DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM

Environmental Quality and Protection

Chief Directorate: Air Quality Management & Climate Change

AQA IMPLEMENTATION: LISTED ACTIVITIES AND MINIMUM EMISSION STANDARDS

OUTPUT B.1

INTERNATIONAL REVIEW

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EXECUTIVE SUMMARY OF KEY RECOMMENDATIONS

INTRODUCTION

The International Review, documented in this report, comprises a desk-top appraisal of relevant international information relating to the identification and classification of sources for which national emission standards are established, substances for which limits are specified and the basis for nationally-set minimum emission standards. The outcome of the review is the specification of clear and unambiguous recommendations of how information gathered may be adopted and/or adapted with a view to informing and fast-tracking the work directed or implied in order to implement Section 21 of the National Environmental Management: Air Quality Act (NEM:AQA).

SCOPE OF STUDY

Given the depth and range of international experience, the scope of the review was tailored to focus on selected, robust case studies pertinent to South Africa's circumstances and AQA implementation requirements, whilst also demonstrating potentially divergent approaches. Examples of local considerations include: the stack to site approach required by the APPA to AQA transition, the need to institutionalise emission standard setting and 'keep it simple' so as to ensure timely implementation, the participatory governance requirements (etc.).

Three main case study countries were selected for inclusion in the study, namely, the United States, the United Kingdom (within the framework of the European Community) and Australia. The USA and UK were chosen because of the advanced nature of the environmental regulatory systems they have established and their proven track record in the development of best practice in this field. The USA and Australia have a highly federalised approach to regulation and this may have some lessons on cooperative governance which will be useful in the South African situation. A further reason for selecting the US, UK and Australia for analysis is that these countries were recently evaluated to support the development of compliance monitoring capabilities within the DEAT's Regulatory Services Directorate during a recent project. Reference is also made to specific aspects from the experience of other countries (e.g. India, Japan, Poland and China) which either illustrate alternative approaches or reinforce mainstream practices.

In the review of international practices and experiences close attention was paid to the following key issues:

- Basis for identifying and classifying ***sources*** to be regulated using nationally-set minimum emission standards;
- ***Substances*** for which national minimum emission standards are typically set and rational for their selection;
- ***Basis for the setting of national minimum emission standards***;
- Divergent approaches in the ***implementation*** of national minimum emission standards;
- ***Future trends*** in industrial regulation which may influence the manner in which sources and substances are selected and emission standards set.

GENERAL OBSERVATIONS IN RESPECT OF EMISSION STANDARDS

- Emission standards are classifiable as a direct command and control instrument. The use of emission standards for prioritised industry sectors is widespread with almost all countries having adopted such a command and control approach as a primary means of controlling pollution.

- Emission standards require a central authority capable of establishing rules for the conduct of polluting sources, monitoring performance with respect to those rules and enforcement of compliance.

- Emission standards represents a method which tends to become more and more complicated over time e.g. US where layers of regulation have been added to deal with new problems and new information. Changes to the regulatory regime take much time and effort.

- Emission standards represent just one instrument of a complex and increasingly broadening mixture of regulatory tools. Other instruments include fuel specifications, air quality limits and economic instruments, (etc.).

- Emission standard setting may result in "technology forcing". Although emission standards may not explicitly dictate technologies to be implemented, in practice they may create strong incentives for firms to choose only officially sanctioned technologies and can therefore be regarded as "technology forcing" (Blackman and Harrington, 1998).

- Economic considerations are of considerable significance in the emission standard setting process. Key considerations in the US's historical approach have, for example, included avoiding the shutting down of plants, give breaks to small facilities, treat existing facilities more leniently than new ones, (etc.). A number of recent studies have also considered the impact of environmental regulations on competitive of industries.

KEY RECOMMENDATIONS

(1) Adoption of a Phased Approach to Emission Standard Setting

Mindful of the requirements of the AQA, the experience of other countries, and of preliminary work undertaken during the APPA Registration Certification Review Project, a stepped approach to emission standard setting is recommended for adoption comprising the *setting of emission standards for prioritised industry sectors and pollutants prior to the subsequent expansion of standards to other industries and substances*. The following steps are recommended for implementation:

- Identification of *key industries and associated pollutants* for which emission standards are to be set at the outset.

- Establish *sector teams* supported by a sector coordinator to carry out the consultation/communication with industry, trade bodies and other affected parties.

- Sector teams to conduct *sector scoping studies* – gathering information about its structure, geographical and size distribution and preferred methods of communication.

- Sector teams to collated *sector guidance documents* comprising information on best available technology including associated emission standards and monitoring requirements (using international BAT documentation and industry-specific information.

- Put in place mechanisms to support:

    - the addition of industry types to the list of activities by DEAT;

    - emission standard setting for such industry types by DEAT in consultation with stakeholders (via sector teams);

- gathering of current BAT information for use in the establishment of emission standards for additional industry types and the review of previously established emission standards.

- Intermittent additions to the list of activities and publication of relevant national minimum emission standards for these activities.

- Periodic review of national minimum emission standards.

Benefits of the effective adoption and implementation of this approach include more focused regulatory efforts resulting in accelerated air quality improvements, development of an experienced regulator and knowledgeable and cooperative regulated industrial sectors.

(2) Selection of Industry Sector Sub-set for Initial Listing

Based on the experience of other countries, and mindful of South Africa's available resources and the nature of its industrial sector, the following recommendations are made:

(a) The following industry types could be considered for possibly inclusion in the initial list of activities requiring prioritised national emission standard setting, with industries not significantly represented within South Africa removed or noted for subsequent listing and emission standard setting (thresholds specified by various countries are given in brackets, where available, and key activities highlighted):

RSA – Proposed Listed Activity Categories	Synopsis of Internationally Prioritised Industry Sectors (based on UK PPC, US NSPS, NSW, India)
1. Combustion installations	• **Coal, gas, biomass and liquid fuel combustion installations** (>50 MW – UK; >30MW – NSW; >73MW - US) • Waste or recovered oil combustion (>3 MW - UK)
2.Petroleum industry	• **Petrochemical production and petroleum refining** (including bulk storage and handling of petroleum liquids and petroleum refinery wastewater systems) (UK – no thresholds; NSW – 2000tpa petrochemicals)
3. Carbonisation and coal gasification	• **Coal gasification** • Gas refining (>1000tpa gas - UK) • Natural gas reforming • Mineral oil refining • Activities involving pyrolysis, carbonisation, distillation, liquefaction, partial oxidation or other heat treatment of coal, lignite, oil, other carbonaceous materials or mixtures • Tar and bitumen production (>5tpd tar, bitumen or aggregate - UK)
4. Metallurgical industry	• **Aluminium** and aluminium alloys • **Iron and steel** production • **Copper** smelters (melting capacity >20 tpd - UK) • **Lead** smelters (melting capacity >4 tpd - UK) • **Zinc** smelters (melting capacity >20 tpd - UK) • **Precious metals** production • **Refractory meta**l production • **Nickel** processes • **Cadmium** processes (melting capacity >4 tpd - UK) • **Ferroalloy** production (silicon, chromium, manganese) • Ferrous metals (hot rolling) (>20 tph crude steel - UK) • **Bulk handling** or storage of **iron ore** (except during mining)(>500 000t - UK) • Lead-acid battery manufacturing (>6.5 tpd lead – US) • Secondary Brass and Bronze Production Plants (Reverberatory and electric furnaces of >1,000 kg production capacity and blast (cupola) furnaces of >250 kg/h production capacity – US)
5. Mineral processing industry	• **Cement and lime** production and/or bulk handling (kilns >50tpd; 5000tpa calcium carbonate, calcium magnesium carbonate or aggregate of both - UK) • **Asbestos** activities • **Glass** and glass fibre manufacturing (>100tpa production – UK; >5tpd - US) • **Ceramic** production (tiles, bricks, refractory bricks, stoneware, porcelain production by firing) (kiln >75 tpd - UK)(NSW threshold is 150tpd or 30000tpa) • **Coal processing**/preparation plants (500tpd coal – NSW; >200tpd - US) • **Metallic mineral processing** plants (crushing, screening, handling) • **Non-metallic mineral processing** plants (crushing, screening, handling) • Phosphate rock plants (>4tph plant capacity – US) • Other mineral activities (melting capacity >20 tpd - UK)

RSA – Proposed Listed Activity Categories	Synopsis of Internationally Prioritised Industry Sectors (based on UK PPC, US NSPS, NSW, India)
6. Organic chemical industry	• Organic chemical production including: o hydrocarbons, o organic compounds containing oxygen, sulphur, nitrogen or phosphorus, organometallic compounds (e.g. lead alkyls) o plastic materials (polymers, synthetic fibres, cellulose-based fibres) o synthetic rubbers o dyes and pigments o surface-active agents • Polymerising or co-polymerising any unsaturated hydrocarbon or vinyl chloride (>50tpd in aggregate - UK) • Use of toluene fi-isocyanate or other di-isocyanate of comparable volatility or where partly polymerised • Flame bonding of polyurethane foams or polyurethane elastomers • Recovery or purifying of acrylic acid or any ester of acrylic acid • Tyre manufacture (>50 000 tpa - UK) • **Storage of chemicals in bulk**
7. Inorganic chemical industry	• Production of inorganic chemicals such as: o Gases (e.g. NH_3, HCl, HF, H_2S, SO_x, NO_x) o Acids (e.g. chromic acid, hydrofluoric acid, nitric acid, sulphuric acid, oleum) o Bases (e.g. ammonium hydroxide, solium hydroxide) o Salts (e.g. ammonium chloride, sodium carbonate) o Non-metals, metal oxides, metal carbonyls o Halogens or interhalogen compounds o Manufacturing Activities Involving • Manufacturing activity involving the use of hydrogen cyanide or hydrogen sulphide • Manufacturing activity involving the use or recovery of: antimony, arsenic, beryllium, gallium, indium, lead, palladium, platinum, selenium, tellurium, thallium • Recovery of any compound of cadmium or mercury • Chemical fertilizer production (20000tpa - NSW) • Bulk storage of chemicals Key activities in this sector are **nitric acid plants**, **sulphuric acid plants**, agricultural **fertilizer** production and ammonium sulphate & ammonium nitrate production
8. Explosives Industry	• **Explosives** production
9. Pharmaceuticals production	• **Pharmaceutical** production using a chemical or biological process
10. Incineration processes including hazardous waste	• **Commercial and industrial waste incineration** • **Hospital/Medical/Infectious waste incineration** • **Municipal waste incineration**
11. The disposal of hazardous and general waste	• **Hazardous** wast disposal facilities • **General** waste disposal facilities (>10tpd or >25000t total capacity - UK) • Disposal of Waste other than by incineration or landfill (>10tpd for hazardous waste and waste oils; >50tpd for non-hazardous waste – UK)
12. Wood products industry	• **Paper, pulp and board** manufacturing activities (>20tpd – UK; >30 000tpa - NSW) • **Timber** processing plants
13. Production and formulation of pesticides	• **Pesticides,** fungicides, herbicides, rodenticides, fumigants, miticides and related product production (NSW – 2000tpa products)
14. Animal matter processing	• **Tanning** plants (>12tpd finished products - UK) • Animal **slaughter** (>50tpd - UK) • **Rendering** plants - animal carcasses or waste disposing or recycling (>10tpd – UK; >5000tpa - NSW)

(b) Consideration should be given as to whether to **extend the proposed categories of listed activities** to include the following industry sectors:

Possible additional categories of listed activities	• Industrial and surface coating activities • Textile manufacture • Printing works (large scale) • Intensive farming – rearing poultry (40 000 places - UK), pigs (2000 places – UK & NSW), cattle (1000 head –NSW), sheep (4000 head – NSW), horses (400 – NSW) • Recovery of waste including fuel production from waste • Food Industries – treating and processing animal raw materials (other than milk)(>75tpd - UK) or vegetable raw materials (>300tpd - UK) or milk (>200 tpd - UK) • Hot Mix Asphalt Facilities • Sewage Treatment Plants

These categories need not be added to the initial list of activities, but can be added during subsequent phases. It is recommended that consideration be given and the most suitable way of regulating emissions from such industries selected once more experience has been gained with the regulation, compliance monitoring and enforcement of the initial group of 'listed activities' and the first one or two 'controlled emitters'.

(c) Express emission standards primarily **for point sources** (stacks and vents) where emission monitoring is possible. Where the control of diffuse emissions is considered significant enough to warrant inclusion in national standards (e.g. fugitive dust at bulk ore/coal handling and processing plants and certain metallurgical industries; evaporative emissions from bulk chemical storage and handling), specific best practice control measures which are applicable across individual industries can stipulated (e.g. floating roof tanks) or alternatively it can be required that a comprehensive fugitive emission management plan be put in place.

(3) Restriction of Emission Standard Setting to Priority Pollutants

The tendency within the EC and the US is to concentrate on key pollutants of concern, rather than trying to target all possible emissions. National emission standards are not routinely issued for greenhouse gas emissions. This is likely to be due to the increased use of market mechanisms such as emissions trading to cost-optimise emission reductions.

It is recommended that a small number (preferably 1 to 4) of pollutants be selected for the setting of emission standards for each industry type selected (with the exception of incineration for which an extended number of substances should be regulated in line with current local and international experience). Reference should be made to information on the US, UK and NSW approaches (documented in the report) in the selection of the most pollutants suitable substances to target. Where appropriate, use could be made of surrogate parameters to reduce compliance monitoring costs.

(4) Adopt BAT as the Basis for Emission Standards

It is commonplace in best practice legislative environments to require that emission standards take into account best available technologies and ambient air quality limits. In practice, minimum nationally-set emission standards tend to be based on best available technology, with the requirement that more stringent emission standards be set at lower tiers of government taking into account air quality limits. In addition to this, the use of environmental impact assessments for informing emission standards for new and modified facilities is widely accepted. This provides a safety net in cases where minimum emission standards best on BAT are not sufficient to protect local environments.

Given that provision is made in the SA NEM:AQA for the setting of more stringent emission standards by provincial and local authorities, it is *recommended that the national minimum emission standards be based on best available technology*.

Best available technology, despite being defined in slightly different terms (or not defined at all in regulation as in the case of NSW), is implemented in similar ways in the case studies considered. It is *recommended that South Africa adopt the concise EU definition of BAT*, viz.:

> *'Best available techniques` shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:*
>
> - ***'techniques`** shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned,*
> - ***'available`** techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and*

advantages, whether or not the techniques are used or produced inside the [country] in question, as long as they are reasonably accessible to the operator,

- ***'best`** shall mean most effective in achieving a high general level of protection of the environment as a whole.*

In the application of BAT for the purpose of informing emissions standards and monitoring protocols for the prioritized industry types, reference should be made to the best practice documentation published by the IPPC, UK and US (as documented in the report). In assessing the economic viability of technologies within local industries, the simpler approach adopted by NSW could be considered whereby use is made of previous studies undertake and information provided by industries within the sector to be regulated.

(5) Format for Expressing Emission Standards

Emission standards should not prescribe the use of one specific technique of technology (technology forcing).

The AQA stipulates that emission standards "must include the *permissible amount, volume, emission rate or concentration* of that substance or mixture of substances that may be emitted and the manner in which measurements must be carried out". This requirement in the Act largely developed as a result of the manner in which emission standards have historically been specified within APPA Registration Certificates (i.e. typically as emission concentrations without limits on volumetric flows or on total masses of emissions). Despite good intentions, the specification of a total mass as a "permissible amount" or a "volume" in a general national minimum emission standard intended to regulate a number of individual industries is problematic.

It is recommended that emission standards be expressed either as an emission concentration or a performance standard or, where appropriate, a combination of both with the actual concentration or level of performance taken from BAT. Total masses of emissions permissible should be included in the Atmospheric Emissions Licenses of Listed Activities.

(6) Specification of General Emission Standards

Certain countries (e.g. Australia-NSW, China) specify general emission standards for application to industries for which sector-specific emission standards are not applicable. Taking into account the recommendation that a select list of industry types be prioritised for the setting of specific emission standards, South Africa could consider the use of general emission standards for application to industries which are not initially listed.

(7) Emission Monitoring Specified on the Basis of Best Practice

The emission monitoring required clearly depends on the nature of the source, the pollutant and the emission standard. Emission standards expressed as emission concentrations require direct stack monitoring. The sector-specific monitoring method and frequency should be taken from the best practice documentation (e.g. EU's Monitoring BREF). In most cases, continuous emissions monitoring is prescribed for the larger sources of criteria pollutants as is typically best practice, with periodic (e.g. annual) testing campaigns stipulated for metals, persistent organic compounds (etc.). Emission standards expressed as a performance standard (e.g. kg of pollutant per ton product) requires a combination of direct monitoring and product tonnage tracking methods.

(8) Emission Standards should be varied to account the Age of Facilities

The setting (retention) of less stringent emission standards for older facilities has a place in the regulatory process of most of the countries considered. (It was found to be more pronounced in the case of the US and NSW, compared to the UK). It is however notable that these emission standards are not static, but that there are timeframes within which facilities are expected to meet firmer standards. Generally, the approach adopted is to link required improvements to major plant

modifications and to take advantage of industry cycles. This is most readily expressed in the NSW regulations where older plants are given five year timeframes to institute upgrades which will bring them in line with more stringent emission standards.

Whereas the US tends to include the dates of facilities within individual industry specific standards, NSW sets out clear industry facility age categories which are applicable across all industry sectors regulated. The NSW approach is simple to understand, lends itself to being more readily used to stipulate cross-sector continuous improvement requirements, and can be more easily revised. This approach, documented in detail in Section 4, is recommended for possible implementation within South Africa.

(9) Compliance Schedules should be Informed by Industry Cycles

Compliance schedules may be specified in various ways. They may be generically specified for an entire industry sector or class of facilities (class defined by industry type and age of facility). Alternatively they can be negotiated and imposed at individual facilities by provisions within permits such as the Atmospheric Emission License to be issued to Listed Activities within South Africa.

Based on international experience, an effective approach would be to set minimum timeframes for compliance nationally (taking account of industry cycles), with provision being made for more restricted compliance schedules to be specified by lower government tiers for industries within their jurisdictions and/or stricter timetables being negotiated for inclusion in permits. Typical compliance timeframes, based on the US, EC and NSW case studies would be:

- 2 to 3 year in the case of new or substantially modified facilities
- 5 to 10 years in the case of existing facilities, potentially differentiated by age

(10) Cost-benefit Analysis should Inform the Future Listing of Activities

Given the short timeframe within which the Minister is expected to publish a 'list of activities' so as to meeting the APPA to AQA transitional phase objectives, it is unlikely that detailed sector-specific CBA will be completed in time to inform the initial listing of activities. It is therefore recommended that the initial list of activities comprise a restricted number of industry types which are know to be potentially significant in terms of their atmospheric emissions. The targeting of industries where the benefits of regulation are expected to outweigh the costs, based on experience from developed and developing countries, would substantially reduce the risks of economic impacts arising due to the emission standards set. Additional measures to reduce risk during this initial phase include: (i) restricting pollutants for which emission standards are specified to the key ones for that industry type thus reducing compliance monitoring and reporting costs; (ii) taking industry cycles into account in the setting of national minimum compliance timeframes, and (iii) making provision for industries to apply for extensions based on EIAs being undertaken (as discussed in the subsequent section).

In targeting industry sectors for which information on emissions and impacts is less available or conclusive, particularly those comprising small and/or older operations, it is imperative that detailed CBAs be undertaken in selecting BATs and setting emission standards. Provision for such studies should be made so as to extend the list of activities and associated set of national minimum emission standards in a manner which does not lead to economic impacts or mass non-compliance.

(11) Provision for Extensions to Compliance Timeframes on a Case-by-case Basis

Given potential economic implications of emission standards, and mindful that emission standard setting in South Africa is not likely to be based on comprehensive sector-based cost-benefit analysis (at least not for the initial group of 'listed activities'), it is recommended that provision be made for specific industries to apply for possible extensions to compliance timeframes.

In framing this provision reference is made to a similar condition set by the NSW Department of Environment and Climate Change (DECC) in its *Clean Air Regulation 2002 (2005 amendment)*as documented in the report. The DECC makes it clear that it does not intend that existing plants be 'unnecessarily or arbitrarily required to upgrade' as a result of its Regulations.

Within the South African context, it is recommended that a provision be included when listing activities, for the proponent of a listed activity to apply for a postponement of the compliance date and for such a postponement to be granted based on the following conditions being met:

- An air pollution impact assessment being completed (in accordance of the format for Atmospheric Impact Reports, as contemplated in Section 30 of the NEM:AQA and specified by the National Air Quality Officer) and submitted to DEAT at least 1 year before the compliance date; and

- Demonstration that the industry's air emissions are not causing any adverse impacts on the surrounding environment.

This provision would ensure that any requirement to upgrade is informed by an understanding of any environmental impact of the affected plant. At the end of the extension period granted a further extension could be made possible subject to a repeat of the impact assessment process.

(12) Considerations during Emission Standard Implementation

It the implementation of emission standards, best practice necessitates comprehensive compliance monitoring and enforcement functions and the regular review of such standards in line with BAT developments.

(13) Investigation into Combining Command-and-control Regime with Market Mechanisms

It is imperative that emission standards not be viewed in isolation from the diverse (and changing) regulatory contexts within which they are applied. The use of market mechanisms, including emissions trading for criteria pollutants, is increasingly being used in the US and is expected to become an integral part of the future European regulatory regime.

