GA NCEDS
Box 1

ENVIRONMENT AGENCY

The National Centre for Environmental Data and Surveillance

Snapshots of the Environment

Regulating Major Industry

1.0 Introduction

1.1 The Snapshots of the Environment series has explored some of the issues related to each of the nine themes identified in the Environment Agency's **'An Environmental Strategy for the Millennium and Beyond'**[1]. Each Snapshot has used the **Viewpoints on the Environment**[2] and the **Stresses and Strains** frameworks to look at some of the pressures on the Environment.

1.2 This sixth Snapshot takes a thematic approach to consider issues of interest to the Environment Agency related to the regulation of major industries. Given the breadth of this topic and the restricted space, this Snapshot can only touch upon some of the issues rather than provide an extensive review. As more information becomes available, or new issues develop, they will be covered in future Snapshots.

1.3 A guide to the acronyms used is provided at the end of this document. An electronic version may be found on the web at **www.environment-agency.gov.uk**.

2.0 Background

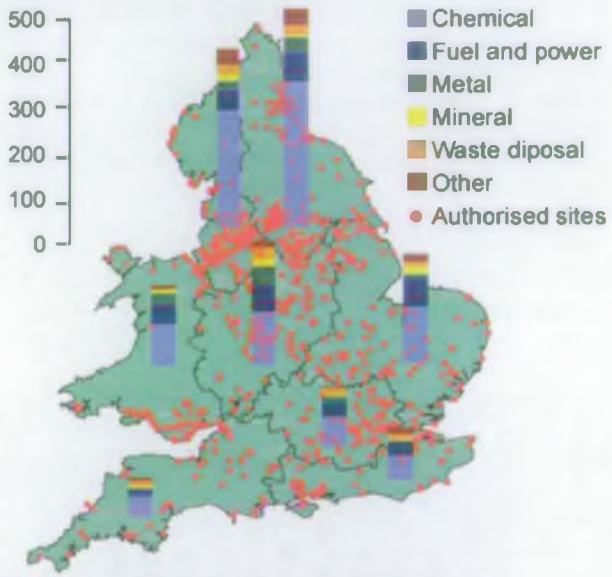
2.1 'Major industries' are establishments which have the greatest potential to pollute the environment. For the purposes of this Snapshot, they fall into one of the categories in Box 1.

Box 1. Major industry categories

- Chemical use, processing, manufacture, refining
- Fuel and power production and associated processes
- Metal production and processing
- Mineral industries, such as cement or lime manufacture and asbestos processes
- Waste disposal and recycling facilities, such as incinerators and recovery processes
- Other large industries such as timber or paper processing, tar and bitumen processes

2.2 Figure 1 illustrates the geographical spread of all the sites in England and Wales that carry out one or more of these processes. It also gives an indication of which processes are carried out in each Environment Agency region.

Fig 1. Industrial sites and authorised process in each Environment Agency Region, 1998[3]



2.3 These industrial sites are regulated by the Environment Agency. The responsibility for the regulation of smaller industrial establishments with releases to air, rests with local authorities (Local Authority Air Pollution Control - LAAPC). The exact number and distribution of LAAPC sites is unknown, although there are an estimated 15,000[4] sites in England and Wales. Other industries with more diffuse pollution, such as agriculture, transport, sewage treatment, mining, construction and forestry are regulated by other means.

