | 1,020 | 77.4 | Opted out |
| 10. | Romania | S.C. Complexul Energetic Rovinari S.A. No. 2 | Rovinari, str. Energeticianului nr.25 | 1,756 | 71.3 | Note 3 |

Note 1: The 2003 Accession Treaty states that, by way of derogation from Article 4(3) and part A of Annexes III and IV of the LCPD, the emission limit values for $SO_2$ shall not apply until 31 December 2015 at the latest to El. Bełchatów, while during this transition period the total $SO_2$ emissions from all Polish LCPs are subject to an overall ceiling – see section 4.3.3.

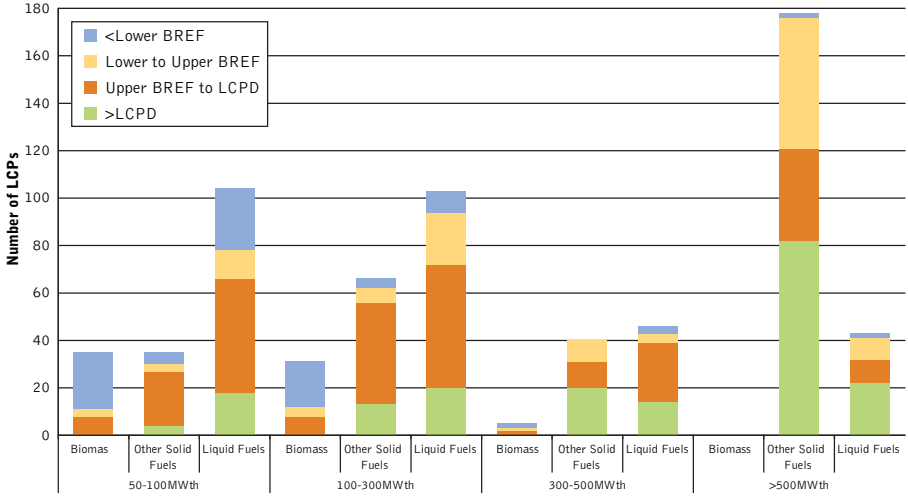
Note 2: The 2005 Accession Treaty states that, by way of derogation from Article 4(3) and part A of Annexes III, IV and VII of the LCPD, the emission limit values for $SO_2$ shall not apply until the date indicated for each unit of the plant 'Bobov dol': unit 2 (until 31 December 2011); unit 3 (until 31 December 2014). During this transition period the total $SO_2$ emissions from all Bulgarian LCPs are subject to an overall ceiling – see section 4.3.3.

**Table 4.17 The ten LCPs with highest average annual emissions of $NO_X$.**

| Number | Member State | LCP Name | LCP Location | Thermal capacity (MWth) | Average annual $NO_X$ emissions 2004-2006 (kt) | Remarks |
|---|---|---|---|---|---|---|
| 1. | United Kingdom | Drax | Drax Power, Drax P Stn, Selby | 10,800 | 58.3 | |
| 2. | Poland | BOT Elektrownia Bełchatów S.A. | Rogowiec, ul. Energetyczna 7, 97-406 Bełchatów | 11,892 | 42.0 | |
| 3. | Spain | CT Teruel I-II-III | Andorra-Teruel (Aragon) | 3,300 | 31.1 | |
| 4. | United Kingdom | Aberthaw | RWE nPower - Aberthaw P Stn | 4,200 | 24.5 | |
| 5. | Poland | Elektrownia "Kozienice" S.A. | Świerże Górne, gm. Kozienice, 26-900 Kozienice | 6,812 | 22.3 | Note 1 |
| 6. | United Kingdom | Cottam | EDF Energy, Cottam P Stn | 5,500 | 22.0 | |
| 7. | Spain | CT Compostilla II (G 3 and 4) | Leon (Castilla y Leon) | 1,675 | 21.5 | |
| 8. | United Kingdom | Ratcliffe | E.On UK, Ratcliffe-on-Soar P Stn, Nottingham | 5,500 | 21.5 | |
| 9. | United Kingdom | Kingsnorth | E.On UK, Kingsnorth P Stn, Kent | 5,500 | 21.4 | Opted out |
| 10. | United Kingdom | Scottish Power plc | Longannet Power Station | 6,400 | 20.4 | |

Note 1: The 2003 Accession Treaty states that, by way of derogation from Article 4(3) and part A of Annex VI of the LCPD, the emission limit values for $NO_X$ that would be applicable from 1 January 2016 shall not apply until 31 December 2017 to El. Kozienice. During this transition period the total $NO_X$ emissions from all Polish LCPs are subject to an overall ceiling – see section 4.3.3.

**Figure 4.26 Overview of 2006 LCP performance vs LCPD ELVs/BAT-AELs for $SO_2$**



The **European Environmental Bureau (EEB)** is a federation of over 150 environmental citizens' organisations based in most EU Member States, most candidate and potential candidate countries as well as in a few neighbouring countries. These organisations range from local and national, to European and international.

EEB's aim is to protect and improve the environment by influencing EU policy, promoting sustainable development objectives and ensuring that Europe's citizens can play a part in achieving these goals. EEB stands for environmental justice and participatory democracy. Our office in Brussels was established in 1974 to provide a focal point for our members to monitor and respond to the EU's emerging environmental policy. In 2004, EEB, working with the Mercury Policy Project/Ban Mercury Working Group, launched the 'Zero Mercury' campaign.

**European Environmental Bureau (EEB)**
Boulevard de Waterloo 34 | B-1000 Brussels | Belgium
Tel.: +32 2 289 1090 | Fax: +32 2 289 1099
E-mail: eeb@eeb.org
Websites: www.eeb.org, www.chemicalreaction.org, www.newngoforum.org, www.participate.org, www.zeromercury.org

AN INTERNATIONAL NON-PROFIT ASSOCIATION | ASSOCIATION INTERNATIONALE SANS BUT LUCRATIF