The NEM:AQA makes provision for the use of market mechanisms including emissions trading. In view of major trends in international policy, it is recommended that the potential for extending and enhancing the regulation of criteria pollutants emitted from listed activities through the marrying of emission standard setting and emission trading approaches be investigated.

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BACKGROUND AND CONTEXT

The Department of Environmental Affairs and Tourism (DEAT) initiated a project in March 2007 entitled AQA Implementation: Listed Activities and Minimum Emission Standards, As Contemplated in Section 21 of the National Environmental Management: Air Quality Act (Act No. 39 of 2004). The overall objective of this project is to facilitate the efficient and effective implementation of Section 21 of the AQA. The following provides an extract from the AQA that provides the departure point for this project:

21. **Listing of activities**
    (1) The Minister must, or the MEC may, by notice in the Gazette -
        (a) publish a list of activities which result in atmospheric emissions and which the Minister or MEC reasonably believes have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage; and
        (b) when necessary, amend the list by -
            (i) adding to the list activities in addition to those contemplated in paragraph (a);
            (ii) removing activities from the list; or
            (iii) making other changes to particulars on the list.
    (2) A list published by the Minister applies nationally and a list published by the MEC applies to the relevant province only.
    (3) A notice referred to in subsection (1) -
        (a) must establish minimum emission standards in respect of a substance or mixture of substances resulting from a listed activity and identified in the notice, including-
            (i) the permissible amount, volume, emission rate or concentration of that substance or mixture of substances that may be emitted; and
            (ii) the manner in which measurements of such emissions must be carried out;
        (b) may contain transitional and other special arrangements in respect of activities which are carried out at the time of their listing; and
        (c) must determine the date on which the notice takes effect.
    (4) (a) Before publishing a notice in terms of subsection (1) or any amendment to the notice, the Minister or MEC must follow a consultative process in accordance with sections 56 and 57.
        (b) Paragraph (a) need not be complied with if the notice is amended in a non-substantive way.

22. **Consequences of listing**
    No person may without a provisional atmospheric emission licence or an atmospheric emission licence conduct an activity -
        (a) listed on the national list anywhere in the Republic; or
        (b) listed on the list applicable in a province anywhere in that province.

Section 21 of the Act thus requires the Minister or MEC to identify industries for regulatory control by publishing a list of activities which the Minister or MEC reasonably believe result in atmospheric emissions that have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Once identified, these activities are known as “listed activities”. In terms of Section 22, once an activity has been identified, no one is allowed to conduct the activity unless they are permitted to do so. Furthermore, it is not enough for the Minister or MEC to just identify the industries to be controlled, minimum emission standards for specified pollutants emitted by the identified industries must also be set in terms of Section 21(3).

The *AQA Implementation: Listed Activities and Minimum Emission Standards Project* has four main, immediate project objectives. Objective A of the project addresses efficient and effective intergovernmental coordination and cooperation and public participation. Objective B comprises the review of current national and international work related to the identification of activities and their related minimum emission standards, with a view to informing and fast-tracking the work directed or implied in order to implement Section 21 of the AQA efficiently and effectively. Objective C involves the development of an implementation plan and the provision of input into the National Framework development process. Capacity development forms the focus of Objective D.

The Review Objective (Objective B) includes three main components, namely:

- (B.1) An International Review – comprises a desk-top appraisal of all relevant international information relating to the identification of activities and their related minimum emission standards and the compilation of specific (clear and unambiguous) recommendations of how this work may be adopted and/or adapted with a view to informing and fast-tracking the work directed or implied in order to implement Section 21 of the AQA.

- (B2) Transition Project Output Review – desk-top review of the products of the National Air Quality Management Programme, Phase II, Transition Project which proposed various "listed activities" for regulation under AQA, and recommendation of how this work may be adopted and/or adapted so as to implement Section 21 of the AQA efficiently and effectively.

- (B3) Priority Industrial Sector Input Review – desk-top review of the various inputs received from prioritised industrial sectors and recommendation of how this input can be used to inform and fast-track the work required to implement Section 21 of the AQA efficiently and effectively.

The International Review undertaken in respect of the Review Objective is documented in this report.

1 INTRODUCTION

The regulation of atmospheric emissions from industrial sources through command-and-control practices, including the setting of national minimum emission standards, has been practiced by various countries across several continents over a number of decades. An exhaustive array of material is consequently available from which ultimately important lessons can be drawn to inform local regulatory practices. The key lies in extracting information which is pertinent to South Africa's local circumstances and will support the country's ambitious air quality objectives within the sustainable development context within which it seeks to operate.

1.1 PURPOSE OF REPORT

The International Review, documented in this report, comprises a desk-top appraisal of relevant international information relating to the identification and classification of sources for which national emission standards are established, substances for which limits are specified and the basis for nationally-set minimum emission standards. The outcome of the review is the specification of clear and unambiguous recommendations of how information gathered may be adopted and/or adapted with a view to informing and fast-tracking the work directed or implied in order to implement Section 21 of the National Environmental Management: Air Quality Act (NEM:AQA).

1.2 SCOPE OF STUDY

Given the depth and range of international experience, the scope of the review was tailored to focus on selected, robust case studies pertinent to South Africa's circumstances and AQA implementation requirements, whilst also demonstrating potentially divergent approaches. Examples of local considerations include: the stack to site approach required by the APPA to AQA transition, the need to institutionalise emission standard setting and 'keep it simple' so as to ensure timely implementation, the participatory governance requirements (etc.).

Notable differences exist in the legislative and regulatory contexts within which various countries establish national emission standards for industrial sources. This necessitates the consideration of the broader legislative context so as to accurately describe the manner in which sources are listed and emission standards set. The USA, for example, is increasingly integrated its command-and-control approach to emission limit setting with emissions trading schemes. European countries are increasingly integrating their pollution control measures across various media including air, water and waste. Japan, as a further example, has adopted a combination of command-and-control and voluntary measures to regulate industrial emissions with emission standards being specified for certain substances and others being controlled through voluntary agreements with sources.

Three main case study countries were selected for inclusion in the study, namely, the United States, the United Kingdom (within the framework of the European Community) and Australia. In the selection of the case studies attention was paid to the comprehensiveness, currency and international acceptance of the approaches adopted, and the relevance of these approaches (or aspects of such approaches) given local circumstances. The USA and UK were chosen because of the advanced nature of the environmental regulatory systems they have established and their proven track record in the development of best practice in this field. The USA and Australia have a highly federalised approach to regulation and this may have some lessons on cooperative governance which will be useful in the South African situation. The UK operates within the context of the European Union, which issues its own Europe-wide legislation which member states must implement. This adds an additional dimension of interest in terms of how regional mechanisms are established to support the

setting and implementation of regulations. A further reason for selecting the US, UK and Australia for analysis is that these countries were recently evaluated to support the development of compliance monitoring capabilities within the DEAT's Regulatory Services Directorate during a recent project (PDG, 2005).

Limiting the number of case studies facilitate a more indepth analysis and demonstration of the broad legislative and regulatory context which support industrial source regulation in the countries selected. Despite focussing in more detail on the US, UK and Australia, practices within a range of other countries were considered during the course of the study. Reference is made to specific aspects from the experience of other countries (e.g. India, Japan, Poland and China) which either illustrate alternative approaches or reinforce mainstream practices.

In the review of international practices and experiences close attention was paid to the following key issues:

- Basis for identifying and classifying ***sources*** to be regulated using nationally-set minimum emission standards;
- ***Substances*** for which national minimum emission standards are typically set and rational for their selection;
- ***Basis for the setting of national minimum emission standards***;
- Divergent approaches in the ***implementation*** of national minimum emission standards;
- ***Future trends*** in industrial regulation which may influence the manner in which sources and substances are selected and emission standards set.

1.3 REGULATORY REGIME FOR IMPLEMENTATION OF STANDARDS

Standards are used within command-and-control approaches to pollution control. It is important to note that emission standards are one category of a range of standards which are applied. A standard is a legally defined regulatory instrument for limiting pollution. The most commonly applied standards for the prevention of atmospheric emissions are (Bernstein, 1993):

- *Ambient air quality standards* – limits the concentration of a pollutant in the ambient air (e.g. micrograms/m^3) (indirectly determining the permissible emissions of a facility).
- *Emission standards* – establishes the legal ceiling on the total quantity or concentration of a pollutant discharged from a pollution sources (e.g. mg/m^3 in off-gas; grams/24 hour period; kg/ton of raw material or product). Standards are typically expressed for a particular averaging period and monitoring requirements specified.
- *Technology-based standards* – specifies the technology that must be used. For example, a facility may be required to use a scrubber to control sulphur oxide emissions with a control efficiency of at least 99%.
- *Performance standards* – defines a performance measure (e.g. concentration of pollutant in off-gas and percent pollution removal to be achieved) and allows sources the flexibility to select the best means to meet this standard.

- *Product standard* – establishes the legal ceiling on the total quantity or concentration of pollutants that can be emitted per unit of product output (e.g. kg per ton of product across total production cycle).

- *Process standard* – limits emissions associated with a specific manufacturing process, e.g. mandatory replacement of mercury cells by diaphragm cells to prevent mercury emissions from chlor-alkali manufacture.

Given the requirement of Section 21 of the South African NEM:AQA that emission standards be specified for listed activities, the report will focus on the use of emission standards in the various case studies selected. It is however notable that several other standards influence the extent of emissions permissible in such cases, particularly air quality standards and also product and performance standards in the case of the US.

Generally, emission standards are set by central governments although in some instances central governments may establish framework regulations but require local, state or regional authorities to set the standards. Sub-national standards are typically be more stringent that those of the central government.

The setting of emission standards presupposes the existence of a monitoring agency that oversees polluters' activities and has the power to impose a penalty in instances of noncompliance. In the absence of enforcement powers, the only incentive the polluter has to stay within the standard is social conscience. Noncompliance with standards is typically associated with penalties (e.g. fee, loss of license); polluters can also be prosecuted or at least threatened with prosecution in many cases.

1.4 REPORT OUTLINE

The USA, UK and Australian case studies are documented in Sections 2, 3 and 4 respectively with reference made to relevant experiences of other countries in Section 5. A synopsis of the main findings drawn from the comparison of the approaches and experience of the selected countries is given in Section 6. These findings, and the knowledge of South Africa's local circumstances, forms the basis for making specific recommendations as presented in the final section.

2 CASE STUDY 1 - USA

2.1 BACKGROUND

2.1.1 Environmental Legislative Framework

The USA is a federal country. Within the federal system, the national government is supreme and above the States in some functions of competence (such as inter-state commerce and pollution control). However, in many fields of competence, US state governments have traditional, inherent and retained powers and are sovereign in these areas. Therefore, rather than to picture the national government as places above the States, it is more accurate to show the governments operating side-by-aide or in parallel under the Constitution (and all the EPA national pollution control laws since 1970 have been written and implemented under this framework).

In terms of environmental law, Congress passes national environmental laws, which are then standardised by the House of Representatives, and published in the US Code, which is a record of all federal laws. The US Environmental Protection Agency (EPA) is then responsible for developing and enforcing regulations that implement the legislation enacted by Congress. Primary environmental legislation includes the National Environment and Policy Act (NEPA), the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act and the Toxic Substances Control Act (etc.). In the US environmental protection is implemented through the following tiers of government as follows:

- Federal Agencies;
- EPA with its Headquarters and Regional offices;
- States; and
- Tribes[1]

The Environmental Protection Agency (EPA), established in 1970 by President Nixon in Reorganisation Plan No 3, is the main body responsible for environmental protection. The EPA's role includes: development and enforcement of regulations, providing financial assistance for environmental programs, performing environmental research, sponsoring voluntary partnerships and programs, furthering environmental education and publishing information on the environment. Although the EPA sets national environmental priorities and standards, the majority of federal environmental statutes (laws) are eventually delegated to the States for implementation. In these cases, individual state environmental agencies implement the enforcement program (i.e., conduct inspections, monitor compliance and take enforcement actions). States may also implement additional state-specific statutes and may be more stringent than the federal statutes and regulations. States are often subdivided into regions or districts within a State, and these districts are sometimes semiautonomous units that implement enforcement programs in their geographic area. The EPA Regions oversee implementation by the States and attempt to ensure consistency among States.

[1] Some Native American tribes have the same status as states in the US, and thus are treated similarly in terms of environmental legislation and regulation.

2.1.2 Clean Air Act

The key federal law that regulates atmospheric emissions from industry is the Clean Air Act (CAA) which provides for the regulation of air emissions from area, stationary and mobile sources. The CAA aims to reduce human and ecosystem exposure from six 'criteria' pollutants and to reduce emissions of hazardous air pollutants and the associated risk from exposure. Furthermore, the CAA aims to protect and improve visibility impairment in national parts and wilderness areas, reduce emission of pollutants that cause acidification and reduce the use of stratospheric ozone depleting substances.

The CAA depends on two very different types of regulatory standards (ambient and technology-based) and two very different governmental roles (federal standard setting and state implementation). Standards and implementation procedures vary depending on two additional factors: (i) whether sources are stationary or mobile and whether sources are located in clean-air or in dirty-air of the country.

The CAA gives the US-EPA the authority to create and enforce regulations including the setting of National Ambient Air Quality Standards (NAAQS), National Emission Standards for Hazardous Air Pollutants (NESHAP) and nationally uniform standards for various categories of stationary sources (i.e. New Source Performance Standards, NSPS). State governments are required to develop State Implementation Plants (SIPs) to identify sources of air pollution, reductions and measures needed to achieve NAAQS. State and local governments are responsible for implementing and enforcing such plans and control measures but the US-EPA oversees these activities (Glicksman *et al.*, 2004).

The CAA of 1990 established a permit programme for air emissions, requiring all 'major sources' of toxic and 'criteria' pollutants to obtain a permit to operate. Permits are also required for new (proposed) major sources and for significant modifications to 'major sources'. Unlike in Europe where pollution regulation is integrated, separate permits are typically issued in the US for emissions to different media (air, water, waste).

2.2 TYPES OF EMISSION STANDARDS SPECIFIED IN THE US

Two groupings of emission standards are evident in the US system. Firstly, nationally set, uniform emission standards which are not dependent on source location. Secondly, provision is made for three emission standards which have been combined with the ambient standards approach and vary depending on whether the source is located in polluted, relatively pristine and protected or visibility management areas.

In addition to these two groupings of emission standards, it is also notable that the US has been integrating its traditional command-and-control regulation with emissions trading. This approach is of interest due to its impact on the nature of national emission standard setting (Glicksman *et al.*, 2004).

2.2.1 Uniform National Emission Standards which are not Site Specific

The US sets technology-based uniform national emission standards which specify the pollution control performance levels expected from particular source types. The CAA makes provision for four types of federally uniform emission standards, viz.: (i) vehicle emission standards, (ii) new source performance standards (NSPS), (iii) national emission standards for hazardous air pollutants (NESHAP) and (iv) "reasonably available control technology". The most pertinent of these standards, given the purpose of the review to inform the setting of emission standards for listed activities in SA, are the NSPS and NESHAPs.

2.2.1.1 New Source Performance Standards (NSPS)

Section 111 of the Clean Air Act authorized the EPA to develop technology-based standards which apply to specific categories of stationary sources. These standards are referred to as New Source Performance Standards (NSPS) and are found in 40 CFR Part 60. The NSPS apply to new, modified and reconstructed affected facilities in specific source categories such as manufacturers of glass, cement, rubber tires and wool fiberglass. As of April 2007, there were approximately 90 NSPS in the US.

The NSPS require the application of the best system of emission reduction that, taking into account such factors as cost, the EPA determines has been adequately demonstrated. The NSPS cover all types of emissions that "may reasonably be anticipated to endanger public health or welfare".

The NSPS are developed and implemented by EPA and are delegated to the states. However, even when delegated to the states, EPA retains authority to implement and enforce the NSPS.

2.2.1.2 National Emission Standards for Hazardous Air Pollutants (NESHAP)

Section 112 of the Clean Air Act makes provision for the regulation of Hazardous Air Pollutants (HAPs) through the setting and implementation of National Emission Standards for Hazardous Air Pollutants (NESHAP).

Originally the EPA was to issue standards for those pollutants at a level that would provide "an ample margin of safety to protect the public health". Although hundreds of hazardous substances appear to qualify for NESHAPs preparation, EPA listed only a handful of substances between 1970 and 1990. The 1990 CAA amendments overhauled the program for regulating hazardous air pollutants, with Congress itself establishing a list of 189 hazardous air pollutants. The EPA must determine which source categories pose a threat of adverse human health or environmental effects through their emissions of a listed pollutant and establish emission standards for each such category. Two founds of standards are authorised by the statute. The first round comprises technology-based standards that require the maximum degree of reduction that EPA determines is achievable. The standards for new sources are designed to be more stringent that those for existing sources. EPA must then assess and report to Congress on any residual risk to public health which remain following application of round 1 standards. If Congress fails to act on the EPA's recommendations for further legislation required to address such risks, then the EPA is required to issue a second round of controls if necessary to provide an ample margin of safety to protect the public health or prevent adverse environmental effects. The statute requires that round 2 standards be issued for any source category of carcinogenic emissions if the round 1 standards do not reduce the lifetime excess cancer risk to the most exposed individual to less than one in a million (Glicksman *et al.*, 2004).

2.2.1.3 Reasonable Available Control Technology (RACT)

This refers to control technology that is both reasonably available, and technologically and economically feasible. RACT is usually applied to existing sources in nonattainment areas, despite being established nationally, and is in most cases less stringent than new source performance standards (Entec, 2006).

2.2.2 Hybrid (Nationally Specified) Emission Standards integrated into State Implementation Planning

The 1977 CAA amendments distinguished "clean-air" and "dirty-air" areas. Since then different requirements have been applied to regions depending on their NAAQS attainment status. The following additional requirements are imposed on states with nonattainment areas:

- Specification of the RACT requirement for existing sources[(2)];

- States must require a permit for the construction and operation of any new or modified major stationary source in the area; to qualify for a permit, the application must comply with a strict technology-based emissions standard defined by the "lowest achievable emissions rates" (LAER) for the applying facility;

- If the state's SIP does not require existing sources to reduce emissions sufficient to accommodate the new construction without exceeding the NAAQS, then the applicant must purchase (or secure) from existing sources a reduction in emission more than sufficient to offset the new emissions from the proposed facility.

Clean-air regions are addressed by the provisions of the CAA dealing with the prevention of significant decline (PSD) of air quality. Under the PSD programme, major emitting facilities must install the "best available control technology" (BACT), to be determined for each facility, and demonstrate that plant operation will not cause ambient air to be "significantly: degraded. What constitutes a "significant" deterioration depends on the exact location of the proposed facility. Attainment areas are categories into Class I, II and III areas. For Class I areas, which comprises mainly of major national parks and wilderness areas, only very small changes would be acceptable thus constricting new industrial development. Class III areas permit air pollution concentrations to rise to approximately 50% of the NAAQS. Class II areas require increments in between.

Visibility is protected separately with the so-called "best available retrofit technology" (BART) approach being applied as needed to existing sources that impact on visibility (Glicksman *et al.*, 2004).

The CAA thus makes provisions for three emission standards applicable to sources that are required to apply for permits under the nonattainment, PSD and visibility protection programmes, viz. LAER, BACT and BART respectively. These standards are not technology-based in the same way as the NSPS and RACT for existing sources. These standards are not applied uniformly but on a case-by-case basis. When setting these standards the states are expected to play a more significant role than the EPA, depending on PSD and nonattainment SIP needs.

The hybrid standards, which are partly ambient air quality oriented and partly technology-based, can best be defined as technical guidelines for officials as they negotiate with source operators on the extent of abatement necessary to achieve local air quality goals. NSPS provide a benchmark for this process, with BACT and even the stricter LAER frequently being set at similar levels to the NSPS baseline.

2.2.3 Integration of Emissions Trading and Traditional Emission Regulation

Market-based mechanisms, particularly emissions trading, are widely used in the US to reduce emissions and meet air quality standards. Key emission trading schemes include the Acid Rain Programme (in operation since 1995), NO_x Budget Programme (ran from 1995 –

[2] Sources emitting VOCs which are located in ozone non-attainment areas are subject to Reasonable Available Control Technology (RACT). Sources emitting particulate matter in particulate non-attainment areas are subject to Reasonable Available Control Measures (RACM)

2003), Regional Clean Air Markets Initiative, RECLAIM (cap-and-trade scheme in the South Coast Air Basin. The Clean Air Interstate Rule (CAIR), issued by the EPA in March 1995, aims to achieve the largest reduction in air pollution in more than a decade, by dramatically reducing air pollution that moves across state boundaries. CAIR will permanently cap emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) in the eastern United States, across 28 eastern states and the District of Columbia. When fully implemented, CAIR aims to reduce SO_2 emissions in these states by over 70 percent and NO_x emissions by over 60 percent from 2003 levels (Glicksman *et al.*, 2004; Entec, 2006).

Flexibility, promotion of technological innovation and cost-optimisation of emission reduction represent some of the potential advantages of emission trading schemes. The disadvantage of emissions trading schemes is that they may result in 'hot spots' if not effectively implemented. Based on the US experience it was demonstrated that the potential for 'hot spots' could be minimised by the implementation of air quality limits and the requirement that sources comply with BAT. The feasibility of hybrid command and control schemes with emission trading within the US regulatory system has been established.