3.0 Industry in context

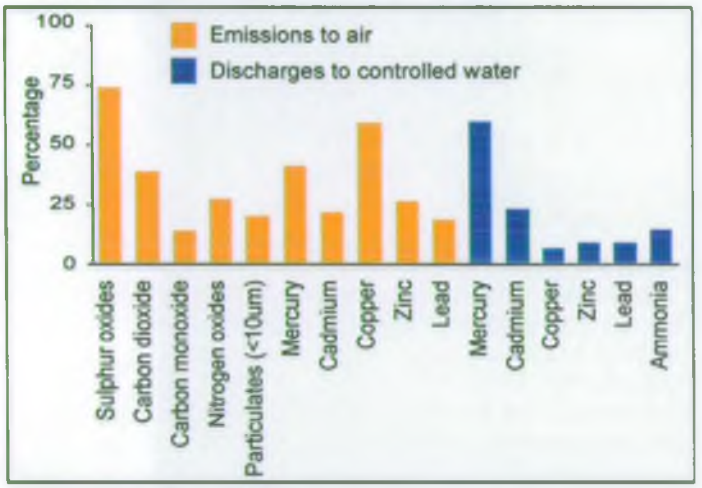
3.1 Industries produce wastes that may, under licence, be discharged into the environment. Such discharges, or emissions, can go directly into the air, surface water (sometimes via sewers) or can be disposed of to land (for example, into a landfill site).

3.2 Figure 2 gives an indication, for some chemicals, of the contribution made by major industry in relation to the country's total emission. The yellow bars compare the emissions to air from major industry in 1998[3], against the total emissions to air in 1997[5].The total emissions to air in 1998 is not yet available, but is likely to be lower than the 1997 figures (which would lead to an increase in the percentage contribution from industry). The blue bars compare the major industrial discharges direct to water in 1998[3], with the estimated total discharge to the coastal waters in 1998[6]. The low estimate is used as it gives

the 'worst case' scenario (note, also, that each dataset is from a different source, so that any comparisons made can only be indicative). It is clear that major industry is responsible for a significant proportion of the environmental release of some substances (such as mercury discharged to the controlled waters or sulphur dioxide released to the air). It is also clear, though, that major industry makes a relatively small contribution to the release of many other substances (such as lead or carbon monoxide). The source of these other substances could be activities such as transport or small industrial sites.

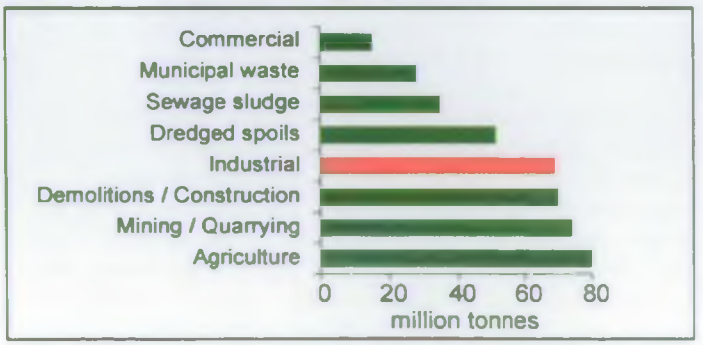
3.3 Major industrial polluters may not produce the largest amount of all hazardous substances, but they can, potentially, lead to chronic or acute localised pollution. This is because there is only a relatively small number of major industrial discharges, and any release from these sites (whether planned or accidental) would mostly impact on the immediate surroundings.

Fig 2. Percentage of total emissions which are due to discharges from major industries, 1998[3,5,6]



3.4 Figure 3 illustrates the amounts of solid waste produced by industry compared with other sectors[7], although the environmental impact of the waste from each sector will vary greatly. Industry only makes up 16% of the total waste arisings.

Fig 3. Annual waste arisings by sector[7]

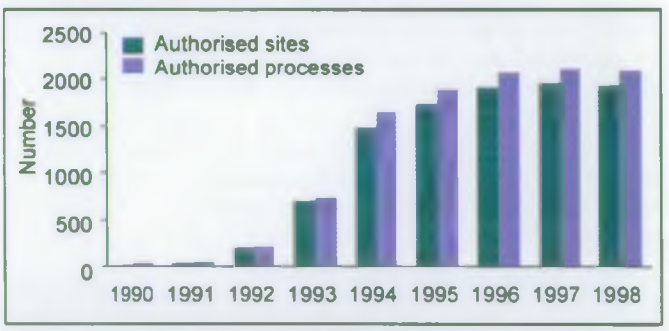


4.0 Integrated Pollution Control (IPC)

4.1 IPC has the principal aim of minimising the risk of environmental pollution by the implementation of pollution prevention measures at source. It considers all the possible discharges and emissions from a process and evaluates which disposal route (air, water or land) would result in the least harm to the environment as a whole. IPC was introduced by the 1990 Environmental Protection Act and applies to all major industrial sites, (known as "Part A" processes). Any establishment that wishes to operate a Part A process, in England and Wales, must first apply to the Environment Agency for an 'authorisation' to operate. After consultation, the Agency may then grant an authorisation to operate, which will establish certain conditions to be met to protect the environment. It is a criminal offence to operate a Part A process without an authorisation. IPC requires industry to use the Best Available Techniques Not Entailing Excessive Costs (BATNEEC) to minimise the emissions and impact of the industrial site.

4.2 In 1998, there were just over 1,900[3] sites carrying out 2,000 authorised processes, roughly half of which were for the chemical industry (note that any one authorised site may be operating a number of authorised processes). Figure 4 shows the number of authorised sites and processes and illustrates how the regulation was phased in from 1990.

Fig 4. Number of authorised sites and process authorisations, 1990 - 1998[3]



4.3 The effectiveness of IPC and the effects of separate industries on the environment can be shown. But because the number of sites incorporated within the IPC legislation has steadily increased, a comparison of the total emissions from industry cannot be made. The concept of considering the possible effects of a given discharge on all media prior to granting an authorisation has since been incorporated into Integrated Pollution Prevention and Control.

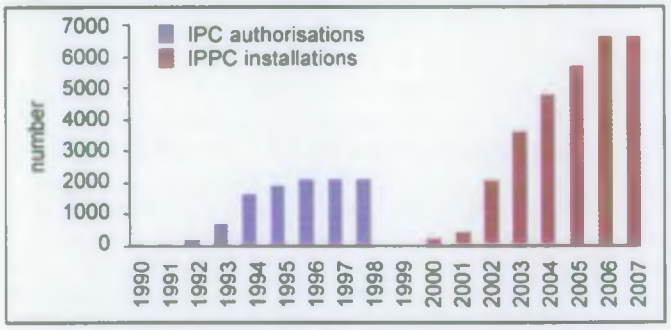
5.0 Integrated Pollution Prevention and Control

5.1 IPPC originates from a European Commission Directive[1] and will support and strengthen IPC over the next few years. It has the overall aim of attaining "a high level of protection for the environment taken as a whole" and is generally designed to prevent, reduce and eliminate pollution at source through the prudent

use of natural resources and the adoption of cleaner technologies. The Directive was adopted by the UK in September 1996, and will come into force for any 'new' sites in spring 2000. IPPC permits will progressively replace all IPC authorisations for 'existing' sites by October 2007.

5.2 Although the IPPC Directive builds on the UK's Integrated Pollution Control legislation it would be wrong to view it as simply IPC with an added "P". IPPC goes much further than IPC, for example, IPPC covers many more types of processes. 1,000[9] waste management sites, 500[9] food and drinks processing plants, and a number of intensive pig or poultry farms, are all likely to be covered by IPPC in addition to those already under IPC regulation. The implementation of IPPC will take the number of authorised sites, or installations, to 6,000[9] for the Agency. Figure 5 illustrates the expected increase in IPPC sites over the phase-in period (2000 to 2007) against the current number of IPC sites.

Figure 5. Predicted IPPC sites and current IPC sites



5.3 IPPC looks at all the possibly polluting impacts of a process to decide upon the best environmental option for running the site. This Best Available Technique (BAT) must be taken into account when planning and operating any IPPC process. Guidance or reference notes, known as 'BREF' notes, are being written to help industry and the regulator evaluate what, currently, represents the best available technique. BAT encompasses the environmental impacts that are traditionally assessed under IPC's BATNEEC, but also includes a number of other more wide-ranging effects (Box 2).