To demonstrate how, in practice, emissions trading and command and control works is being integrated reference may be made to the Clean Air Mercury Rule, issued in 2005. This rule represents the first ever federally-mandated requirement that caps and reduces mercury emissions from coal-fired power stations. The Clean Air Mercury Rule establishes "standards of performance" limiting mercury emissions from new and existing coal-fired power plants and creates a market-based cap-and-trade program that will reduce nationwide utility emissions of mercury in two distinct phases. The first phase cap is 38 tons and emissions will be reduced by taking advantage of "co-benefit" reductions – that is, mercury reductions achieved by reducing sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions under CAIR. In the second phase, due in 2018, coal-fired power plants will be subject to a second cap, which will reduce emissions to 15 tons upon full implementation. New coal-fired power plants ("new" means construction starting on or after Jan. 30, 2004) will have to meet stringent new source performance standards in addition to being subject to the caps.

2.3 NATIONAL EMISSION STANDARDS , REGULATED SOURCES AND SUBSTANCES

Although an overview of all the main emission standards in the US is provided in the previous section, it makes sense to focus on federally-set, uniform emission standards to inform the setting of South Africa's emission standards for listed activities under the NEM:AQA. The NSPS and the NESHAPs will therefore be covered in more detail in this section.

2.3.1 Industry Types for which National Emission standards are Specified

The CAA requires the EPA to publish a list of categories of stationary sources which are expected to 'cause or contribute significantly to air pollution which may reasonable be anticipated to endanger public health or welfare'. This is similar to the requirement for the listing of activities under the NEM:AQA and it is considered beneficial to consider the categories of stationary sources listed by the EPA to date. Categories of stationary sources listed by the EPA since the promulgation of the 1990 CAA amendments are listed in Appendix A, with reference made to the pollutants for which emission standards are specified, and the relevant general listed activity category proposed for adoption in terms of Section 21 of the South African Air Quality Act.

"Major sources" of criteria pollutants are typically included on the following basis:

- Generally, stationary sources emitting over 100 tpa of criteria pollutants (CO, Pb, NO_2, O_3, PM and SO_x)

- In severely polluted areas, stationary sources emitting over 10 tpa of 'criteria' pollutants

In terms of the regulation of toxic air pollutant emissions, the EPA publishes a list of industrial sources referred to as "source categories" as required under the CAA. Two types of stationary sources that generate routine emissions of air toxics are defined:

- "Major" sources are defined as sources that emit 10 tons per year of any of the listed toxic air pollutants, or 25 tons per year of a mixture of air toxics. These sources may release air toxics from equipment leaks, when materials are transferred from one location to another, or during discharge through emission stacks or vents

- "Area" sources consist of smaller-size facilities that release lesser quantities of toxic pollutants into the air. Area sources are defined as sources that emit less than 10 tons per year of a single air toxic, or less than 25 tons per year of a combination of air toxics. Though emissions from individual area sources are often relatively small, collectively their emissions can be of concern - particularly where large numbers of sources are located in heavily populated areas.

EPA published the initial list of "source categories" in 1992 (57FR31576 , July 16, 1992) and since that time has issued several revisions and updates to the list. For each listed source category, EPA indicates whether the sources are considered to be "major" sources or "area" sources. The 1990 Clean Air Act Amendments direct EPA to set standards for all major sources of air toxics (and some area sources that are of particular concern). The current list of source categories regulated by the EPA under NESHAP is given in Appendix B.

Generally, emission standards are specified for point sources with management and control measures being specified for diffuse sources, e.g. VOC emissions from chemical storage and handling and fugitive dust sources.

2.3.2 Pollutants Regulated by National Emission standards

Typically the following categories of pollutants are regulated in the USA: six 'criteria' pollutants, Hazardous Air Pollutants, ozone depleting substances and pollutants causing acidification.

The NSPS cover all types of emissions that "may reasonably be anticipated to endanger public health or welfare". Pollutants specified for regulation by NSPS to date are as follows:

- Particulate matter
- Sulphur dioxide
- Oxides of nitrogen
- Carbon monoxide
- Opacity
- Sulphuric acid mist
- Hydrogen chloride
- Fluoride
- Mercury
- Cadmium
- Lead

- Dioxins and furans

Individual source types for which emission standards for each of the above pollutants have been set are indicated in Appendix A.

Initially 189 (currently 188) Hazardous Air Pollutants (HAPs) are listed by the EPA for the purpose of establishing NESHAP (Appendix C) under the CAA. Hazardous air pollutants, also known as toxic air pollutants or air toxics, are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Examples of toxic air pollutants include benzene, which is found in gasoline; perchlorethlyene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by a number of industries.

2.3.3 Basis for the Setting of National Emission standards

New Source Performance Standards (NSPS) - NSPS require the application of the best system of emission reduction that, taking into account such factors as cost, the EPA determines has been adequately demonstrated. NSPS specifically specify “standards of performance” which are defined as “a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which, taking in to account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements, the Administrator determines has been adequately demonstrated. Technical studies undertaken to inform the setting of such standards of performance are published in background documents to the NSPS. The NSPS also include monitoring, record keeping and reporting provisions. NSPS are codified in 40 CFR Part 60.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - For hazardous air pollutants, the Maximum Achievable Control Technology (MACT) standards must be satisfied in both new and existing sources. The Maximum Achievable Control Technology (MACT) Standards are technology-based air emission standards established under Title III of the 1990 Clean Air Act Amendments. All "source-specific" MACT categories with emissions above the MACT standard threshold are designated major sources and facilities under the threshold are designated minor sources (also known as area sources). The schedule for promulgating the initial list of 174 MACT standards was divided into four groups, or "bins". The two-year, four-year, seven-year, and ten-year bins correspond to the year following 1990. Determinations on whether or not an area source in any given source-specific category is regulated based upon the health risk the sources present to the public. Currently EPA has promulgated 62 different MACT standards covering over 100 different "source-specific" industries (Appendix B). Also, EPA has an additional 23 standards that are currently "proposed" and are expected to cover an additional 70+ industries. Since the initiation of the MACT program, EPA has decreased the number of individual standards from 174 to approximately 85 by combining various standards but still covering the same number of industries it initially intended to target.

Compliance with the MACT standards are industry-specific technology-based standards designed to reduce HAP emissions. These standards can require facility owners/operators to meet emission standards, install emission control technologies, monitor emissions and/or operating parameters, and use specified work practices. Each MACT standard establishes its own compliance date. The MACT compliance date is usually but not always three years after the promulgation the MACT standard. In addition, the standards typically include record keeping and reporting provisions. MACT standards are codified in 40 CFR Part 63.

2.3.4 Emission Monitoring

Emission monitoring requirements are included in subpart A of 40 CFR parts 60 (NSPS) and 61 (NESHAPS) and within the specific subpart for the specific standard itself. Specific details on test methods is given in the appendices. Detailed emission monitoring requirements are also specified in the permits of facilities.

Generally, the use of continuous monitoring systems (CMS) to determine compliance is retricted to large facilities, particularly for criteria pollutants (including opacity). Detailed instruction are given in terms of the manner in which such monitoring is conducted, record keeping processes and reporting requirements. In instances where CMS is not used, difficulties of accurate emissions monitoring frequently causes authorities to settle for a two stage effort. Early monitoring ensures “initial compliance” and subsequent periodic monitoring ensures “continuous compliance”.

In 1997 the US-EPA introduced the Compliance Assurance Monitoring (CAM) Regulation to assist facility operators to conduct effective monitoring of their air pollution control equipment for compliance demonstration purposes. The CAM rule requires operators to monitor the operation and maintenance of their control equipment so that they can evaluate the performance of their control devices and report whether or not their facilities meet established emission standards to the appropriate enforcement agency (i.e., State and local environmental agencies). The CAM rule also provides State and local environmental agencies with enforcement tools to require facilities to respond appropriately to the monitoring results and improve pollution control operations.

Approximately 10% of the processes at major industrial facilities that are subject to air pollution emission standards have control equipment. The CAM rule covers approximately 60 percent of these facilities. Altogether, the control devices monitored under the CAM rule controls over 97% of the total emissions from subject facilities. For situations where continuous compliance monitoring is already specified in an operating permit, the rule exempts the source from additional CAM rule-related monitoring requirements. The continuous compliance monitoring data can then be used to fulfil the CAM rule requirements.

3 CASE STUDY 2 – UK

3.1 EUROPEAN UNION: CONTEXT FOR UK REGULATORY ACTIVITIES

To understand the environmental governance activities of European countries like the UK, it is important to first understand its relationship between Member States and the European Union and how this relationship influences the activities of national government and in particular the development of national legislation.

The EU is not a federation like the United States. Nor is it simply an organisation for co-operation between governments, like the United Nations. The countries that make up the EU (its "member states") remain independent sovereign nations but they pool their sovereignty in order to gain a strength and world influence none of them could have on its own (EU 2003).

Pooling sovereignty means, in practice, that the member states delegate some of their decision-making powers to European institutions they have created, so that decisions on specific matters of joint interest can be made democratically at European level.

The three main decision-making institutions are the **European Parliament** (represents the EU's citizens and is directly elected by them), the **Council of the European Union** (represents the individual member states) and the **European Commission** which seeks to uphold the interests of the Union as a whole. This "institutional triangle" produces the policies and laws (**directives**, regulations and decisions) that apply throughout the EU. The rules and procedures that the institutions must follow are laid down in the treaties**,** which are agreed by the member states' presidents and prime ministers and ratified by their parliaments. In principle, it is the Commission that proposes new EU laws but it is the Parliament and Council that adopt them.

3.1.1 Air Pollution Regulatory Framework

Several directives and programmes established within the EU make up the current air pollution regulatory framework for the regulation of industry within Member States. These instruments include: the Integrated Pollution Prevention Control (IPPC) Directive, the Air Quality Framework Directive (and various daughter directives), the National Emission Ceilings, the Auto-Oil Programme, the Solvents Directive and the Waste Incineration Directive.

3.1.1.1 Integrated Pollution Prevention and Control (IPPC) Directive

The key EU directive which influences how member states are legislating on environmental regulation and how they are designing their institutions to implement and monitor the implementation of this legislation, is Directive (96/61) – the Directive on Integrated Pollution Prevention Control (IPPC). It is a holistic and cross-cutting piece of legislation which has an impact on many different aspects of environmental protection and pollution prevention. The purpose of the IPPC Directive is to achieve integrated prevention and control of pollution arising from a wide range of industrial and agricultural activities and a high level of protection of the environment as a whole.

The EU operates under a principle called 'subsidiarity', where Member States have exclusive responsibility for the implementation of the IPPC Directive and must ensure that its domestic legislation can implement the terms of the directive. The role of the Commission is to facilitate exchange of information at EU level. Most Member States have decided to further delegate their obligations under the Directive to regional or local authorities. The EU IPPC

Directive 96/61 is to be phased in gradually between 2000 and 2007 (with an extension for the countries which have just joined the EU).

Industrial Sources Affected Listed

The directive takes a source or installation (as opposed to a process) approach to integrated pollution control and aims to create a European-wide authorization or permit system that requires large and medium sized industrial installations to obtain an integrated operating permit. The **industry sectors** covered are listed in Annex 1 of the Directive and include: Energy industries, production and processing of metals, mineral industries, chemical industries, waste management sector, pulp and paper industry, pre-treatment of textiles, tanning of hides, slaughterhouses and processing of food products, disposal or recovery of animal by-products, rearing of poultry or pigs, surface treatment using organic solvents, production of carbon/electrographite. A comprehensive description of the industry sectors taken from Annex 1 of the IPPC Directive is given in Appendix C of this report.

Best Available Technology the Basis for the IPPC Directive

The underlying principle of the Directive is that both operators and regulators shall take an integrated, overall look at each installation. "Integrated" means that the permits must take into account the *whole* environmental performance of the plant, i.e. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, risk management, (etc.). All installations covered by Annex I of the IPPC Directive are required to obtain a permit to operate from the authorities in the EU countries. The Directive defines the basic obligations to be met by all the industrial installations concerned, *whether new or existing*. The permits must be based on the concept of **Best Available Technologies (BAT)**, according to its definition in the Directive, as follows:

> *11. 'best available techniques` shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:*
>
> - ***'techniques`** shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned,*
> - ***'available`** techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator,*
> - ***'best`** shall mean most effective in achieving a high general level of protection of the environment as a whole.*

Annex IV of the Directive contains considerations to be taken into account when determining BAT, such as the use of low-waste technology and less hazardous substances, furthering recovery and recycling of substances, length of time required to introduce the best available technique (etc.).

In support of the implementation of IPPC, the European Commission organises an exchange of information on BAT between experts from the EU Member States, industry and environmental organisations, under the co-ordination of the European IPPC Bureau. This work has been divided into some 30 sectors along the lines of industrial sector listed in

Annex I of the Directive; for each sector a so-called BREF (BAT reference document) is produced.

The European IPPC Bureau also undertakes to collect, digest and disseminate validated information on best practice pertaining to air pollution (and other) monitoring. "Reference Document on the General Principles of Monitoring" contains information from Member States across the EU. This Monitoring BREF documents standard methods for sampling gas streams and analytical methods for air emissions. Lists of substances related to various industrial processes are also presented in the monitoring BREF to indicate the substances for which monitoring need be considered.

Priority Pollutants

The IPPC requires the application of emission limit values, based on Best Available Technology (BAT), to a comprehensive list of **priority pollutants** liable to reach water from diffuse sources. The main pollutants listed as requiring regulation with regard to air emissions are listed in Annex II of the Directive as follows:

- Sulphur dioxide and other sulphur compounds
- Oxides of nitrogen and other nitrogen compounds
- Carbon monoxide
- Volatile organic compounds
- Metals and their compounds
- Dust
- Asbestos (suspended particulates, fibres)
- Chlorine and its compounds
- Fluorine and its compounds
- Arsenic and its compounds
- Cyanides
- Substances and preparations which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air
- Polychlorinated dibenzodioxins and polychlorinated dibenzofurans

It is important to note that the IPPC Directive states that whereas emission limit values should be based on BAT, they *should not prescribe the use of one specific technique or technology* and should take into consideration the technical characteristics of the installation concerned, its geographical locations and local environmental conditions.

Furthermore, the directive states that when an environmental quality standard requires more stringent conditions that those that can be achieved by using BAT, supplementary conditions will in particular be required by the permit.

European Pollutant Emissions Register

Article 15(3) of the IPPC Directive requires the establishment of an EC inventory of principal emissions and their sources known as the "European Pollutant Emissions Register" (EPER). This registry aims to provide information to the public, help authorities to assess the effectiveness of IPPC and identify priority areas. The EPER improves *awareness* of environmental pollution and enhances *transparency* and comparability. It allows members of the public to compare emissions from individual facilities, industrial sectors, or countries. Governments use the EPER to monitor progress of achievements by industry in meeting environmental targets in national or international agreements or protocols. EPER was launched in February 2004 (web-based data base). EPER requires reporting on 50

pollutants released to air and water every three years. The first reporting year was 2003 on emissions from 2001 (or 2000 or 2002 where data from 2001 is not available). This required data to be collected from some existing installations before they have obtained IPPC permits. In preparing EPER data returns (the next, on emissions in 2004, is due in 2006).

3.1.1.2 Emission Monitoring

The choice of emission limit values in the permit conditions are always dependent on how the installation will be monitored and the way in which the law will be enforced. In the EU there is often consensus on performance data on comparable installations but there is a wide variation in different countries in the way in which the monitoring data is collected and handled and the use of these data under the national law. This is problematic when assessing the compliance status of industrial operations across countries (even in the EU).

For example, consider these divergent approaches:

- Automatic prosecution if an absolute emission concentration limit is breached based on a single independent analysis; or

- Prosecution if a emission concentration limit is breached more than say 5% of the time; or

- Prosecution if a limit based on total quantity emitted, for example over a year, is breached (implies continuous monitoring is necessary).

Mainland EU member states have a preference for uniform emission standards as the principal tool for pollution control with only the UK (and to some extent Ireland) insisting on setting emission standards individually by reference to environmental quality.

3.1.1.3 Ambient Air Quality Directives

The EC has issued a series of directives aimed at controlling ambient levels of certain pollutants and monitoring their concentrations in the air. In 1996, the Environment Council adopted the Framework Directive 96/62/EC on ambient air quality assessment and management. This Directive covers the revision of previously existing legislation and the introduction of new air quality standards for previously unregulated air pollutants, setting the timetable for the development of daughter directives on a range of pollutants. The list of atmospheric pollutants to be considered includes sulphur dioxide, nitrogen dioxide, particulate matter, lead and ozone – pollutants governed by already existing ambient air quality objectives- and benzene, carbon monoxide, poly-aromatic hydrocarbons, cadmium, arsenic, nickel and mercury.

The Framework Directive was followed by daughter directives, which set the numerical limit values, or in the case of ozone, target values for each of the identified pollutants. To date the following daughter directives have been published:

- First Daughter Directive (1999/30/EC) - Limit values for NOx, SO_2, Pb and PM_{10} in ambient air - came into force in July 1999.

- Second Daughter Directive (2000/69/EC) - limit values for benzene and carbon monoxide in ambient air - came into force on the 13th of December 2000.

- Third Daughter Directive (2002/3/EC) – relating to ozone – adopted on 12th of February 2002.

- Fourth Daughter Directive (2004/107/EC) – relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

Besides setting air quality limit and alert thresholds, the objectives of the daughter directives are to harmonise monitoring strategies, measuring methods, calibration and quality assessment methods to arrive at comparable measurements throughout the EU and to provide for good public information.

3.1.1.4 EU Directives Pertaining to Stationary Source Emissions

Large Combustion Plants (LCPs)

Directive 2001/80/EC - Aims to limit emissions of acidifying pollutants and ozone precursors, which are carried over very long distances and damage human health, leading to ground level ozone episodes and deposits in the form of "acid rain". It includes emission limit values for SO_2 (sulphur dioxide), NO_x (nitrogen oxides) and dust and encourages the combined generation of heat and power and sets specific emission limit values for the use of biomass as fuel. The proposed values are *minimum values*, with Member States able to adopt stricter values if they so wish.

Waste Incineration Plants

Directive 2000/76/EC – covers the incineration of hazardous and non-hazardous waste. Aims at preventing or reducing as far as possible the negative effects of incineration through stringent operational conditions and technical requirements and by setting emission limit values – including for acid gases such as *nitrogen oxides* (NOx), *sulphur dioxide* (SO_2) and *hydrogen chloride* (HCl) as well as for heavy metals.

Volatile Organic Compounds (VOCs)

Directive 94/63/EC - Aims to prevent emissions to the atmosphere of volatile organic compounds (VOCs) during the storage of petrol at terminals and its subsequent distribution to service stations. The Directive contains measures that terminals should employ such as floating roofs and reflective coatings so as to reduce evaporative losses from storage tanks. In addition when petrol is loaded onto tankers and transported to service stations the directive ensures that any vapours are recovered and returned to the tanker or terminal.

Directive 1999/13/EC – Limits emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (the so-called VOC Solvents Emissions Directive, SED) is the main instrument for the reduction of VOC emissions in the European Community. The Directive sets *emission limit values* (expressed in terms of the maximum solvent concentration in waste gases) *and fugitive emission values* (expressed as a percentage of solvent input). Member states are required either to implement the set of emission limit values foreseen by the Directive, or to design and implement a *National Plan* to achieve the same reduction. Annex I to the SED sets out a number of different activities that are covered by the Directive, most with thresholds for annual solvent consumption below which activities are excluded. These activities broudly include:

- Various coating processes, such as printing, varnishing, painting and adhesive coating (amongst others);
- Coating manufacture;
- Surface cleaning;
- Dry cleaning;
- Wood impregnation;

- Other activities such as footwear manufacture, dry cleaning, wood/plastic lamination, rubber conversion, vegetable oil / animal fat extraction/refining and manufacture of pharmaceutical products.

The main requirements of the SED apply to existing installations from 31 October 2007 and to new installations from 1 April 2001. In summary, the requirements include:

- Member States must introduce an authorisation or general bidning rules to ensure compliance with specified emission limit values in waste gases and fugitive emission standards (or total emission standards). Alternatively, a reduction scheme may be applied in order to achieve equivalent emissions reductions thorught he use of of coatings and other products that contain little or no solvent.

- Requirement to substitue, within the 'shortest possible time' certain VOCs that are classified as carcinogens, mugatens or toxic to reproduction and to apply stricter emission llimits to these substances.

- Operators are required to provide data to the competent authority, at least annually to enable compliance to be verified (either continuous or periodic, depending upon the mass flow rate of total organic carbon and whether abatement equipment is required). Compliance with the emission limit values or the reduciton scheme must be demonstrated to the satisfaction of the competent authority.

As indicated above, Member States are given the opportunity to implement national plans for reducing emissions from the activities and installations covered. These would need to reduce emission by at least the same amount and within the same timescale as would otherwise have been achieved. (As at early 2007, no Member States have submitted National Plans to the Commission.)

Sulphur Content of Liquid Fuels

Directive 1999/32/EC addresses the reduction of the sulphur content of certain liquid fuels. It aims to reduce the emissions of sulphur dioxide resulting from the combustion of certain types of liquid fuels. These reductions in emissions is achieved by imposing limits on the sulphur content resulting from the combustion of certain types of liquid fuels as a condition for their use within the territory of the Member States.

Other Sources of Emissions

Diffuse pollution from agriculture (a major emitter of methane, nitrous oxide and ammonia) and point source emissions from a wide range of industrial installations are covered by the *IPPC Directive*.

3.1.1.5 National Emissions Ceilings (for Acidification and Eutrophication)

Directive 2001/81/EC sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (viz. SO_2, NOx, VOCs and ammonia), but leaves it largely to the Member States to decide which measures to take in order to comply.