Box 2. BAT requirements

- Energy efficiency
- Noise and vibration
- Raw materials usage
- Prevention of accidents
- Furthering the use of recovery and recycling
- Site restoration after the industry has relocated or closed down

Other, more general, requirements for BAT

- Technical and economical viability
- Costs and benefits
- Geographic location
- Local environmental conditions

6.0 Industrial control under IPPC

6.1 IPPC uses a 'permit' system to control each installation, in order to obtain a high level of protection for the environment as a whole. The permits will specify the conditions under which the plant must operate, and the need for the operator to produce an annual report of all polluting releases. Permits will also include Emission Limit Values (ELVs) for the releases of hazardous substances to air, water and land. An ELV is a concentration (e.g. no more than 1 microgramme of mercury per litre of effluent) or a load (e.g. no more than 2 kilogrammes of benzene per year) of a particular substance in the industry's emissions that must not be exceeded.

6.2 The ELV and the plant operating conditions will be based on the Best Available Technique, which will take into account, amongst other factors, the technical characteristics of the installation, the substance to be released and the local environmental conditions at the discharge site.

6.3 The UK, in common with all EU countries, is contributing to the creation of reference notes (BREFs) by supplying information on ELVs. The first such submission of ELVs is due in 2002. Figures on industrial energy and raw material consumption will also be required. Any ELV set out in one of the reference notes could in theory be set as a statutory minimum. Box 3 gives some ELV ranges (the maximum and minimum limits) for authorised emissions to air, as a load, and for discharges to water, as a concentration or a load. Figures such as these could be submitted as part of the UK's ELV set.

Box 3. Example limit values

Emissions to air, kg/year (minimum-maximum)[3]	
Carbon dioxide	45,000 to 1,000,000,000
Carbon monoxide	1 to 10,000,000,000
Copper	20 to 4,000
Sulphur oxides (as SO_2)	100 to 70,800,000
Zinc	10 to 96,400
Discharges to water, kg/year (minimum-maximum)[3]	
Ammonia	40 to 3,000,000
Cadmium	0.000004 to 6,485
Mercury	0.000007 to 2,594
Zinc	20 to 255,500
Discharges to water, µm/litre (minimum-maximum)[10]	
Cadmium	1 to 14,400
Chloroform	0.022 to 67,000
Mercury	0.0082 to 40,000
PCP	1 to 1,000

7.0 International control of major industry

7.1 IPPC permits will need to contain conditions to minimise transboundary pollution, and where such pollution may occur, bilateral discussions with the other Member States could take place. The UK is already a signatory to a number of international agreements to reduce inputs of hazardous substances

to coastal waters and the atmosphere, where such discharges could cause pollution in other states.

7.2 The Oslo-Paris Convention 1992 (OSPAR) is one example of an agreement between a number of European states. It is designed to reduce pollution to the North East Atlantic from rivers and direct discharges (such as sewage works and industry). Each state agreed to reduce, by 1995, inputs of certain substances by 50% (based on the 1985 discharge levels). England and Wales have achieved large reductions for most substances (Figures 6 and 7)[6,11].

Fig 6. Mercury and cadmium OSPAR loads, 1990-98[6]

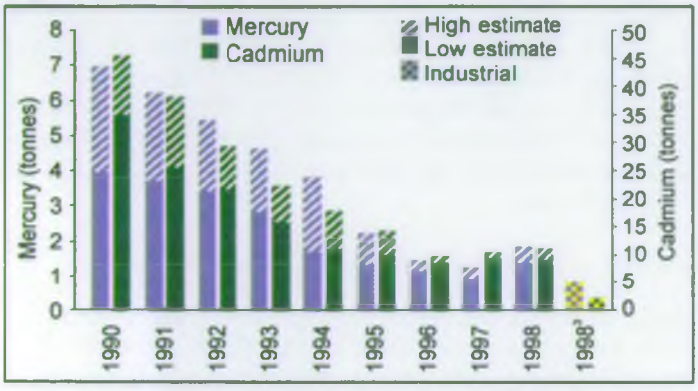
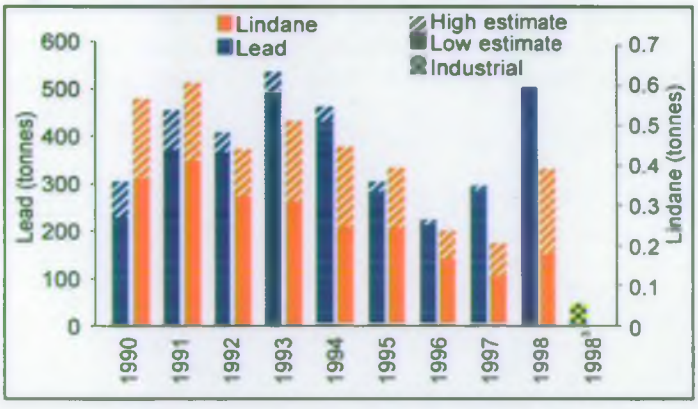


Fig 7. Lindane and lead OSPAR loads, 1990-98[6]



7.3 The majority of this reduction was due to improved industrial environmental performance, better regulation and a general downward trend in industrial production.

7.4 The Montreal Protocol 1987 is an example of a global agreement to prevent pollution. It is designed to limit the levels of ozone depleting substances and has been signed by 150 countries (including the UK). The Protocol has, for example, successfully led to the phase-out of the production of halons and CFCs.

8.0 Pollution Inventory

8.1 Information on the location of IPC sites, a summary of what they manufacture and reports on annual releases is held in the Pollution Inventory (PI), which is available for viewing on the Environment Agency's web site (Figure 8). The information contained in the PI is supplied to the Agency by each industrial operator.

8.2 All European Union countries will be required to produce an annual register of all polluting emissions from IPPC installations. It is likely that the Agency will be requested to provide this data, and that this will be delivered through the Pollution Inventory.

8.3 The PI enables the public to assess releases from any major industrial operator near to their home, workplace or any point in the country, which discharges to the air, water or land. It holds the maximum permitted release limits and the actual annual release levels for a number of hazardous substances which may be discharged to water and sewer, and for nearly 150 substances which may be emitted to air. It also gives information on the nature of these substances.

8.4 The Pollution Inventory has superseded the Chemical Release Inventory (CRI) which operated from 1990 to 1997. The PI and CRI data have been collated differently, but both are presented within the current PI to make it easy to access. The PI lists the emissions from the site as a whole (including fugitive emissions such as leaks from valves, fumes from solid waste, etc) but does not require reporting of the individual stacks, whereas the CRI contained stack emissions, to aid regulation, but not fugitive releases. The PI holds information on fewer substances than the CRI, but for these substances the requirements are more rigorous and consistent. The PI has standard levels above which any release must be reported, whereas in the CRI the reporting limits could change for each stack. The PI requests the same information from each site, whereas the CRI was site specific. All these changes lead to the PI being a more consistent and effective regulatory tool, which allows meaningful comparisons between companies.

Fig 8. Pollution Inventory - example pages[3]

8.5 As a regulatory tool, the PI could, for example, be used to calculate the total emission to all media from each industrial site, with the confidence that each site's release is comparable to that from every other site. These individual releases could then be compared to the total emission from all authorised sites to obtain the percentage contribution for each site. This would enable the Agency to establish which of the authorised sites has the highest contribution to the total annual emission for any given substance (Figure 9[3]). This type of information has not previously been available.