3.2 UK INSTITUTIONAL ARRANGEMENTS FOR ENVIRONMENTAL REGULATION

The United Kingdom of Great Britain and Northern Ireland is made up of 4 countries (England, Scotland, Wales and Northern Ireland) and operates under a complex system of

devolved government. A central Parliament and government are located in Westminster (England) with devolved legislatures for Scotland, Wales and Northern Ireland (currently suspended).

Under devolution, power is delegated from the central government to the other national legislatures and is implemented by their own supporting civil services. Added to this structure of devolved governance, Scotland and Northern Ireland also have their own separate legal systems.

Under this system, responsibility for the environment is divided as follows:

- England: legislation passed by central government (Westminster) and administered by the Department of Environment, Food and Rural Affairs (DEFRA) with environmental protection carried out by a separate Non-Departmental Public Body – the Environment Agency
- Scotland: legislation is passed by the devolved Scottish Parliament and administered by the Scottish Executive with environmental protection carried out by the Scottish Environmental Protection Agency (SEPA).
- Wales: legislation is passed by the devolved National Assembly for Wales but is also administered by the Department of Environment, Food and Rural Affairs, with environmental protection also carried out by the Environment Agency
- Northern Ireland. The legislative Assembly has been suspended. Administration of environmental affairs is carried out by the Northern Ireland Environment and Heritage Service and environmental protection falls under the environmental protection directorate of this department.

Each of the systems above works differently when it comes to environmental regulation and enforcement, although the system in England and Wales is similar as it involves the same administrative institutions (DEFRA and the EA). For the purposes of this study, the main systems operating within England and Wales (DEFRA and EA) will be focused on.

3.2.1 Broad Functions of DEFRA and the Environment Agency in England and Wales

The Environment Agency was established in 1996 under an act of Parliament (Environment Act 1995). It is what is called a 'Non-Departmental Public Body' of the Department for Environment, Food and Rural Affairs (DEFRA). As noted above, it also works in Wales, where it is an 'Assembly Sponsored Public Body' of the National Assembly for Wales. The remit of the EA (as noted above) covers the whole of England and Wales which is approximately 15 million ha of land, 36 000 kms of river and 5 000 km of coastline and 2 million ha of coastal waters. It has a broad range of functions, which include integrated pollution prevention and control, water resource management, water quality, conservation, waste management, land quality, (etc.).

3.2.2 Development and Implementation of IPPC (England and Wales)

Until the 1970s pollution control in the UK was characterised by a range of disconnected, media-specific legislation regulated by different bodies (e.g. Clean Air Act 1956). Her Majesty's Inspectorate of Pollution (HMIP) was created as the unified regulator allowing the development of the UK's first integrated approach to pollution control (IPC) through the Environmental Protection Act of 1990. *The industrial sectors regulated by IPC were largely derived from those covered in previous legislation.* IPC required industrial operators to obtain an authorisation to undertake a *prescribed process*, with the regulators considering impacts of releases on all three media (air, water and to a lesser extent land) in the issuing of

such authorisations. IPC introduced the concept that BATNEEC (best available techniques not entailing excessive cost) should be applied extending the best practicable means (BPM) approach as well as the requirement that BPEO be applied across all media. IPC was implemented in England and Wales between 1991 and 1996 following a phase timetable for applications according to each industrial sector (Gray *et al*., 2007).

Although IPC did not incorporate waste generation and management it did lay three critical foundations for future integrated pollution control approaches, viz.:

- Setting emission standards for a particular site based on the lowest levels that could cost effectively be achieved through the use of the BATNEEC approach;
- Periodic review of authorisations so that emissions could be reduced as technological advances made this possible; and
- Introduction of cross-media permitting to industry.

In the UK, IPPC (as outlined by the EU Directive) has been legislated for within the Pollution Prevention and Control Act of 1999 and relevant regulations – termed the PPC regime. The PPC regime, which replaces the IPC approach described above, extends the coverage of regulation from just emission to wider environment impacts, resource and energy use, noise and odour, soil and groundwater protection. The new regime also covers *whole installations* rather than discrete processes and the *range of sectors has been broadened to include industries such as food and drink and intensive agriculture*[3]. It is notable that the EU IPPC Directive, whilst forming the framework for UK legislation, borrowed heavily from the UK Integrated Pollution Control (IPC) regime. (Hersh, 2006).

3.2.3 Regulation of Installations under the PPC Regime

3.2.3.1 Classification of Installations

The UK Pollution Prevention and Control Act 1999 establishes three regulation regimens for industrial 'installations':

- *Part "A" installations*, which are, or which will become, subject to the Integrated Pollution Prevention and Control (IPPC) regime. Part "A," is further divided into two:

  - *"A1" regulated by the Environment Agency*

    The Environment Agency regulates A1 installations (referred to as A(1) in the PPC Regulations) through Integrated Pollution Prevention and Control (IPPC) (Environment Agency's "*Integrated Pollution Prevention and Control*, *A Practical Guide*"). This system requires installations to obtain permits to operate. An application must be made and the regulator then decides whether to issue or refuse a permit. In applying for a permit the operator must account for various environmental issues including: satisfactory environmental management of the installation, adequate compliance monitoring and the assessment of pollution releases and best available technology. If a permit is issued, it will include conditions aimed at reducing and preventing pollution. The installation will be required to meet environmental quality standards including emission standards and ambient air quality standards (Chartered Institute of Environmental Health, 2004).

  - *"A2" regulated by the relevant local authority under Local Authority Integrated Pollution Prevention and Control (LA-IPPC).*

[3] PPC encompasses many more sites than were previously covered by IPC. Initial estimates are about 6000 – 8000 sites compared with ~2 400 under IPC. A more recent estimate is that 7 500 permits are to be issued under PPC (information obtained from Peter Newman, Industry Regulation, EA, February 2007).

Installations subject to LA-IPPC are controlled through a *single permitting process* designed to protect the environment. All emissions to air, water (including discharges to sewer) and land together with a range of other environmental effects defined as emissions (*e.g.* noise and vibration) are considered together. This process therefore introduces far wider controls than those to date undertaken by local authorities under the LAPC regime. LA-IPPC also takes the integrated approach beyond the initial task of permitting, including compliance monitoring, permit reviews, variations, transfers, through to the restoration of sites when industrial activities cease (Chartered Institute of Environmental Health, 2004).

- *Part "B" installations* remain subject to a system of control similar to that already operating under the LAPC regime and are regulated by the local authority or port health authority under Local Authority Pollution Prevention and Control (LAPPC). The permitting process for these processes remain similar to that employed for authorisations under Part I of the EPA although there are some minor changes (*e.g.* the use of the defining term "installation" rather than "process"). Only emissions to air are controlled in Part "B" installations (Chartered Institute of Environmental Health, 2004).

All installations ("A" and "B") covered by the PPC Regulations are subject to a process of permitting (rather than authorisation). Where installations of more than one category exist on the same site, broadly speaking (though not invariably), regulation will "default" to the Environment Agency.

3.2.3.2 Phasing in of PPC across Sectors

PPC is being phased in sector by sector in the UK (2001 to 2007). By April 2006, approximately half of the forecast number of permits had been issued by the Environment Agency (Gray *et al*., 2007). This phased approach was important in terms of spreading the workload despite there still being notable peaks in workload, e.g. in 2006/2007 when large sectors such as combustion and intensive farming were brought into PPC.

Permits issued under the PPC are based on BAT with the UK making use of the BREFs (BAT reference documents) collated by the European IPPC Bureau to support its permitting process. In fact, the UK's sectoral programme was largely based on the programme for the publication of the BREFs with these documents forming the basis for the UK's own *PPC sector guidance documents*. Unfortunately, delays in BREF production resulted in some sectors in the UK having reached their application window for coming into PPC before the relevant BREF was complete. This led to uncertainty over what constitutes BAT for that sector.

The UK sector guidances contain clear, indicative standards for both new and existing installation. Timetables for upgrading existing installations are also included. Operators are expected to take account of the information provided in the guidances when applying for a permit. When no such guidances are available, operators and regulators are required to refer directly to the relevant BREF notes. This is also the case if a BREF has been updated but the UK guidance has not. Furthermore, if neither a BREF note nor UK sector guidance is available, operators and regulators are advised to assess BAT based on other sources of data. In a site-specific assessment of BAT, operators are told to present a systematic, reasoned and balanced assessment of the options available and their overall effects on the environment (DEFRA, 2005).

The UK uses *sector implementation teams* supported by a sector coordinator to carry out most of the consultation/communication with industry and trade bodies. The communication strategy varies from sector to sector but usually involves a scoping of the sector to gather

information about its structure, geographical and size distribution, along with the preferred methods of communication. Furthermore, a *sector permitting plan*, is developed for each principal sector. This plan aims to focus regulators and industry on the most important aspects requiring to be addressed. The UK EA produces regulatory packages tailored for each industrial sector. This package contains all the guidance and application tools that an applicant needs.

The introduction of PPC in the UK through the implementation of several phased, discrete steps over a long time scale, is stated by Gray *et al.* (2007) to have resulted in an experienced regulator, knowledgeable and cooperative regulated industrial sectors. Other important lessons from the UK phasing approach have been noted to include:

- Allowing experienced industries to go through the transitional phase first to ease the learning process of both industry and regulatory authority sides;
- Allow industries previously unregulated to make improvements and understand the regulatory process;
- Meet the upswing of business cycles in certain industries, which makes securing improvements easier for all concerned; and
- Bring more potentially polluting industries under the new regime earlier than less polluting industrial sectors.

3.2.4 Other Legislation influencing the Regulation of Emissions from UK Industries

3.2.4.1 Landfill Regulations

The UK Landfill Regulations issued in 2002 implement EU Directive 1999/31/EC on the landfill of waste (know as "the Landfill Directive"). Using the framework of the PPC Regulations, they contain controls and technical specifications that apply to landfills as well as specifying overall limits on the amount of biodegradable municipal waste that may be disposed of to landfill.

The Landfill (England and Wales) (Amendment) Regulations 2004 served to amend the regulatory regime governing landfills for the purpose of implementing Council Decision 2003/33/EC. This Council Decision supplements the requirements of the Landfill Directive by specifying detailed procedures for acceptance of waste for each class of landfill.

3.2.4.2 Large Combustion Plants Regulations 2002

These regulations implement EC Directive 2001/80/EC on the limitation of emission of certain pollutants into the air from large combustion plants and thus have a bearing on the application of IPPC to such plants.

3.2.4.3 Waste Incineration Regulations 2002

These regulations implement EC Directive 2000/76/EC issued for the incineration of waste. In addition to specifying the Directive's ELVs for incineration and co-incineration plant, the regulations incorporate the Directive's technical and operating requirements for the plants it covers.

3.2.4.4 Greenhouse Gas Emissions Trading Scheme Regulations 2003

These regulations provide the framework for a greenhouse gas emissions trading scheme for the purpose of implementing Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the EU and amending the IPPC Directive. The regulations control emissions of carbon dioxide from any of the activities listed in their Schedule 1. They also amend the PPC Regulations so as to forbid the setting of ELVs,

equivalent parameters or technical measures in respect of greenhouse gases emitted by those activities unless the regulator considers it necessary to ensure that no significant local pollution is caused (DEFRA, 2005).

3.2.4.5 Solvent Emissions (England and Wales) Regulations 2004

These regulations use the PPC Regulations to deliver the requirements of the EC Solvent Emission Directive (SED). As a result the PPC regulations have been adjusted to ensure that in the majority of the cases the PPC and SED application requirements are combined. They require the holders of permits under the PPC Regulations 2000 who carry out solvent activities at the time of coming into force of the Regulations to apply for a variation of their permits to incorporate the Directive requirements. Those requirements include an emissions reduction scheme.

3.2.5 Air Quality Management Planning

An overview of air quality management practices in the UK and the manner in which such practices interact with the regulation of industries is provided in Appendix D.

3.3 NATIONAL EMISSION STANDARDS, REGULATED SOURCES AND SUBSTANCES

3.3.1 Industry Types for which National Emission standards are Specified

The industrial activities covered by the Pollution, Prevention and Control Regulations issued in 2000 (Part 1, Schedule 1 to the Pollution Prevention and Control Regulations (England and Wales) 2000) are very wide ranging and cover installations in the following industrial sectors:

- Energy Industries: (Chapter 1 of the Regulations)
    - Combustion Activities
    - Gasification, Liquefaction and Refining Activities
- Production and Processing of Metals: (Chapter 2 of the Regulations)
    - Ferrous Metals
    - Non-Ferrous Metals
    - Surface Treating Metals and Plastic Materials
- Mineral Industries: (Chapter 3 of the Regulations)
    - Production of Cement and Lime
    - Activities Involving Asbestos
    - Manufacturing Glass and Glass Fibre
    - Production of Other Mineral Fibres
    - Other Mineral Activities
    - Ceramic Production
- The Chemical Industry: (Chapter 4 of the Regulations)
    - Organic Chemicals
    - Inorganic Chemicals
    - Chemical Fertiliser Production
    - Plant Health Products and Biocides
    - Pharmaceutical Production
    - Explosives Production
    - Manufacturing Activities Involving Carbon Disulphide or Ammonia
    - Storage of Chemicals in Bulk
- Waste Management (Chapter 5 of the Regulations)

    - Disposal of Waste by Incineration
    - Disposal of Waste by Landfill
    - Disposal of Waste other than by Incineration or Landfill
    - Recovery of Waste
    - Production of Fuel from Waste
- Other Activities (Chapter 6 of the Regulations)
    - Paper, Pulp and Board Manufacturing Activities
    - Carbon Activities
    - Tar and Bitumen Activities
    - Coating Activities, Printing and Textile Treatments
    - The Manufacture of Dyestuffs, Printing Ink and Coating Materials
    - Timber Activities
    - Activities Involving Rubber
    - The Treatment of Animal and Vegetable Matter and Food Industries
    - Intensive Farming
- SED (Solvent Emission Directive) Activities (Chapter 7 of the Regulations)

Prescribed processes in the regulations were included largely on a historical basis and reflect actual problems encountered in the past in addition to processes requiring regulation under EC directives.

Sector Guidance documents, based on the EC BREFs, and containing emission limit values (ELVs) have been published for various specific industry subsectors falling within the above classifications. A comparison of how the UK sectors related to the proposed South African listed activities is given in Appendix F. An indication is also provided of the UK Sectoral Guidance Documents and EC BREFs currently available for each of these activities.

As in the US case, emission standards are generally specified for point sources with management and control measures being specified for diffuse sources, e.g. requiring operators to demonstrate that they have taken all necessary measures to minimise fugitive releases. Fugitive releases are therefore treated as non-point sources and are dealt with by overall monitoring undertaken by the operator which is reported to the regulator combined with a defined *maintenance and replacement programme* being put in place to minimise the fugitive release (information obtain from Peter Newman, Industry Regulatory, EA, February 2007).

It is however notable that enclosure and extraction is required for certain diffuse sources, with emission standards established for the vented emissions. A good example of this is Solvent Emission Directive (SED) Activities which include various sources of VOCs including coating manufacture, textile and fabric finishing, spray painting, paper coating (etc.) (see Section 3.1.1.4). Emission standards are specified in terms of total mass emissions or based on individual compounds such as ammonia with one per annum extractive monitoring typically required to demonstrate compliance (DEFRA, *Sector Guidance Note IPPC SG6, Secretary of State's Guidance for the A2 Surface Treatment Using Organic Solvents Sector*, October 2003.)

3.3.2 Pollutants Regulated and Basis for National Emission standards

The UK Pollution Prevention and Control Regulations 2000 make reference to the same list of pollutants for which emission limit values for atmospheric releases could be specified, as is contained in the EC IPPC Directive (see Section 3.1.1.1). The main basis for the setting of emission limit values (ELVs) under the UK PPC Regulations is the application of BAT (as

defined by the EC IPPC Directive), for all activities except landfills[4]. The ELVs must however also satisfy the regulatory requirement that where an environmental quality standard (EQS) requires stricter ELVs than those achievable under BAT, the regulator must impose those stricter limits[5].

UK and other member states are expected to set limits according to BAT to ensure a level playing field througout the EU so as ato avoid any distortion to trade. For this reason it is not normal for member states to unilaterally set limits for other substances. It is up to anyone whether an individual, pressure group or even a member state to proposed to the EC for tighter limits to be introduced and for other processes and substances to be included. Any such proposal if adopted by the EC has to go through the full evaluation process and be approved by the European Parliament and finally by the Council of Ministers. For that reason it can take five years in the gestation process. Currently the EC is planning for environmental legislation which will take effect in 2020 (information obtained from Peter Newman, Industry Regulation, EA, February 2007).

It is interesting to note that the Greenhouse Gas Emission Trading Scheme Regulations 2003 amended the PPC Regulations so as to forbid the setting of ELVs, equivalent parameters or technical measures in respect of greenhouse gases emitted by those activities, unless the regulator considers it necessary to ensure that no significant local pollution is caused.

3.3.3 Emission Monitoring

Source monitoring of atmospheric emissions is undertaken in accordance with the requirements in the Environment Agency's Technical Guidance Notes M1 to M4. Monitoring requirements stated in the permit requirements are both site- and process-specific. Factors that influence monitoring frequency for atmospheric emissions are as follows:

- emission quality
- emission quantity
- installation capacity
- potential damage (risk to receiving environment)
- use of monitoring data
- industrial sector type
- proximity to permitted emission limit value
- variability of parameter value over time
- level of confidence between operator and regulator
- location of the installation.

Generally monitoring is undertaken during commissioning, start-up, normal operation and shut-down. Surrogates are frequently used to minimize monitoring costs. Where monitoring shows that substances are not emitted in significant quantities consideration is given to a reduced monitoring frequency.

In general continuous monitoring and recording are likely to be required under the following circumstances:

- Where the potential environmental impact is significant or the concentration of the substance varies widely.

[4] The minimum standard for landfills are specified by the Landfill Directive and a BREF for the sector is not expected to be published.

[5] The so-called 'Air Quality Management Plan' approach has been adopted by all major coal- and oil-fired power stations in England and Wales. This approach places the responsibility on operators to ensure compliance using a combination of dispersion modelling and measurement. This represents a progression in environmental regulation from prescriptive control of emissions to a risk management approach under operator control (Webb and Hunter, 2004).

- Where a substance is abated continuous monitoring of the substance is required to show the performance of the abatement plant.
- Where other control measures are required to achieve satisfactory levels of emissions;

Gas flow should be measured or otherwise determined to relate concentrations to mass releases. To relate measurements to reference conditions it is necessary to measure and record the temperature and pressure of the emissions. The water vapour content must also be measured if it is likely to exceed 3% unless the measuring techniques used for other pollutants provide results on a dry basis.

Where appropriate, periodic visual and olfactory assessment of releases is given as being required to ensure that all final releases to air are essentially colourless, free from persistent trailing mist or fume and free from droplets.

4 CASE STUDY 3 - AUSTRALIA

4.1 INSTITUTIONAL AND LEGISLATIVE FRAMEWORK

4.1.1 National Legislation and Environmental Protection Measures

Australia is governed by a federal governance system and under this system the country is divided into 8 semi-autonomous states and territories namely Australian Capital Territory, New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria, and Western Australia

At a national level, the Department of the Environment and Water Resources (formerly the Department of the Environment and Heritage) develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage. This Department is responsible for setting out the environmental policy framework and administers a number of environmental laws to ensure the conservation and protection of the environment such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This Act protects the environment, particularly matters of National Environmental Significance. It streamlines national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places. The EPBC Act came into force on 17 July 2000.

Ministerial Councils facilitate consultation and cooperation between governments, develop policy jointly, and take joint action to resolve issues which arise between governments in the Australian Federation. The main ministerial councils and forums include:

- Environment Protection and Heritage Council (EPHC)
- Ministerial Council on Energy (MCE)
- National Environmental Protection Council (NEPC)
- National Resource Management Ministerial Council (NRMMC)
- Primary Industries Ministarial Council

The *National Environment Protection Council (NEPC)* comprises environment ministers from the Australian Government and each state and territory. The purpose of NEPC is to ensure that Australians enjoy the benefit of equivalent protection from air, water or soil pollution and from noise wherever they live, and that business decisions are not distorted and markets are not fragmented by variations in major environment protection initiatives between member governments.

NEPC takes a cooperative approach to the management of environmental issues in Australia. Membership of NEPC includes environment ministers from the Australian Government and each state and territory. The Australian Government Minister for the Environment and Heritage chairs NEPC. Each NEPC minister has equal voting power. Decisions of NEPC can only be made with a two-thirds majority of ministers. The Australian Government does not have the power of veto.

NEPC has powers to make National Environment Protection Measures (NEPMs) on:

- ambient air quality
- ambient marine, estuarine and fresh water quality
- the protection of amenity in relation to noise (but only if differences in environmental requirements relating to noise would have an adverse effect on national markets for goods and services)
- general guidelines for the assessment of site contamination
- environmental impacts associated with hazardous wastes

- the re-use and recycling of used materials
- motor vehicle noise and emissions (in consultation with the National Transport Commission)

National Environment Protection Measures (NEPMs) outline national objectives for protecting or managing particular aspects of the environment and may include a combination of goals, guidelines, standards or protocols. A rigorous consultation process ensures that stakeholders and interest groups, including industry, environmental groups, government agencies, non-government organisations and members of the public are involved in making a NEPM. After NEPC makes a NEPM, each jurisdiction must enact laws to implement it.

NEPMs which have already been developed since the establishment of the NEPC in 2001 which are relevant to air pollution control and air quality management are:

- Air Toxics NEPM - establishes procedures to collect information regarding certain hazardous air pollutants in order to develop national ambient standards by 2012.

- Ambient Air Quality NEPM – establishes ambient air quality standards and monitoring and reporting protocols for listed air pollutants, namely CO, SO_2, lead, NO_2, photochemical oxidants (measured as ozone), and particulates (PM_{10}).

- Diesel Vehicle Emissions NEPM - establishes guidelines to assist jurisdictions to develop programs to minimise exhaust emissions from diesel vehicles. The guidelines cover smoky vehicles, emission tests and repairs, audited maintenance, and engine retrofit and rebuild.

- National Pollutant Inventory (NPI) NEPM - assists environmental management by government, industry and the community by providing improved information on released emissions. Since 1 July 1998, many industrial facilities have been required to estimate and report annually their emissions of NPI listed substances. This information is publicly available on the National Database of Pollutant Emissions.

4.1.1.1 National Ambient Air Quality Limits for Criteria Pollutants

Ambient air quality standards have been set for seven criteria pollutants namely: sulphur dioxide, carbon monoxide, nitrogen dioxide, ozone, lead, PM10 and PM2.5. These standards apply in all states and territories of Australia as minimum standards.

The Commonwealth's contribution to the implementation of the Air NEPM is largely through the suppor tof initiatives aimed at reducing the impact of air pollution in urban areas. Various projects have been conducted, pricipally funded under the Natural Heritage Trust *Air Pollution in Major Cities Program*, aimed at assisting compliance with the national air quality standards by:

- Implementing national strategies to assist States and Territories to meet these standards
- Improving monitoring to target management actions better
- Supporting air quality research to improve the basis for policy and decision making
- Undertaking community education on air quality issues

Each State and Territory is responsible for managing and protecting its own environment including the regulation of industry. States are however required to report the extent to which the air quality standards are met on an annual basis, to provide information on the reasons for exceedances and to summarise activities taken in order to achieve compliance

with national air quality limits. States and territories are also able to set their own more stringent air quality limits.

4.1.1.2 Air Toxics Regulation

The aim of the Air Toxics NEPM issued in April 2004 is to provide a framework for monitoring, assessing and reporting on ambient levels of five air toxics, viz. benzene, toluene, xylene, formaldehyde and polycyclic aromatic hydrocarbons (PAHs). The purpose being to assist in the collection of information for the future development of national air quality standards for these pollutants. The NEPM applies to areas where emissions from cumulative sources give rise to elevated levels of air toxics, so called toxic "hot spots". Although industries may contribute to ambient levels in a specific area, the NEPM is not aimed at direct monitoring or control of industrial emissions. The measure provides guidance on how to identify suitable monitoring sites, how to monitor (method, averaging period, etc.) and requires annual reporting by each state and territory.

Specific emission standards and maximum ground level concentrations for industrial sources are used in some jurisdictions to control emissions from industrial sources. These emissions of air toxics are regulated through State, Territory and local government regulatory mechanisms (NEPC, May 2003).

4.2 STATE APPROACH: NEW SOUTH WALES CASE STUDY

The Federal government sets national minimum ambient air quality limits and establishes guidelines to assist jurisdictions to develop programs to minimise exhaust emissions from diesel vehicles. The states are able to set more stringent limits for their jurisdictions and are responsible for implementing measures to regulate sources including industries. Although source and emissions data from certain industries are contained within the National Pollutant Inventory, emission standards are set and permitting programmes developed and implemented by states. New South Wales has arguably one of the more comprehensive industrial regulatory regimes and has therefore been selected as a case study to demonstrate the manner in which emission standards are developed and used within the Australian context.

4.2.1 Protection of the Environment Operations Act 1997 (POEO Act)

The *Protection of the Environment Operations Act 1997* is the major pieces of environment protection legislation in NSW. The POEO Act specifies which industrial activities require environment protection licences and establishes the NSW Environmental Protection Agency (NSW EPA) (currently the Department of Environment and Climate Change, DECC) as the appropriate regulatory authority for such so-called 'scheduled activities'. Individual facilities that are license under the Act – as listed in Schedule 1 of the Act - are often referred to as licensed or scheduled industries or premises (DEC, 2004).

According to Section 128 of the Act, it is an offence for emissions to atmosphere to exceed 'standards of concentration' specified in the Regulations to the Act. These 'standards of concentration' represent emission standards for specific pollutants and are listed in a recent amendment to the *Protection of the Environment Operations (Clean Air) Regulation 2002*. Where no performance standards have been specified Section 128 of the POEO Act states that the operation of any plant or activity be undertaken by such practicable means as may be necessary to prevent or minimise pollution.

4.2.2 Protection of the Environment Operation (Clean Air) Regulation 2002

The Clean Air (Plant and Equipment) Regulation 1997 (CAPER) was until recently the legislative tool used by the NSW government to implement the objectives of the POEO Act specifically with regard to the management of industrial air emissions in NSW. CAPER specified air pollutant emission standards for industrial sources for a range of pollutants including particulate matter, oxides of nitrogen, halogens, smoke, heavy metals and dioxins. CAPER also set restrictions on the sulphur content of local fuels, standards for smoke and solid particle emissions from non-scheduled premises (typically smaller industries that are regulated by local councils) and performance requirements for pollution control equipment associated with the storage of bulk liquid hydrocarbons.

CAPER was repealed in 2005 and replaced by an amendment to the Protection of the Environment Operation (Clean Air) Regulation promulgated in 2002 (Clean Air Regulation 2002). Key features of the amendment include (DEC, 2004):

- Industry-specific emission standards for major scheduled activities
- Emission concentration standards for new plant that reflect contemporary technology
- Generic emission standards that apply where no specific standards are set for scheduled and non-scheduled industry
- A process for the review of the emission standards that apply to older scheduled activities and plant
- Performance standards for new flares, afterburners and vapour recovery units
- Introduction of additional emission standards for plant and activities using non-standard fuels
- A requirement that when plant on a premises (scheduled or unscheduled) in the Greater Metropolitan Area is replaced, the replacement plant shall be subject to contemporary emission performance standards as specified in the Regulation
- The requirements that any major modification of existing plants be subject to contemporary emission performance standards as given in the Regulation or a site-specific emission limit.

4.2.3 Protection of the Environment Operations (General) Regulation 1998

The *Protection of the Environment Operations (General) Regulation 1998* introduced the system of load-based licensing (LBL), which is an application of the polluter pays principle in the setting of environment protection licence fees. The LBL regime comprises two main components:

- An annual load fee based on the licensee's annual pollutant emissions to air and water
- An annual load limit that 'caps' the mass of pollutants that may be emitted

Load fees are payable by industries that emit 'assessable pollutants' as defined under Schedule 1 of the *Protection of the Environment Operations (General) Regulation 1998.* The lower the licensee's annual emissions of assessable pollutants, the lower the load fee the licensee pays; the LBL system thus providing an incentive for licensees to reduce their annual mass of emissions.

The annual load limit caps the mass of a particular pollutant that a facility can legally discharge each year. These limits are intended to partially protect the environment against the cumulative impacts of pollution by limiting pollution from the facility regardless of any increase in production at the facility.

4.2.4 Relationship between the Clean Air Regulation 2002 and Load Based Licensing

The emission concentration limits in the Clean Air Regulation are intended to set a minimum standard of performance that protects against localised and acute pollution episodes whereas LBL caps annual masses of emission and helps to protect against long-term air quality impacts. The Clean Air Regulation and LBL are therefore seen as complementing each other to minimise emissions from industry so as to meet air quality standards and protect health.

Of the over 500 licensed activities with stack discharges to air, the DEC (2004) estimated that approximately 130 licensees report air emissions to LBL with most of these being subject to load limits.

4.2.5 Pollution Reduction Programmes (PRPs)

Pollution Reduction Programmes are negotiated agreements between the NSW DECC and a licensee, whereby the licensee agrees to reduce emissions. Once agreed, a PRP becomes a condition of the license. Between July 2002 and 2005, 150 PRPs related to air emissions had been concluded. (There are about 500 licensee holders with air emissions.)

4.3 NSW EMISSION STANDARDS, REGULATED SOURCES AND SUBSTANCES

4.3.1 Emission Limit Types and Sources Regulated

Schedule 1 of the *Protection of the Environment Operations Act 1997* which lists activities requiring a license to operate, make a distinction between whether or not the activity is premises based (fixed and mobile plants). Activities listed are given in Appendix F. It is notable that emission concentrations within the *Clean Air Regulation 2002 (as amended)* and annual load limits *under the General Regulation 1998* are not set for all of the activities listed.

The *Clean Air Regulation 2002* makes provision for three types of emission standards and six age groups for so-called Scheduled Industry. These are described below.

4.3.1.1 Grouping of Scheduled Industries by Age of Plant and Requirements for Improvement

The NSW government has periodically reviewed its air emission standards a number of times since the introduction of such standards initially 35 years previously. These reviews have reflected the availability of new control technologies and more current information on health impacts associated with air pollutants. As a result, more stringent standards have been set for new industry at the time of each review. These new standards have not generally been applied retrospectively to existing industry and so several groups of emission standards are supported.

For scheduled premises prior to 1999, the standards applicable are determined by the date of application for pollution control approval. Since 1999 the date a premises became scheduled (and licensed) under the POEO Act determines the applicable standards. There are six different groups of emission standards that apply to scheduled premises, as follows:

- **Group 1** – any activity commenced to be carried on, or equipment operated, before 1 January 1972. Also any activity commenced, or equipment operated after 1 January 1972 as a result of an application for a pollution control approval made before 1 January 1972.
- **Group 2** – any activity commenced to be carried on, or equipment operated, on or after 1 January 1972, as a result of an application for a pollution control approval made on or after 1 January 1972 and before 1 July 1979.

- **Group 3** – any activity commenced to be carried on, or equipment operated, on or after 1 July 1979, as a result of an application for a pollution control approval made on or after 1 July 1979 and before 1 July 1986.
- **Group 4** – any activity commenced to be carried on, or equipment operated, on or after 1 July 1986, as a result of an application for a pollution control approval made on or after 1 July 1986 and before 1 August 1997.
- **Group 5** – any activity commenced to be carried on, or equipment operated, on or after 1 August 1997, as a result of:
- an application for a pollution control approval made on or after 1 August 1997 and before 1 July 1999
- an application for an environment protection licence made on or after 1 July 1999 and before 1 September 2005.
- **Group 6** – any activity commenced to be carried on, or equipment operated, on or after 1 September 2005, as a result of an application for an environment protection licence made on or after 1 September 2005.

Review of Emission Standards for Older Plants

As a result, under NSW law, it is possible for items of equipment at a premises to be subject to different groups of standards, depending on the date the equipment was installed. It is however notable that the *Clean Air Regulations 2002 (as amended)* makes provision for the review of emission standards for older scheduled plants. This review is based on the following key observations:

- The objective of protecting against adverse impacts by controlling emissions through applying contemporary technology is no less necessary just because the plant is established.

- Given the economic life of pollution control equipment (typically 20 years) and the investment cycle of industry, it is reasonable to expect that older industry has replaced older equipment with more modern control equipment and processes or is due to do so.

The Regulations requires the following objectives to be met:

(i) All plant and activities subject to Group 1 standards are required to meet Group 2 standards by 1 January 2008.
(ii) All plant and activities subject to Group 2 standards are required to meet Group 5 standards by 1 January 2012 (i.e. Group 1 and Group 2 plant and activities would have to meet Group 5 standards by 2012).

Future reviews of the Regulations could result in expiry dates for the emission standards of other groups of scheduled industry, e.g. Groups 3 and 4 may be considered.

Provision for Five-year Extensions to Existing Standards

The NSW DECC does not intend that existing plants be 'unnecessarily or arbitrarily required to upgrade' as a result of the Regulations. For this reason Group 1 and Group 2 premises may seek a five-year extension to their existing standards by:

- Undertaking an air pollution impact assessment (in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW)* – this impact assessment would be required to be completed 1 year before the specified retirement dates and a report submitted to the NSW DECC.

- Demonstrate that its air emissions are not causing any adverse impacts on the surrounding environment.

The requirement is intended to provide flexibility for a case-by-case review of emission standards of older industrial plant, while also sending a clear signal to industry that outdated plant and equipment (including pollution control technology) will need to be progressively upgraded to more current technology. This approach does however serve to ensure that any requirement to upgrade is informed by an understanding of any environmental impact of the affected plant. At the end of the five-year extension a further extension would be possible subject to a repeat of the impact assessment process (DEC, 2004).

4.3.1.2 Types of Emission standards for Scheduled Industries

Generic emission standards - Generic emission standards are set for all discharges to air from scheduled premises which are not subject to the industry-specific emission standards or site-specific emission standards.

Industry-specific emission standards – Priority industries with potentially significant emissions to air have been issued specific emission standards which take precedence over the generic emission standards. Industry-specific standards are specified in the *Clean Air Regulation 2002 (as amended)* for:

- Agricultural fertiliser and ammonium nitrate production
- Cement or lime production or cement or lime handling
- Ceramic works
- Electricity generation
- Glass production
- Paper, paper pulp or pulp products industries
- Petrochemical production
- Petroleum refining
- Primary aluminium production
- Secondary aluminium production
- Primary iron and steel production
- Secondary iron and steel production
- Primary non-ferrous production (excluding aluminium)
- Secondary non-ferrous production (excluding aluminium)

These 'priority industries' were selected on the basis of typical emission levels as informed by National Pollutant Inventory (NPI) information and by consideration of the toxicity of the pollutants emitted. Other industries would be covered by the proposed generic standards which are specified on the same basis. Industry-specific standards are similar to the generic emission standards but provide a more detailed statement of the plant and activities to which they apply.

Site-specific emission standards – Proponents of major new industrial developments are required to perform an environmental impact assessment as part of the consent process. (This process is very similar to South Africa's EIA regulations.) The requirements for impact assessment, in respect of air pollutants, are detailed in the *Approved Methods for Modelling and Assessment of Air Pollutants in NSW*. The *Clean Air Regulations 2002 (as amended)*

makes reference to the Approved Methods in situations where the development of site-specific emission standards may be necessary to ensure that ambient air quality standards are adhered to.

Example of Industry-specific Emission Concentrations for Primary Aluminium Production

Emission Concentrations specified for primary aluminium producers falling within various age groupings are given as follows in Schedule 3 of the *Clean Air Regulations 2002 (as amended)*:

Aluminium: primary production			
Air impurity	**Activity or plant**	**Standard of concentration**	
Solid particles (total)	Any activity or plant (except as listed below)	Group 1	400 mg/m^3
		Group 2, 3 or 4	250 mg/m^3
		Group 5	100 mg/m^3
		Group 6	50 mg/m^3
	Any crushing, grinding, separating or materials handling activity	Group 1	400 mg/m^3
		Group 2, 3 or 4	250 mg/m^3
		Group 5	100 mg/m^3
		Group 6	20 mg/m^3
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	Pre-baked anode production	Group 1, 2, 3 or 4	2,500 mg/m^3
		Group 5	2,000 mg/m^3
		Group 6	300 mg/m^3
Fluorine (F_2) and any compound containing fluorine, as total fluoride (HF) equivalent	Production of aluminium from alumina	Group 1	40 mg/m^3
		Group 2	20 mg/m^3
		Group 3 or 4	1.0 kg/t Al
		Group 5	0.8 kg/t Al
		Group 6	0.6 kg/t Al
Dioxins or furans	Pre-baked anode production	Group 1, 2, 3, 4 or 5	—
		Group 6	0.1 ng/m^3
Volatile organic compounds (VOCs), as n-propane equivalent	Pre-baked anode production	Group 1	—
		Groups 2, 3 and 4	—
		Group 5	—
		Group 6	40 mg/m^3 VOCs or 125 mg/m^3 CO
Smoke	Pre-baked anode production	Group 1, in approved circumstances	Ringelmann 3 or 60% opacity
		Group 1, in other circumstances	Ringelmann 2 or 40% opacity
		Group 2, 3, 4, 5 or 6, in approved circumstances	Ringelmann 3 or 60% opacity
		Group 2, 3, 4, 5 or 6, in other circumstances	Ringelmann 1 or 20% opacity

From the emission standards given it is evident that newer plants are not only assigned more stringent standards but also that they are subject to standards for additional pollutants (and therefore additional monitoring and reporting requirements).

4.3.2 Pollutants Regulated by State Emission standards

A synopsis of the pollutants regulated by NSW emission standards specified for each industry type is given in Table 4.1, in addition to pollutants regulated by general emission standards which are applicable to other industries. It is important to note that older industries may not be subject to emission standards for all pollutants, as was illustrated by the example given previously for the primary aluminium production sector.

The most widely regulated pollutants are particulate matter (including opacity) and oxides of nitrogen. Emission concentrations are very infrequently specified for sulphur dioxide, with this pollutant primarily being controlled through regulating the sulphur content of raw materials, e.g. sulphur content of fuels.

Table 4-1 Pollutants regulated by NSW emission standards as specified in the *Clean Air Regulations 2002 (as amended)* for various industry type and for general standards (applicable for other industry types)

Industry Sectors	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	VOCs	Flourides	TRS	NMOC	TOC	Type1	Type2	HF	H_2S	Methanol
Afterburners and other thermal treatment plant (excluding flares)	x		x		x		x	x	x	x	x					x	x			
Vapour recovery units and other non-thermal treatment plant											x									
Flares					x															
Agricultural fertiliser or ammonium nitrate production	x	x	x		x	x														
Aluminium: primary production	x		x		x				x		x									
Aluminium: secondary production	x		x		x			x	x	x	x	x				x	x			
Cement or lime production or cement or lime handling	x		x		x			x	x	x		x				x	x			
Ceramic works	x		x		x		x	x	x	x	x					x	x	x		
Electricity generation	x		x		x			x	x	x	x					x	x	x		
Glass production	x		x		x			x		x						x	x			
Iron and steel: primary production	x		x		x				x	x	x					x	x		x	
Iron and steel: secondary production	x		x		x			x	x	x	x					x	x			
Non-ferrous metals (excluding aluminium): primary production	x		x		x			x	x	x	x					x	x			
Non-ferrous metals (excluding aluminium): secondary production	x		x		x			x	x	x	x					x	x			
Paper, paper pulp or pulp products industries	x		x		x			x	x	x	x		x			x	x		x	x
Petrochemical production	x		x		x						x								x	
Petroleum refining	x		x		x						x								x	
General standards of concentration	x	x	x		x	x	x	x	x	x	x							x	x	

Abbreviations: VOCs – volatile organic compounds; TOC – total organic compounds; TRS – total reduced sulphur
Type 1 substance means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements.
Type 2 substance means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements.

4.3.3 Basis for the Setting of National Emission standards

Unlike in the EU and US, the concept of best available technologies is not integrated into NSW legislation. Despite this, it took a similar if much more simplified approach to determining the emission standards for inclusion in the *Clean Air Regulation 2002 amendment*.

Prior to the *Clean Air Regulations 2002* being amended a cost benefit analysis was undertaken to assess the consequences and the results published in a Regulatory Impact Statement (RIS) (DEC, 2004)[(6)]. The RIS considers the costs of adhering to the emission standards being proposed, taking into account the availability and cost of technologies to do so. This component of the RIS makes reference to previous costing studies undertaken in Australia and elsewhere. In the costing of particulate abatement, reference is made to estimated health costs arising due to particulate exposures, with the aim of demonstating that health costs justify the controls required.

Emission standards are specified for point sources. In the case of fugitive releases, emission standards would only apply if such releases were diverted directly, or via abatement equipment, to a stack or vent. No specific, detailed requirements are given, generally or on an industry-by-industry basis in the national regulations for the management and control of fugitive sources.

4.3.4 Emission Monitoring

General testing and emission monitoring requirements are stipulated on a pollutant-by-pollutant basis across all industry types. These are given in Appendix G for illustrative purposes. Continuous emissions monitoring is generally specified for criteria pollutants with other regulated pollutants tending to be monitored intermittently on a campaign basis.

[6] The *Subordinate Legislation Act 1989* requires that a Regulatory Impact Statement be prepared when an existing regulation is remade. The RIS must assess the economic, social and environmental costs and benefits of proposed regulations and their alternatives, and must identify which alternative will achieve the desired objectives with the greatest net benefit or the least net cost to the community. The RIS process also enables interested stakeholders, including industries and member of the wider community, with the opportunity of providing direct input into regulatory development.

5 EXPERIENCE OF OTHER COUNTRIES

A brief overview is given of some key components in the use of emission standards for the regulation of industry within other countries is given in the subsections below. This review is not intended to be comprehensive in terms of being representative of all nations or in terms of providing a complete overview of the selected nation's air pollution regulations. Instead reference is made to interesting or unique aspects of air pollution regulation of industrial emissions by various countries, particularly where such aspects may be pertinent to South Africa's circumstances.

5.1 JAPAN

Japan has a relatively decentralised approach to industrial pollution regulation. The national government generally adopts legislation - on an industry sector or media specific basis – that comprises standards for operation (e.g. emission limit values). Local government (i.e. Prefectures) are required to treat this legislation as a minimum standard, being free to adopt stricter standards if they consider these to be necessary.