Fig 9. Industrial sites contributing significant proportions of the total emissions in England and Wales, 1998[3]

Operator	Emission (tonnes)	Percent of total PI
ICI Chemicals & Polymers Ltd, Middlesbrough.		
Benzene	290	15.4%
1,3-Butadiene	37	36.6%
National Power plc, Selby.		
Carbon dioxide	21,836,691	10.1%
Sulphur dioxide	121,980	9.9%
Nitrogen oxides	65,156	21.2%
British Steel plc, Scunthorpe.		
Carbon monoxide	141,660	19.9%
British Steel Engineering Steels, Sheffield.		
Zinc	106	23.3%
Associated Octel Ltd, Ellesmere Port.		
Lead	114	49.1%
IMI Refineries, Walsall.		
Copper	6.80	11.2%
Brittania Zinc Ltd, Bristol.		
Cadmium	1.68	34.0%
Mercury	1.35	21.9%
Terra Nitrogen (UK) Ltd, Bristol.		
Ammonia,	4,400	31.8%
Powergen UK plc, Kent		
Particulates (<10µm)	2,564	7.6%

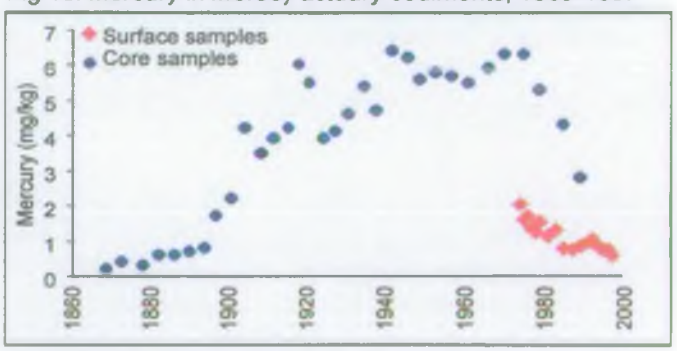
8.6 The analysis may be developed to take into account the environmental performance of the establishment. A large power station, for example, may have a sound environmental strategy which produces very low levels of carbon dioxide per kilowatt of power generated, but it may still rank highly on the list due to its overall size. Conversely, poorly performing but smaller establishments would not appear to be a significant contributor, but may well be the sites that could benefit most from an increase in environmental management. Additionally, the size of each establishment or release does not necessarily relate directly to its environmental impact.

8.7 The future for the Pollution Inventory could see the inclusion of some local authority controlled sites along with sewage treatment works and landfill sites. Smaller trade sites regulated by the Agency and figures on the energy and raw material consumption for each site may also be included.

9.0 Conclusion

9.1 Considerable progress has been made in reducing industrial discharges to the environment through, for instance, regulation such as IPC and agreements such as OSPAR. A good example of this is the decrease in the levels of mercury found in the sediment taken from the Mersey Estuary. In the 1970s more than 70 tonnes of mercury was being discharged to the estuary every year, in 1985 this had dropped to 8 tonnes and in 1995 it was less than 1 tonne. This reduction in input over recent years has been mirrored by the reduction in the level of contamination in the sediments. Figure 10[12] illustrates the historic contamination, as revealed by the analysis of sediment core samples (blue) and more recent contamination as seen in surface samples (red). With the implementation of IPPC and through tools such as the Pollution Inventory, we should continue to see such reductions in industrial pollution well into the future.

Fig 10. Mercury in Mersey Estuary sediments, 1869-1997[12]



Acronyms

BAT - Best Available Technique
BATNEEC - Best Available Technique Not Entailing Excessive Cost
BREF - BAT Reference note
CRI - Chemical Release Inventory
ELV - Emission Limit Value
IPC - Integrated Pollution Control
IPPC - Integrated Pollution Prevention and Control
LAAPC - Local Authority Air Pollution Control
OSPAR - Oslo and Paris Commissions
NCEDS - National Centre for Environmental Data and Surveillance (Environment Agency)
PI - Pollution Inventory

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