The Prefectures, and a number of metropolitan authorities, are responsible for implementation and enforcement. In practice, all 47 Prefectures have adopted stricter standards, most typically due to environmental quality standards not being met. Although the national legislation of Japan does not reflect the integrated approach of IPPC, many Prefectures have adopted various integrated approaches to industrial regulation (e.g. Tokyo's use of emission ceilings for air and water pollution to regulate total pollution load) (Entec, 2006).

Japan has adopted a mixture of instruments to deliver pollution control, including significant use of both direct regulation and voluntary agreements but also includes the use of economic mechanisms. Pollutants such as NOx, SOx, PM, dioxins, HF, HCl, Pb and Cd are regulated primarily via direct regulation, through the establishment of emission limit values in national law. However, many other hazardous substances are controlled via voluntary agreements. VOCs are controlled via a mixture of the two approaches, with voluntary agreements being focused on for small sources. The policy mix supporting the control of VOCs came into force in 2006 and aimed to balance stability and a minimum approach through legal regulation with flexibility and innovation supported by the voluntary approach. The VOC policy aims to achieve reductions of 30% by 2010, with the Ministry of Environment indicating it will review the approach if this target is not reached.

In the regulation of industry using emission standards such limits are specified for each industrial facility through a notification system. There is no air permitting process for industries such as refineries per se. Industries are "notified" of their emission standards and are required through regulation to comply (Marbek Resource Consultants, 2003).

For areas characterised by high densities of industries, where air quality standards are exceeded, total mass emission controls are implemented – set directly through regulation. Total mass emission reduction plans are prepared by the prefectural governor for such areas with facilities notified of their individual emission reduction requirements (Marbek Resource Consultants, 2003).

Japan uses voluntary agreements to a greater extent than most other countries. This is in part due to the presence of strong business associations which can negotiate such agreements. By the late 1990s more than 30 000 activities had adopted such agreements with respect to pollutant emissions. Agreements could include emission limit values, use of particular technologies and processes, reporting requirements, etc. It is however notable

that public participation only occurs in 12% of cases, with many agreements not being made available for public inspection (Entec, 2006).

5.2 CHINA

A substantial body of legislation on air emissions and air quality is in place in China. In its review of EU air pollution policies and legislation with other countries AEAT Environment (2004) noted that Chinese air pollution policy is, in many respects, proceeding at a similar pace as many western countries with continued updates and consideration of different approaches to air quality improvements.

In China, use is made of technical standards, air quality standards (vary depending on location – residential, commercial, industrial or agricultural) and fiscal measures (e.g. pollution levy on SO_2 and particulates). Emission standards are applied to individual devices or factories and also to entire provinces through emission ceilings which are typically specified through a Five Year Plan. Emission standards are in place for boilers, power plants, kilns, cement plants, road vehicles and cement plants. There is also a set of general emission standards that applies to all industries no covered under other standards. General standards are provided for new and existing sources. Emission standards are published for a range of 33 compounds and elements.

Chinese emission standards vary according to source characteristics such as age of the facility, fuel used and at times also stack height. In the case of sulphur dioxide emissions from power generation, for example, differential removal requirements are applied to new power plants depending on whether high or low sulphur coal is burned. Emission standards are also tighter for low stacks, providing the incentive for the building of tall stacks thereby reducing local emissions but contributing to acid rain and other long-range pollutant transport problems.

In comparing Chinese standards for new coal-fired plants against the EU's LCPD, AEAT Environment (2004) notes that the 1998 EU standards are broadly similar to those under the Chinese regulations for SO_2 and NO_x but the limits in the revised LCPD are significantly stricter than the Chinese equivalents. Controls on dust emissions in Europe are also observed to be much stricter that for China under both the 1988 and revised LCPD. One criticism of China's regulation of industry is that emission standards are not strongly enforced.

5.3 POLAND

Many factors which impact on Poland's air quality and affect the ability of this country to address its emissions are of relevance to South Africa. Such factors include:

- Low profitability of certain enterprises, which make it difficult to allocate indispensable resources for urgent technical and technological modernisation.
- Relatively low purchasing power of the population.
- Coal-based structure of the primary fuel balance.
- Dynamic growth of road transport.
- Need to balance economic development with environmental protection (sustainable development).

Furthermore, Poland is rapidly putting in place the programmes and capacity necessary to meet the EU environmental protection requirements and to provide the framework for achieving its planned greenhouse gas emission reductions[7].

Poland's Second National Environmental Policy (December 2000, adopted by Parliament on 23 August 2001) provides for the protection of the environment, while pursuing the principle of sustainable development. With regard to air quality, this policy aims to prevent air emissions and other hazards at source, i.e. transforming the production and consumption model towards reduction of environmental pressure, in particular by means of applying best available technique (BAT). In addressing air pollution emphasis is placed on the following measures which have relevance for industry regulation:

- The implementation of preventative actions for a wide range of pollutants, including heavy metals, persistent organic pollutants, substances impacting on health and environment (e.g. sulphur dioxide, nitrogen oxides, ammonia, volatile organic compounds, ozone), greenhouse gases and ozone depleting substances.

- Pollution control at the source through changes of energy carriers, with special emphasis on renewable energy use, use of clean raw materials and technologies and energy and raw material use minimisation.

- Further development of standardisation of emissions in industry, energy sector, and transport.

- Further development and implementation of product standards, limiting air pollutant emission as a result of full product cycle.

In its application of emission standards, Poland has targeted criteria and various toxic and persistent air pollutants. Stringent emission standards are being introduced to reduce particulate emissions by 75% on average; SO_2 emissions by 56%, nitric oxides emissions by 31%, VOC emissions (excluding methane) by 4% per cent and ammonia emissions by 8%, against the 1990 levels. Measures are applied to reduce toxic substances from heavy metal category (mercury, lead, cadmium) and persistent organic pollutants (pesticides, benzo(a)pyrene, and dioxins). Such measures have included the introduction of emission standards for 12 areas of industrial activity, in accordance with Aarhus Protocols to the Convention on Long-Range Transboundary Air Pollution concerning Heavy Metals and Persistent Organic Pollutants, and the elimination of production and use or limitation of use of products containing those toxic substances.

The Polish Environmental Protection Act of 27 April 2001 introduced integrated permits for the operation of installations which may cause susbstantial pollution, with the condition of obtaining the permit being meeting the requirements of BAT. BATs have since been widely introduced in the air protection sector based on tested case studies from highly developed countries. The Act stipulates that any emissions from an IPPC licensable activity must not result in the contravention of any relevant air quality standard specified under specific Polish Air Quality legislation and also comply with relevant emission limit values provided for by way of regulations. Any emissions from the activity, or any premises, plant, processes, operating procedures or other factors which effect such emissions must comply with (or not result in the contravention of) any relevant EU standards. The IPPC system in Poland is non-

[7] Poland became a member of the EU in 2004. This means that the European directive on IPPC applies to Poland. The EU environmental requirements are considered among the most difficult of the pre-accession requirement to implement, and it was thus expected that they would be phased in over an extended period of time. However the Polish government has committed to try to meet the requirements without transition periods (Mott, 2003). The exceptions it has specified are for rules regarding large power plants, urban waste-water treatment and volatile organic compounds. As a result of this agreement with the EU, the IPPC directive applied from the day that Poland entered the EU.

prescriptive but rather site-specific, i.e. plants are licensed individually and not in the context of an industry group sector.

Poland recognised the challenge faced in implementing EU requirements whilst not impacting on economic development, with a special note being made of the low profitability of its business sector. Althugh Poland set very ambitious targets for the reductions of atmospheric emissions as described above, it aimed in the short-term to target the "hot spots" (i.e. degrated areas), focusing on the industrial enterprises responsible for or contributing to the degradation (i.e. the "list of 80" and industries on regional lists). Emphasis was also placed on realising sulphur dioxide emission reductions from the power supply industry which is coal-based (Figure 5.1).

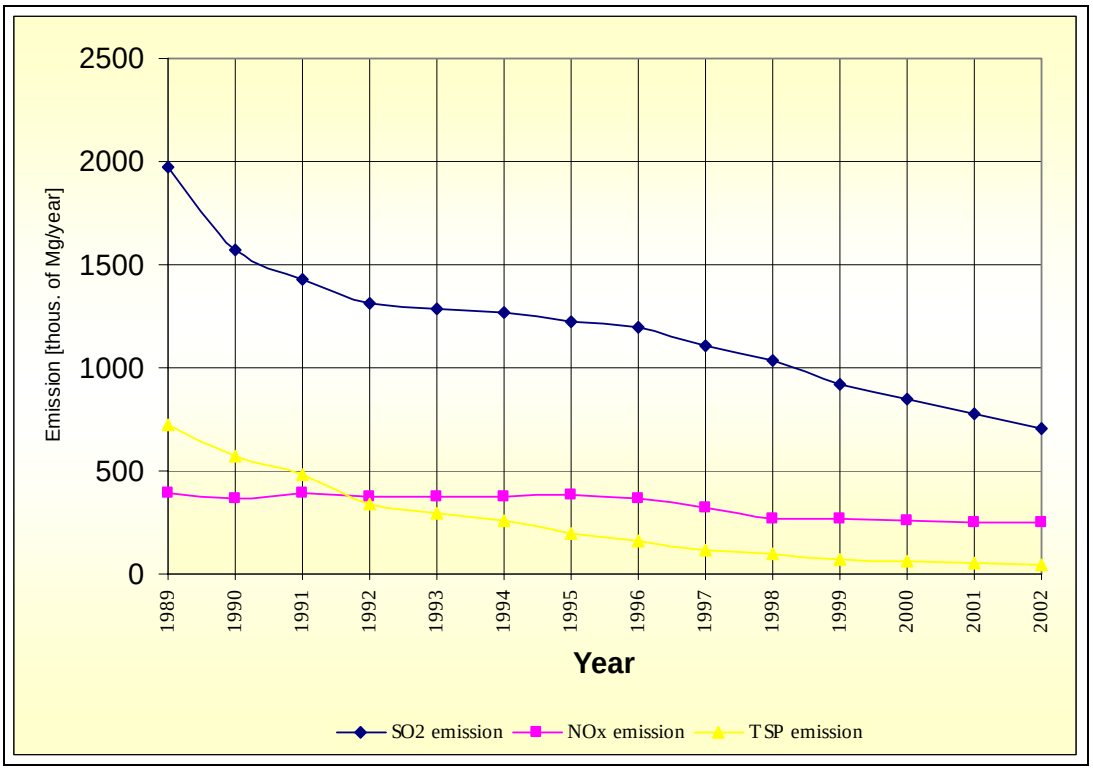

Figure 5-1. Reduction in sulphur dioxide, oxides of nitrogen and total suspended particulate (TSP) emissions from Large Combustion Plants in Poland during the period 1989 to 2002 (Jagusiewicz, 2004).

5.4 INDIA

Various of the factors contributing to air pollution in India are similar to those in South Africa, including: urban population growth (including unplanned settlements), increased industrial activity, many small scale industries, high vehicle growth and burning of fossil fuels within the power sector and by industry and households. India also faces significant social and economic constraints in adopting air pollution control measures. In terms of industrial air pollution problems, India has identified 24 critically polluted areas. Industries of concern include pesticide producers, dye manufacturers, refineries, power stations and pharmaceutical industries.

The Air (Prevention and Control of Pollution) Act of 1981, amended in 1987, still represents the primary regulatory instrument. This act provides for the prevention, control and abatement of air pollution, giving central and state boards the authority to issue consents to

industries operating within designated air pollution control areas. Central government and states prescribe emission standards for stationary and mobile sources. The Central Pollution Control Board (CPCB) is the national board with oversight powers over state boards. State Pollution Control Boards (SPCBs) implement and enforce national standards, making them more stringent if warranted by local conditions, and grant consents to establish and operate processes under the Air Act (OECD, 2006).

Major initiatives undertaken for air pollution control in India within the industrial sector during the last two decades have included (Sengupta, 2004):

- Emission standards have been developed since the 1980s for 17 categories of highly polluting industries[8], viz.: Aluminium Industries, Asbestos Products, Carbon Black Industries, Calcium Carbide Plant, Cement Industries, Copper, Lead and Zinc Smelting, Coal Mines, Coal Washeries, Glass Industries, Integrated Iron & Steel, Nitric Acid Plants, Oil Refineries, Oil Drilling and Gas Extraction Industry, Sulphuric Acid Plants, Thermal Power Plant – Coal Based, Thermal Power Plant – Gas Based, and Stand alone Coke Oven Plants.
- Emission standards have also been established and implemented for other small/medium scale industries for which there are numerous operations (e.g. stone crushers, brick kilns)
- Action Plan implementation and targeted pollution control in 24 problem areas
- Pollution control in Taj Trapezuim Zones (e.g. natural gas to foundries, monitoring of air quality)
- Development of national ambient air quality standards based on health impact (developed 1982 and revised in 1994).

Despite major emission reductions (in excess of 90%) being reportedly achieved from thermal power plants, oil refineries, aluminium smelters and cement industries (Sengupta, 2004), the Minimum National Standards established by the CPCB have come under fire as being unrealistically stringent and economically unfeasible (World Bank, 2006). Many industry stakeholders are reported to have expressed concerns that national emission standards for several industries are higher than what is possible to achieve considering the type of production process and technology, as well as the economies of scale.

The current national emission standards in India are determined primarily of the basis of industry studies undertaken by technical institutions at the initiative of the CPCB. These studies comprised the assessment of available abatement technologies and provided tentative estimates of cost for different levels of abatement. These studies did not however generally consider the impacts of these costs on a variety of sources, including smaller and/or older units, and the implications for the economy as a whole (World Bank, 2006).

The recommendations that India integrate sector-specific economic analyses into its consideration of BAT, and that it differentiate between facilities on the basis of age and size, are considered particularly important as it moves towards expanding its emission standards to other industrial sources, e.g. development standards for hazardous pollutants emitted by a chemical industry (World Bank, 2006).

A further criticism of India's regulatory regime arises from it not having sufficiently addressed small and medium enterprise (SME) emissions. Although progress has been made in the implementation of air pollution controls for large industries, pollution prevention and control

[8] A total of 1551 large and medium units were identified in the country under the 17 highly polluting industrial sectors. The distribution of the industries indicated that certain states have substantially larger numbers of industries (States of Maharashtra, Uttar Pradesh, Gujarat, Andhra Pradesh and Tamil Nadu). The sugar sector has the maximum number of operations (i.e. 392), followed by pharmaceuticals, distillery, cement and fertiliser. About 77% and 15% of the industries are predominantly water polluting and air polluting respectively and 8% of the industries are potentially both air and water polluting.

systems are reported to be inadequate for SMEs. Such enterprises, which include brickworks, foundries and stone crushers, are responsible for 40% of the industrial production, use limited pollution control technologies and are reported to be responsible for 70% of the total industrial pollution load nationally (Figure 5.2). SMEs have received less attention by air pollution regulatory authorities due to: (i) difficulties in the monitoring of these units, (ii) the relatively high costs of pollution abatement for small units compared with large units, and (iii) potential adverse impact of enforcing standards on the output and employment of these industries. (These industries are the second largest employer in the country, after agriculture) (OECD, 2006).

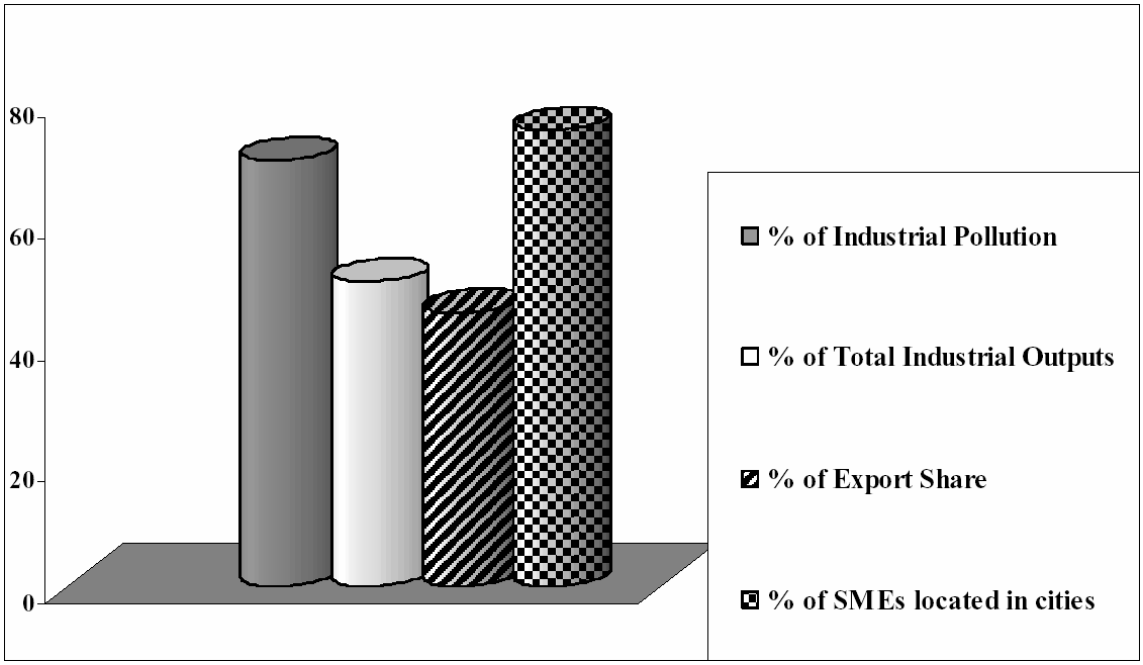

Figure 5-2 Importance of small and medium scale enterprises in India (World Bank, 2006)

It is held that the successful targeting of SMEs will necessitate looking at different regulatory programmes, processes and approaches due to differences in the nature of pollution, impact and response required for these sources differs significantly from large industrial point sources. For example, monitoring the large number of SMEs using the same compliance monitoring mechanisms for permitted industries would be time and cost prohibitive for the SPCBs. Extensive compliance assistance (technical assistance programmes, awareness campaigns) would also need to be implemented if mass non-compliance was to be avoided.

The area based environmental management approach represents an alternative approach to the setting of emission standards and monitoring of compliance aimed at addressing the multitude and diversity of sources. An example of such an approach which has been tried in India for the regulation of SMEs is action plan development for critically polluted areas. This approach has improved stakeholder engagement, the establishment of adequate performance indicators, and ensured the greater integration of area-wise sources in the programme (World Bank, 2006).

Emerging new areas for air pollution control in India include the following:

- Development of air quality standards/guidelines for hazardous air pollutants

- Development of a NOx control standard for thermal power plants and refineries (focus on sulphur dioxide to date)
- Prevention and control of **fugitive emissions** in the cement industry through the development of good practice guidelines
- Focus on detoxification and destruction of high COD waste from the pesticide industry by putting in place guidelines for incineration
- Development of the technologies and standards required to control emissions of **volatile organic compounds, methyl chloride, hydrogen chloride and other pollutants from the pesticide industry**
- Development of **odour control technology** for the paper and pulp industry and standardization of odour measurement methods
- Development of stack height guidelines for thermal power plants and industries using the ventilation coefficients of different regions
- Major drive towards **control of air pollution from the large number of small scale air polluting industries**
- Establishment of **emission standards for toxic air pollutants** for pesticides, pharmaceutical and dye industries
- Continued listing of critically polluted areas to be reviewed and new areas to be included (for focused air pollution control efforts)

5.5 SYNOPSIS OF LESSONS LEARNED

Some of the most critical lessons to be learned from the experiences of other countries for industry regulation within the South African context are as follows:

- ***Targeting of air pollution controls (on a sectoral and spatial basis)***

  Faced with realising significant reductions in industrial emissions, India targeted large industrial sources within the most degraded areas thus focusing its regulatory efforts and its compliance monitoring and enforcement resources. Therefore despite limited resources significant advances could be made with substantial emission reductions having been secured for certain major sources (e.g. power stations, cement industries). It also provided the India environmental authorities with the confidence needed to move towards the regulation of smaller but more numerous smaller emitters, and to start targeting the more elusive problem of diffuse emissions.

- ***Sector-specific economic analysis of best practice technologies, taking facility age and size into account***

  The case study of India demonstrates that best practice international experience must be adjusted to the structure of the nation's economy. The assessment of available technologies enhanced by sector-wide economic analysis is presented as a useful instrument for establishing the techno-economic viability of the prescribed standards. In order to result in viable emission standards the standard setting procedures should consider differentiation between new and old facilities and between larger and smaller units.

- ***Flexibility within emission reduction measures***

  Poland faced the challenge of regulating industrial emissions whilst taking into account pressing economic consideration. It was noted that enterprises characterized by low profitability find it difficult to allocate indispensable resources for urgent technological modernization and control measure implementation aimed at reducing atmospheric

emissions. Despite being ambitious in bringing its industries in line with EU emission standards, Poland supported a flexible and varied approach to realising emission reductions ranging from cleaner fuels, process and product changes.

- ***Incremental changes to avoid mass non-compliance***

  Factors reported by OECD (2004) as resulting in unjustifiably high air pollution abatement costs included: emission and technical standards which are too high, the transition time necessary to come into conformity is too short, or the regulation is inflexible.

- ***Differentiation of emission standards based on stack height may be detrimental in terms of contributing to acid deposition and long-range transport issues (China).***

- ***Weak enforcement undercuts emission reductions possible through the setting of strict emission standards (China).***

- ***Command-and-control practice, such as emission standard setting and implementation systems, can be integrated with other approaches including voluntary agreements[9] and market mechanisms (Japan).***

- ***Setting of national emission standards and sophisticated compliance monitoring and reporting systems may not be suitable for SMEs***

  Experience in India and other countries (Mexico, Philippines) has shown that the use of emission standards and permitting regimes suited to large industry are not likely to be successful in the regulation of air pollution from SMEs. Alternative, more decentralised ("area-based") approaches and initiatives have been shown to be more appropriate.

[9] Within the South African context, caution would need to be exercised to ensure that the manner in which such agreements are concluded is in line with the principals of transparency, public consultation and access to information.

6 COMPARISON OF INTERNATIONAL APPROACHES AND RECOMMENDATIONS FOR IMPLEMENTATION WITHIN SOUTH AFRICA

In drawing on the experience of the case study countries to inform the South African process, it is useful to compare directly some aspects of the approaches in terms of targeting sources and setting emission standards, noting the most appropriate approach given local considerations.

Important local considerations include:

- NEM: AQA requirements, specifically:
  - AQA requires that *minimum emission standards* in respect of a substances or mixture must be established *for all "listed activities*". Minimum emission standards must (i) be *reasonable*, (b) be informed by Section 24(b) of Constitution and (c) be guided by national environmental management principles as set out in Section 2 of the NEMA (e.g. reflect BPEO)).
  - The emission standards must include the *permissible amount, volume, emission rate or concentration* of that substance or mixture of substances that may be emitted and the manner in which measurements must be carried out.

- Key local strategies, specifically: 'keep it simple', transparent and technically robust, the participatory governance and regulatory authority capacity development requirements, and the need for project coordination and cooperation (e.g. links with the APPA Registration Certificate Review Project)

6.1 GENERAL OBSERVATIONS IN RESPECT OF EMISSION STANDARDS

- Emission standards are classifiable as a direct command and control instrument. The use of emission standards for prioritised industry sectors is widespread with almost all countries having adopted such a command and control approach as a primary means of controlling pollution.

- Emission standards require a central authority capable of establishing rules for the conduct of polluting sources, monitoring performance with respect to those rules and enforcement of compliance.

- Emission standards represents a method which tends to become more and more complicated over time e.g. US where layers of regulation have been added to deal with new problems and new information. Changes to the regulatory regime take much time and effort.

- Emission standards represent just one instrument of a complex and increasingly broadening mixture of regulatory tools. Other instruments include fuel specifications, air quality limits and economic instruments, (etc.).

- Emission standard setting may result in "technology forcing". Although emission standards may not explicitly dictate technologies to be implemented, in practice they may create strong incentives for firms to choose only officially sanctioned technologies and can therefore be regarded as "technology forcing" (Blackman and Harrington, 1998).

- Economic considerations are of considerable significance in the emission standard setting process. Key considerations in the US's historical approach have, for example, included avoiding the shutting down of plants, give breaks to small facilities, treat existing

facilities more leniently than new ones, (etc.). A number of recent studies have also considered the impact of environmental regulations on competitive of industries.

6.2 PHASED APPROACH TO EMISSION STANDARD SETTING

Various countries including the US, UK and India took a phased approach to national emission standards setting, gradually introducing emission standards for selected sectors. In the case of the US, new source performance standards (NSPS) have been progressively implemented since the 1990 Clean Air Act amendment (and is ongoing). The UK has progressively introduced sectoral guidances containing emission limit values over the period 2001 to 2007 (frequently in line with the completion of the EC IPPC BREFs). India identified a block of 17 industrial sectors on which to focus attention on as a priority[10]. The NSW state of Australia similarly identified 14 industrial sectors for the establishment of emission standards in its 2005 amendment of its Clean Air Regulations.

Although the NEM:AQA comprises many of the same underpinning principals of environmental governance as is characteristic of the case study countries, the manner in which Section 21 is written limits how closely South Africa can follow the examples of such countries. Most notable is the requirement that the Minister must list activities and *simultaneously* publish minimum emission standards and monitoring protocols in respect of substances resulting from such listed activities.

Consider a case whereby the Minister publishes a comprehensive "list of activities" and then follows the same rigorous and phased approach to emission standards setting as adopted by the US and UK. Considerable time (5 to 10 years) would be required to compile the necessary technical documentation and undertake sufficient stakeholder engagement to support the establishment of emission standards, monitoring protocols and compliance timeframes. This approach would clearly not meet the requirements of Section 21 of the AQA. Alternatively, should the Minister delay the publication of the list of activities pending the completion of the emission standard setting process, regulation of industry under the AQA would be unacceptably delayed.

Mindful of the requirements of the AQA, the experience of other countries, and of preliminary work undertaken during the APPA Registration Certification Review Project, a stepped approach to emission standard setting is recommended for adoption comprising the *setting of emission standards for prioritised industry sectors and pollutants prior to the subsequent expansion of standards to other industries and substances*. In outlining this approach attention is paid to the procedure followed by the UK in its transition from IPC to PPC (Section 3.2.3.2). This procedure is in line with South Africa's principles of transparency and stakeholder engagement and furthermore reflects to a large extent the approach (albeit more informally conceived and implemented) adopted by the DEAT in its APPA Registration Certificate Review Project[11]. The following steps are recommended for implementation:

- Identification of *key industries and associated pollutants* for which emission standards are to be set at the outset.

- Establish *sector teams* supported by a sector coordinator to carry out the consultation/communication with industry, trade bodies and other affected parties.

[10] An interesting difference in approach is that whereas the US, UK and NSW identified industry sectors on a national basis (state-wide basis in terms of NSW), India targeted industries within 24 areas characterised by significantly poor air quality.

[11] South Africa adopted a "step change" rather than a phased approach in the transition from industrial regulation using registration certificates under the APPA to atmospheric emissions licenses under AQA. This step change comprised the conversion of existing registration certificates held by the several of the largest, most complex and potentially most polluting industrial sectors through the APPA Registration Certificate Review Project (initiated in Jan 2006 and scheduled to be completed by Dec 2007).

- Sector teams to conduct *sector scoping studies* – gathering information about its structure, geographical and size distribution and preferred methods of communication[12].

- Sector teams to collated *sector guidance documents* comprising information on best available technology including associated emission standards and monitoring requirements (using international BAT documentation and industry-specific information.

- Put in place mechanisms to support:

    - the addition of industry types to the list of activities by DEAT;

    - emission standard setting for such industry types by DEAT in consultation with stakeholders (via sector teams);

    - gathering of current BAT information for use in the establishment of emission standards for additional industry types and the review of previously established emission standards[13].

- Intermittent additions to the list of activities and publication of relevant national minimum emission standards for these activities.

- Periodic review of national minimum emission standards.

Benefits of the effective adoption and implementation of this approach include more focused regulatory efforts resulting in accelerated air quality improvements, development of an experienced regulator and knowledgeable and cooperative regulated industrial sectors.

6.3 INDUSTRY SECTORS AND SOURCE TYPES TARGETTED

Emissions reductions tend to be targeted where they are least cost. This is primarily why larger industrial plants are targeted rather than smaller costs (e.g. enforcement and admin costs for regulation of 40 and 15 MW combustion plants are similar but costs relative to emission reduction potential are likely to be higher for smaller plant. Compliance cost for larger plants will probably not be significantly greater than for a smaller plant – but the difference in emissions could be significant.) (AEAT, Nov 2004).

Furthermore, if the definition of an industry type to be regulated is too broad or the threshold for coverage (e.g. power generation plants >50MW), too low) too many installations may be included within the regulatory regime. This will have implications for identification of relevant plants, and costs of administration and enforcement.

The US, UK, NSW, India, Poland and China represent just some of the many countries who have focussed their efforts and resources by identifying and targeting key industrial sectors as a priority in the setting of emission standards. The rational provided as the basis for selecting such sectors varies but is essentially similar, e.g.

[12] Provision for stakeholder engagement was evident in the best practice case studies considered. In all three case studies, information were obtained from the regulated industry for inclusion in the technical background studies, industry and others (government agencies, wider community) were given opportunities to review and provide comment on drafts. Such stakeholder engagement and consultation was more extensive and intensive in the US and UK due to their focus on one sector at a time, their public hearing processes and phased approaches.

[13] Best available techniques will change with time, particularly in the light of technical advances, the regulatory authorities must either monitor themselves or establish mechanisms to remain informed of such progress.

- ‘Major source’ defined on basis of exceedance of a specified pollutant mass threshold (US);
- Historically problematic polluter (UK);
- Industry sector targeted by EU directives (UK, Poland);
- Significant emitter based on emissions data from national emissions inventory (NSW); and
- Source responsible for significant air quality degradation and health risks (India).

A comparison of the **main sectors** targeted to date by various countries, in relation to the proposed sectors proposed for designation as ‘listed activities’ in South Africa is given in Table 6.1. Many similarities are apparent in terms of the industry sectors having been prioritised in terms of the setting of emission standards. In terms of identifying key sectors, it is also of interest to consider the most important industries in terms of environmental protection expenditure internationally, viz. chemicals, rubber and plastics, metal products, food, beverages and tobacco and pulp and paper (AEAT Environment, 2004).

Table 6-1 Synopsis of industries for which emission standards have been specified in the UK, US, NSW and India, classified according to the proposed ‘listed activities’ categories

RSA - PROPOSED LISTED ACTIVITIES	UK PPC REGULATION SECTORS	US NSPS SECTORS	NSW CLEAN AIR REGULATION SECTORS	INDIA'S INITIAL 17 TARGET INDUSTRIES
1. Combustion installations	Combustion Activities (coal, gas, biomass, liquid fuels)	Coal-Fired Electric Steam Generating Units Electric Utility Steam Generating Units Fossil-Fuel-Fired Steam Generators Industrial-Commercial-Institutional Steam Generating Units Onshore Natural Gas Processing: SO_2Emissions Small Industrial-Commercial-Institutional Steam Generating Units Stationary Combustion Turbines Stationary Compression Ignition Internal Combustion Engines Stationary Gas Turbines	Electricity Generation	Thermal Power Plant – Coal Based Thermal Power Plant – Gas Based
2.Petroleum industry	Gasification, Liquefaction and Refining Activities SED (Solvent Emission Directive) Activities	Bulk Gasoline Terminals Equipment Leaks of VOC in Petroleum Refineries Petroleum Refineries Storage Vessels for Petroleum Liquids Storage Vessels for Petroleum Liquids VOC Emissions From Petroleum Refinery Wastewater Systems Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels)	Petrochemical Production Petroleum Refining	Oil Refineries
3. Carbonisation and coal gasification	Carbon Activities Tar and Bitumen Activities			Carbon Black Industries Stand alone Coke Oven Plants

RSA - PROPOSED LISTED ACTIVITIES	UK PPC REGULATION SECTORS	US NSPS SECTORS	NSW CLEAN AIR REGULATION SECTORS	INDIA'S INITIAL 17 TARGET INDUSTRIES
4. Metallurgical industry	Ferrous Metals Non-Ferrous Metals Surface Treating Metals and Plastic Materials	Ferroalloy Production Facilities Lead-Acid Battery Manufacturing Plants Primary Aluminium Reduction Plants Primary Copper Smelters Primary Emissions from Basic Oxygen Process Furnaces Primary Lead Smelters Primary Zinc Smelters Secondary Brass and Bronze Production Plants Secondary Emissions from Basic Oxygen Process Steelmaking Facilities Secondary Lead Smelters Steel Plants: Electric Arc Furnaces and Argon-Oxygen Decarburization Vessels Steel Plants: Electric Arc Furnaces	Primary Aluminium Production Secondary Aluminium Production Primary Iron and Steel Production Secondary Iron and Steel Production Primary Non-Ferrous Production (excluding Aluminium) Secondary Non-ferrous Production (excluding Aluminium)	Aluminium Industries Copper Smelting Lead Smelting Zinc Smelting Integrated Iron and Steel
5. Mineral processing industry	Cement and Lime Production Asbestos Activities Glass and Glass Fibre Manufacturing Production of Other Mineral Fibres Other Mineral Activities Ceramic Production	Metallic Mineral Processing Plants Non-metallic Mineral Processing Plants Calciners and Dryers in Mineral Industries Coal Preparation Plants Glass Manufacturing Plants Lime Manufacturing Plants Phosphate Rock Plants Portland Cement Plants	Cement or Lime Production and/or Handling Ceramic Works Glass Production	Asbestos Products Cement Industries Coal Mines Coal Washeries Glass Industries Oil Drilling and Gas Extraction Industry
6. Organic chemical industry	Organic Chemicals Storage of Chemicals in Bulk	Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry Synthetic Fiber Production Facilities Volatile Organic Compound (VOC) Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations Volatile Organic Compound (VOC) Emissions from the Polymer Manufacturing Industry Volatile Organic Compound (VOC) Emissions From the Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Unit Processes Volatile Organic Compound Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Reactor Processes Rubber Tire Manufacturing Industry		
7. Inorganic chemical industry	Inorganic Chemicals Storage of Chemicals in Bulk Manufacturing Activities Involving Carbon Disulphide or Ammonia	Ammonium Sulfate Manufacture Nitric Acid Plants Phosphate Fertilizer Industry: Diammonium Phosphate Plants Phosphate Fertilizer Industry: Granular Triple Superphosphate Storage Facilities Phosphate Fertilizer Industry: Superphosphoric Acid Plants Phosphate Fertilizer Industry: Triple Superphosphate Plants Phosphate Fertilizer Industry: Wet-Process Phosphoric Acid Plants Sulfuric Acid Plants Sulfuric Acid Production Units	Agricultural Fertilizer & Ammonium Nitrate Production	Sulphuric Acid Plants Calcium Carbide Plant Nitric Acid Plants
8. Explosives Industry	Explosives Production			
9. Pharmaceuticals production	Pharmaceutical Production			
10. Incineration processes including hazardous waste	Disposal of Waste by Incineration	Commercial and Industrial Solid Waste Incineration Units Hospital/Medical/Infectious Waste Incinerators Incinerators Large Municipal Waste Combustors Other Solid Waste Incineration Units Small Municipal Waste Combustion Units		

RSA - PROPOSED LISTED ACTIVITIES	UK PPC REGULATION SECTORS	US NSPS SECTORS	NSW CLEAN AIR REGULATION SECTORS	INDIA'S INITIAL 17 TARGET INDUSTRIES
11. The disposal of hazardous and general waste	Disposal of Waste by Landfill Disposal of Waste other than by Incineration or Landfill	Municipal Solid Waste Landfills		
12. Wood products industry	Paper, Pulp and Board Manufacturing Activities Timber Activities	Kraft Pulp Mills	Paper, Paper Pulp or Pulp Products Industries	
13. Production and formulation of pesticides	Plant Health Products and Biocides			
14. Animal matter processing	Treatment of Animal and Vegetable Matter and Food Industries			
OTHER	Coating Activities, Printing and Textile Treatments Manufacture of Dyestuffs, Printing Ink and Coating Materials Activities Involving Rubber Intensive Farming Production of Fuel from Waste Recovery of Waste Food Industries	Hot Mix Asphalt Facilities Asphalt Processing and Asphalt Roofing Manufacture Automobile and Light Duty Truck Surface Coating Operations Beverage Can Surface Coating Industry Flexible Vinyl and Urethane Coating and Printing Grain Elevators Graphic Arts Industry: Publication Rotogravure Printing Industrial Surface Coating Industrial Surface Coating Magnetic Tape Coating Facilities Metal Coil Surface Coating New Residential Wood Heaters Petroleum Dry Cleaners Polymeric Coating of Supporting Substrates Facilities Pressure Sensitive Tape and Label Surface Coating Operations Surface Coating of Metal Furniture Sewage Treatment Plants Equipment Leaks of VOC From Onshore Natural Gas Processing Plants. Standard of Performance for Wool Fiberglass Insulation Manufacturing Plants		

In terms of the types of sources within these industry sectors which are typically regulated using emission standards, it is notable that emission standards are set primarily for **point sources** such as stacks and vents. In instances where fugitive releases are regulated using emission standards, it is required that the activity be undertaken in an enclosure with extraction, with the emission limit being set for the extraction vent. In other instances, control or management measures may be specified for diffuse emissions to reduce the potential for emissions. This is most frequently done in the case of controlling VOC emissions from chemical handling and storage. More general requirements are given for the control of fugitive dust releases, e.g. requirement that operators prepare and implement a dust management and maintenance plan for the site. More detailed information is expected to be included in the individual permits of facilities.

Based on the experience of other countries, and mindful of South Africa's available resources and the nature of its industrial sector, the following recommendations are made:

(d) The following industry types could be considered for possibly inclusion in the initial list of activities requiring prioritised national emission standard setting, with industries not significantly represented within South Africa removed or noted for subsequent listing and emission standard setting (thresholds specified by various countries are given in brackets, where available, and key activities highlighted):

RSA – Proposed Listed Activity Categories	Synopsis of Internationally Prioritised Industry Sectors (based on UK PPC, US NSPS, NSW, India)
1. Combustion installations	• **Coal, gas, biomass and liquid fuel combustion installations** (>50 MW – UK; >30MW – NSW; >73MW - US) • Waste or recovered oil combustion (>3 MW - UK)
2.Petroleum industry	• **Petrochemical production and petroleum refining** (including bulk storage and handling of petroleum liquids and petroleum refinery wastewater systems) (UK – no thresholds; NSW – 2000tpa petrochemicals)
3. Carbonisation and coal gasification	• **Coal gasification** • Gas refining (>1000tpa gas - UK) • Natural gas reforming • Mineral oil refining • Activities involving pyrolysis, carbonisation, distillation, liquefaction, partial oxidation or other heat treatment of coal, lignite, oil, other carbonaceous materials or mixtures • Tar and bitumen production (>5tpd tar, bitumen or aggregate - UK)
4. Metallurgical industry	• **Aluminium** and aluminium alloys • **Iron and steel** production • **Copper** smelters (melting capacity >20 tpd - UK) • **Lead** smelters (melting capacity >4 tpd - UK) • **Zinc** smelters (melting capacity >20 tpd - UK) • **Precious metals** production • **Refractory meta**l production • **Nickel** processes • **Cadmium** processes (melting capacity >4 tpd - UK) • **Ferroalloy** production (silicon, chromium, manganese) • Ferrous metals (hot rolling) (>20 tph crude steel - UK) • **Bulk handling** or storage of **iron ore** (except during mining)(>500 000t - UK) • Lead-acid battery manufacturing (>6.5 tpd lead – US) • Secondary Brass and Bronze Production Plants (Reverberatory and electric furnaces of >1,000 kg production capacity and blast (cupola) furnaces of >250 kg/h production capacity – US)
5. Mineral processing industry	• **Cement and lime** production and/or bulk handling (kilns >50tpd; 5000tpa calcium carbonate, calcium magnesium carbonate or aggregate of both - UK) • **Asbestos** activities • **Glass** and glass fibre manufacturing (>100tpa production – UK; >5tpd - US) • **Ceramic** production (tiles, bricks, refractory bricks, stoneware, porcelain production by firing) (kiln >75 tpd - UK)(NSW threshold is 150tpd or 30000tpa) • **Coal processing**/preparation plants (500tpd coal – NSW; >200tpd - US) • **Metallic mineral processing** plants (crushing, screening, handling) • **Non-metallic mineral processing** plants (crushing, screening, handling) • Phosphate rock plants (>4tph plant capacity – US) • Other mineral activities (melting capacity >20 tpd - UK)
6. Organic chemical industry	• Organic chemical production including: o hydrocarbons, o organic compounds containing oxygen, sulphur, nitrogen or phosphorus, organometallic compounds (e.g. lead alkyls) o plastic materials (polymers, synthetic fibres, cellulose-based fibres) o synthetic rubbers o dyes and pigments o surface-active agents • Polymerising or co-polymerising any unsaturated hydrocarbon or vinyl chloride (>50tpd in aggregate - UK) • Use of toluene fi-isocyanate or other di-isocyanate of comparable volatility or where partly polymerised • Flame bonding of polyurethane foams or polyurethane elastomers • Recovery or purifying of acrylic acid or any ester of acrylic acid • Tyre manufacture (>50 000 tpa - UK) • **Storage of chemicals in bulk**

RSA – Proposed Listed Activity Categories	Synopsis of Internationally Prioritised Industry Sectors (based on UK PPC, US NSPS, NSW, India)
7. Inorganic chemical industry	• Production of inorganic chemicals such as: o Gases (e.g. NH_3, HCl, HF, H_2S, SO_x, NO_x) o Acids (e.g. chromic acid, hydrofluoric acid, nitric acid, sulphuric acid, oleum) o Bases (e.g. ammonium hydroxide, solium hydroxide) o Salts (e.g. ammonium chloride, sodium carbonate) o Non-metals, metal oxides, metal carbonyls o Halogens or interhalogen compounds o Manufacturing Activities Involving • Manufacturing activity involving the use of hydrogen cyanide or hydrogen sulphide • Manufacturing activity involving the use or recovery of: antimony, arsenic, beryllium, gallium, indium, lead, palladium, platinum, selenium, tellurium, thallium • Recovery of any compound of cadmium or mercury • Chemical fertilizer production (20000tpa - NSW) • Bulk storage of chemicals Key activities in this sector are **nitric acid plants**, **sulphuric acid plants**, agricultural **fertilizer** production and ammonium sulphate & ammonium nitrate production
8. Explosives Industry	• **Explosives** production
9. Pharmaceuticals production	• **Pharmaceutical** production using a chemical or biological process
10. Incineration processes including hazardous waste	• **Commercial and industrial waste incineration** • **Hospital/Medical/Infectious waste incineration** • **Municipal waste incineration**
11. The disposal of hazardous and general waste	• **Hazardous** wast disposal facilities • **General** waste disposal facilities (>10tpd or >25000t total capacity - UK) • Disposal of Waste other than by incineration or landfill (>10tpd for hazardous waste and waste oils; >50tpd for non-hazardous waste – UK)
12. Wood products industry	• **Paper, pulp and board** manufacturing activities (>20tpd – UK; >30 000tpa - NSW) • **Timber** processing plants
13. Production and formulation of pesticides	• **Pesticides,** fungicides, herbicides, rodenticides, fumigants, miticides and related product production (NSW – 2000tpa products)
14. Animal matter processing	• **Tanning** plants (>12tpd finished products - UK) • Animal **slaughter** (>50tpd - UK) • **Rendering** plants - animal carcasses or waste disposing or recycling (>10tpd – UK; >5000tpa - NSW)

(e) Consideration should be given as to whether to **extend the proposed categories of listed activities** to include the following industry sectors:

Possible additional categories of listed activities	• Industrial and surface coating activities • Textile manufacture • Printing works (large scale) • Intensive farming – rearing poultry (40 000 places - UK), pigs (2000 places – UK & NSW), cattle (1000 head –NSW), sheep (4000 head – NSW), horses (400 – NSW) • Recovery of waste including fuel production from waste • Food Industries – treating and processing animal raw materials (other than milk)(>75tpd - UK) or vegetable raw materials (>300tpd - UK) or milk (>200 tpd - UK) • Hot Mix Asphalt Facilities • Sewage Treatment Plants

These categories need not be added to the initial list of activities, but can be added during subsequent phases. The above activities are regulated under national/state emission standards in more developed countries. Various of these activities are however recommended for regulation as 'controlled emitters' under the RSA NEM:AQA (Hietkamp and Nkhwashu, 2005). Paying attention to the experience of countries such as the US and UK, but also heeding India's experience with its

regulation of SMEs discussed in Section 5, further consideration should be given to whether the proposed listed activities need to be expanded. It is recommended that this consideration be given and the most suitable way of regulating emissions from such industries selected once more experience has been gained with the regulation, compliance monitoring and enforcement of the initial group of 'listed activities' and the first one or two 'controlled emitters'.

(f) Express emission standards primarily **for point sources** (stacks and vents) where emission monitoring is possible. Where the control of diffuse emissions is considered significant enough to warrant inclusion in national standards (e.g. fugitive dust at bulk ore/coal handling and processing plants and certain metallurgical industries; evaporative emissions from bulk chemical storage and handling), specific best practice control measures which are applicable across individual industries can stipulated (e.g. floating roof tanks) or alternatively it can be required that a comprehensive fugitive emission management plan be put in place. In the latter case, the operator of the facility would be expected to demonstrate to the relevant regulatory authority that all necessary measures had been taken to minimise fugitive releases, and undertake monitoring to demonstrate continued control of its fugitives. More detailed controls or requirements should be retained for inclusion in the individual emissions license of the activity.

Reasons for limiting the initial list of activities to specific industry types which are know to be potentially significant in terms of their atmospheric emissions include:

- Selection of *known significant emitters* based on available information, given that a comprehensive national emission inventory is not available for source selection as is used elsewhere (e.g. US, NSW);
- *Reduce the workload* of the regulatory authority during the learning phase;
- Allow more *experienced industries* (in terms of previous regulation, BAT, etc.) to go through the initial phase first;
- Bring more potentially *polluting industries* under the new regulatory regime earlier than less polluting industrial sectors;
- *In the absence of a comprehensive cost-benefit analysis, target industries where the benefits of regulation are expected (based on international experience) to outweigh the costs*; and
- Reduced risk of the initial list of activities being contested.

6.4 PRIORITISATION OF POLLUTANTS

Substances have been prioritised for national standard setting on various grounds, the most common of which include:

- Pollutants contributing to widespread health risk, either directly (e.g. PM, SO_2) and/or due to their being precursors of significant pollutants (NO_x, VOCs)
- Pollutants resulting in acidification (SO_x, NO_x)
- Persistent pollutants (mercury, dioxins/furans)

(etc.)

The most widely regulated substances are criteria pollutants (SO_2, NO_x, PM, CO, also opacity as surrogate for PM), total VOCs, total organic compounds (TOC), specific metals (lead, mercury, arsenic, cadmium, antimony, chromium, beryllium, manganese, nickel, selenium, vanadium), hydrogen chloride, hydrogen fluoride, total reduced sulphur (TRS), sulphur trioxide and sulphuric acid mist, polychlorinated dibenzodioxins and polychlorinated dibenzofurans (total or TEQ), asbestos and cyanides.

The tendency within the EC and the US is to concentrate on key pollutants of concern, rather than trying to target all possible emissions. The exact number of pollutants to target however ranges significantly, e.g. from the restriction of limits within NSPS to a handful of pollutants by the US (Section 2) to the significant number regulated by Poland (Section 5).

National emission standards are not routinely issued for greenhouse gas emissions. This is likely to be due to the increased use of market mechanisms such as emissions trading to cost-optimise emission reductions.

It is recommended that a small number (preferably 1 to 4) of pollutants be selected for the setting of emission standards for each industry type selected (with the exception of incineration for which an extended number of substances should be regulated in line with current local and international experience). Reference can be made to information on the US, UK and NSW approaches (documented in Sections 2 to 4 and various appendices) in the selection of the most pollutants suitable substances to target. Where appropriate, use could be made of surrogate parameters to reduce compliance monitoring costs.

6.5 BAT AS A BASIS FOR EMISSION STANDARDS

It is commonplace in best practice legislative environments to require that emission standards take into account best available technologies and ambient air quality limits. In practice, minimum nationally-set emission standards tend to be based on best available technology, with the requirement that more stringent emission standards be set at lower tiers of government taking into account air quality limits. In addition to this, the use of environmental impact assessments for informing emission standards for new and modified facilities is widely accepted. This provides a safety net in cases where minimum emission standards best on BAT are not sufficient to protect local environments.

Given that provision is made in the SA NEM:AQA for the setting of more stringent emission standards by provincial and local authorities, it is *recommended that the national minimum emission standards be based on best available technology*.

Best available technology, despite being defined in slightly different terms (or not defined at all in regulation as in the case of NSW), is implemented in similar ways in the case studies considered. It is *recommended that South Africa adopt the concise EU definition of BAT*, viz.:

> *'Best available techniques` shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:*
>
> - ***'techniques`** shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned,*
> - ***'available`** techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the [country] in question, as long as they are reasonably accessible to the operator,*
> - ***'best`** shall mean most effective in achieving a high general level of protection of the environment as a whole.*

In the application of BAT for the purpose of informing emissions standards and monitoring protocols for the prioritized industry types, reference should be made to the best practice documentation published by the IPPC, UK and US (see Appendices A, B and E). In assessing the economic viability of technologies within local industries, the simpler approach adopted by NSW could be considered whereby use is made of previous studies undertake and information provided by industries within the sector to be regulated.

6.6 FORMAT OF EXPRESSING EMISSION STANDARDS

Emission standards should not prescribe the use of one specific technique of technology (technology forcing). This has been demonstrated to be the least cost-effective aspects of historical command-and-control systems and has to suppress technological innovation. Emission standards can be expressed in one or more of the following formats:

- Emission concentrations (e.g. mg of a pollutant per m^3) including and excluding volumetric flow rates permissible (e.g. m^3/hr);
- Total mass (e.g. tonnes per annum, kg per day)
- Emission rates (e.g. g/s)
- As a performance standard (kg pollutant per ton of raw material; kg pollutant per ton final product)

An example of the nature of emission standards issued by the US, UK and Australian NSW for the Glass Manufacturing Industry is given in Table 6-2 to demonstrate the differences in the manner in which such limits are expressed internationally.

The AQA stipulates that emission standards "must include the *permissible amount, volume, emission rate or concentration* of that substance or mixture of substances that may be emitted and the manner in which measurements must be carried out". This requirement in the Act largely developed as a result of the manner in which emission standards have historically been specified within APPA Registration Certificates (i.e. typically as emission concentrations without limits on volumetric flows or on total masses of emissions). Despite good intentions, the specification of a total mass as a "permissible amount" or a "volume" in a general national minimum emission standard intended to regulate a number of individual industries is problematic.

It is recommended that minimum emission standards be expressed either as an emission concentration or a performance standard or, where appropriate, a combination of both with the actual concentration or level of performance taken from BAT. Total masses of emissions permissible should be included in the Atmospheric Emissions Licenses of Listed Activities.

6.7 SPECIFICATION OF GENERAL EMISSION STANDARDS

Certain countries (e.g. Australia-NSW, China) specify general emission standards for application to industries for which sector-specific emission standards are not applicable. Taking into account the recommendation that a select list of industry types be prioritised for the setting of specific emission standards, South Africa could consider the use of general emission standards for application to industries which are not initially listed.

Table 6-2 Comparison of the nature of emission standards issued by the US, UK and Australian NSW for the Glass Manufacturing Industry

Country	Threshold for Inclusion	Pollutants Regulated	Processes for which Emission standards are given	Emission standards Format	Monitoring Requirement
US NSPS	Any facility constructed or modified after June 15, 1979. Does not apply to hand glass melting furnaces, glass melting furnaces designed to produce less than 4.55 Mg (5 tons) of glass per day and all-electric melters.	PM, opacity	Emission standards specified according to fuel used (gas, liquid) and glass manufacturing plant segments: container glass; pressed and blown glass (including borosilicate recipes, soda-lime and lead recipes, other), wool fibreglass, flat glass	Emission intensity (g of particulate/kg of glass produced)	Performance tests based on ASTM methods for PM and direct measurement or mass balance for glass quantity estimates
NSW Clean Air Regulation 2002	Glass manufactured through a firing process	PM, NOx, Type 1, Type 2, Cd, Hg, smoke	Emission standards given for melting furnace (PM emission standards also given for material crushing, grinding and handling) Emission standards specified for various ages of plant	Emission concentrations	Typically continuous for criteria pollutants and campaign for others
UK Sector Guidance	Manufacturing glass fibre or manufacturing glass frit or enamel frit (100 tpa or more) (A1 installation) Manufacturing glass where melting capacity of plant 20 tpd or more (A2 installation).	PM, SOx, NOx, HCl, HF, As, Co, Ni, Se, Ammonia, VOC, total metals,	Emission standards given for furnace operations and for downstream processes for flat glass, container glass and domestic glass sections	Emission concentrations	Typically continuous for criteria pollutants and annual for others, e.g. metals

Notes:
Type 1 substance means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements.
Type 2 substance means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements.

6.8 EMISSION MONITORING REQUIREMENTS

The emission monitoring required clearly depends on the nature of the source, the pollutant and the emission standard.

Emission standards expressed as emission concentrations require direct stack monitoring. The sector-specific monitoring method and frequency should be taken from the best practice documentation (e.g. EU's Monitoring BREF). In most cases, continuous emissions monitoring is prescribed for the larger sources of criteria pollutants as is typically best practice, with periodic (e.g. annual) testing campaigns stipulated for metals, persistent organic compounds (etc.). Emission standards expressed as a performance standard (e.g. kg of pollutant per ton product) requires a combination of direct monitoring and product tonnage tracking methods.

6.9 VARIATION OF EMISSION STANDARDS WITHIN INDUSTRY SECTORS

The setting (retention) of less stringent emission standards for older facilities has a place in the regulatory process of most of the countries considered. (It was found to be more pronounced in the case of the US and NSW, compared to the UK). It is however notable that these emission standards are not static, but that there are timeframes within which facilities are expected to meet firmer standards. Generally, the approach adopted is to link required improvements to major plant modifications and to take advantage of industry cycles. This is most readily expressed in the NSW regulations where older plants are given five year timeframes to institute upgrades which will bring them in line with more stringent emission standards.

Whereas the US tends to include the dates of facilities within individual industry specific standards, NSW sets out clear industry facility age categories which are applicable across all industry sectors regulated. The NSW approach is simple to understand, lends itself to being more readily used to stipulate cross-sector continuous improvement requirements, and can be more easily revised. This approach, documented in detail in Section 4, is recommended for possible implementation within South Africa.

6.10 COMPLIANCE SCHEDULES

Compliance schedules may be specified in various ways. They may be generically specified for an entire industry sector or class of facilities (class defined by industry type and age of facility). Alternatively they can be negotiated and imposed at individual facilities by provisions within permits such as the Atmospheric Emission License to be issued to Listed Activities within South Africa.

Based on international experience, an effective approach would be to set minimum timeframes for compliance nationally (taking account of industry cycles), with provision being made for more restricted compliance schedules to be specified by lower government tiers for industries within their jurisdictions and/or stricter timetables being negotiated for inclusion in permits. Typical compliance timeframes, based on the US, EC and NSW case studies would be:

- 2 to 3 year in the case of new or substantially modified facilities
- 5 to 10 years in the case of existing facilities, potentially differentiated by age

6.11 COST-BENEFIT ANALYSIS

The case study of India clearly demonstrated that best practice international experience must be adjusted to the structure of a nation's economy. The assessment of available technologies enhanced by sector-wide economic analysis is presented by the World Bank (2006) as a useful instrument for establishing the techno-economic viability of the prescribed standards.

Cost-benefit analyses of the implications of introducing new or revised emission standards have routinely been undertaken by countries such as the UK, US and NSW[14]. Comprehensive approaches have included the costing of externalities and assessments of the extent to which cost savings (e.g. health spending reductions) due to emission reduction could offset the costs of implementing BAT to achieve the required limits.

Given the short timeframe within which the Minister is expected to publish a 'list of activities' so as to meeting the APPA to AQA transitional phase objectives, it is unlikely that detailed sector-specific CBA will be completed in time to inform the initial listing of activities. It is therefore recommended that the initial list of activities comprise a restricted number of industry types which are know to be potentially significant in terms of their atmospheric emissions. The targeting of industries where the benefits of regulation are expected to outweigh the costs, based on experience from developed and developing countries, would substantially reduce the risks of economic impacts arising due to the emission standards set. Additional measures to reduce risk during this initial phase include: (i) restricting pollutants for which emission standards are specified to the key ones for that industry type thus reducing compliance monitoring and reporting costs; (ii) taking industry cycles into account in the setting of national minimum compliance timeframes, and (iii) making provision for industries to apply for extensions based on EIAs being undertaken (as discussed in the subsequent section).

In targeting industry sectors for which information on emissions and impacts is less available or conclusive, particularly those comprising small and/or older operations, it is imperative that detailed CBAs be undertaken in selecting BATs and setting emission standards. Provision for such studies should be made so as to extend the list of activities and associated set of national minimum emission standards in a manner which does not lead to economic impacts or mass non-compliance.

6.12 PROVISION FOR EXTENSIONS TO COMPLIANCE TIMEFRAMES

Given potential economic implications of emission standards, and mindful that emission standard setting in South Africa is not likely to be based on comprehensive sector-based cost-benefit analysis (at least not for the initial group of 'listed activities'), it is recommended that provision be made for specific industries to apply for possible extensions to compliance timeframes.

In framing this provision reference is made to a similar condition set by the NSW DECC in its *Clean Air Regulation 2002 (2005 amendment)* (section 4.3.1.1). The DECC makes it clear that it does not intend that existing plants be 'unnecessarily or arbitrarily required to upgrade' as a result of its Regulations.

Within the South African context, it is recommended that a provision be included when listing activities, for the proponent of a listed activity to apply for a postponement of the compliance

[14] The Regulatory Impact Statement undertaken recently (2005) by the NSW DEC in support of its proposed emission standards provides a good example of how prior studies and information from the industry sectors to be regulated could be used in the costing of outcomes (DEC, 2005).

date and for such a postponement to be granted based on the following conditions being met:

- An air pollution impact assessment being completed (in accordance of the format for Atmospheric Impact Reports, as contemplated in Section 30 of the NEM:AQA and specified by the National Air Quality Officer) and submitted to DEAT at least 1 year before the compliance date; and

- Demonstration that the industry's air emissions are not causing any adverse impacts on the surrounding environment.

This provision would ensure that any requirement to upgrade is informed by an understanding of any environmental impact of the affected plant. At the end of the extension period granted a further extension could be made possible subject to a repeat of the impact assessment process.

6.13 EMISSION STANDARD IMPLEMENTATION

It the implementation of emission standards, best practice necessitates comprehensive compliance monitoring and enforcement functions and the regular review of such standards in line with BAT developments.

6.14 BROADER TRENDS IN THE REGULATORY CONTEXT

It is imperative that emission standards not be viewed in isolation from the diverse (and changing) regulatory contexts within which they are applied. The use of national emission standards for industry is widespread and a rich *history* exists in terms of how such standards should be set and implemented. Using historical information on one regulatory instrument to inform emission standard setting in South Africa, whilst being efficient is not the most suitable way of positioning the country to consider cutting-edge developments in regulatory practice. Key differences in regulatory frameworks of specific relevance to emission standards for industrial operations are highlighted in this section, and insight provided of significant changes anticipated.

Fundamental differences are apparent in the EU and US regulatory approaches as is evident from the case studies presented. The EU supports the integration of regulation across media and currently does not provide for criteria pollutant emissions trading despite recognising the important role such market mechanisms play in individual member states [(15)]. A key feature in the US approach has been the widespread use of market based instruments, specifically emission trading schemes to minimise the cost to industry of reducing emissions, with the existing SO_2 trading scheme (established in 1995) a NO_x trading scheme (established in 1999) being recently extended to cover mercury (2005). Future policy in the US appears to have a strong focus towards the continued use of market based instruments, with the extension of the current emission trading schemes to other pollutants and industry sectors.

In its review of the impact of the environmental legislation within the EU and other countries on the competitiveness of European industry, AEAT Environment (2004) noted that the US's increased use of market-based instruments would result in a lower cost approach for US industry. The implication being that in future, diverging policies with regard to industry regulation could impact negatively on the competitiveness of industries in countries were

[15] The EU Emission Trading Scheme currently makes provision for emission trading of greenhouse gases across over 10 000 individual industries situated within member states in support of it meeting its Kyoto Protocol greenhouse gas emission reduction requirements.

cost-optimise emission reductions were not being secured by the implementation of mixed packages of regulatory tools and market mechanisms.

The EU is currently reviewing its air quality policy framework within the context of the Clean Air for Europe (CAFÉ) programme. Within this context an extensive review of the IPPC Directive has being undertaken and potentially far reaching changes considered. Specific focus areas of the review which are of interest given the objectives of this study include the streamlining of EU regulations with greater integration between EU directives, and the reconsideration of the EU's overall approach to controlling environmental impacts of industry. Issues under consideration in terms of industry regulation are varied and include, for example (Corden and Ritchie, December 2006):

- Technical amendments in the light of experience, e.g. removal of unnecessary monitoring and reporting.
- Consideration of intensive cattle rearing and 20 to 50 MW combustion installations as requiring further special attention.
- Mechanisms to be implemented to encourage industry to go beyond regulatory compliance (e.g. incentives for innovation and enhanced deployment of technologies, use of EMSs, voluntary schemes, use of economic instruments such as emissions trading and taxes)[16].
- Enable emissions trading for certain pollutants (integration of BAT-based permitting with potential NO_x, SO_2 emission trading schemes),

Recommendations of the IPPC Directive review, concluded in 2007, with regard to the long-term vision on industrial emissions control are unlikely to come into effect until 2012 at the earliest. The deadline of 2007 for implementation of the IPPC Directive will therefore remain unaffected. The recommendations will however significantly affect the evolution of EU policy with regard to the regulation of industrial emissions. It is expected that the use of market mechanisms, including emissions trading for criteria pollutants, will become an integral part of the future European regulatory regime.

The NEM:AQA makes provision for the use of market mechanisms including emissions trading. In view of major trends in international policy, it is recommended that the potential for extending and enhancing the regulation of criteria pollutants emitted from listed activities through the marrying of emission standard setting and emission trading approaches be investigated.

[16] Emission regulation in various best practice legislative regimes is based on the dynamic concept of BAT, where BAT can change over time due to new technological developments and their introduction into the market. In practice, once a permit has been issued, depending on the approach taken by the regulatory authority, some operators may take a minimal and static approach to ensuring that the conditions of the permit are complied to within a strict sense. In encouraging firms to go beyond such regulatory requirements and to enhance the dynamic nature of the BAT concept – thereby also supporting innovative environmental technologies – additional incentives or instruments could be used. A recent report published by the European Commission (April 2007) serves to identify and assess tools and instruments that have encouraged firms regulated under the EU IPPC Directive to change their behaviour, to be innovative, and to perform beyond regulatory compliance. Case studies considered included Sweden's environmental charge on NOx emissions, performance tracking in the US, Denmark's Green Network initiative, the use of a solvent tax in Switzerland and France, and the use of energy efficiency measures in Solvenia and the Netherlands.

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8 APPENDIX A – STATIONARY SOURCES FOR WHICH NEW SOURCES PERFORMANCE STANDARDS (NSPS) ARE ISSUED BY THE US-EPA UNDER THE CLEAN AIR ACT, AND AIR POLLUTANTS FOR WHICH EMISSION STANDARDS ARE SPECIFIED – CLASSIFIED ACCORDING TO THE PROPOSED ACTIVITIES TO BE LISTED UNDER THE SOUTH AFRICAN AQA

Proposed Activities to be Listed in terms of Section 21 of the RSA NEM:AQA	Stationary Source for which NSPS are Issued by the US-EPA	Relevant Subpart	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	Pb	VOCs	Flourides	TRS	NMOC	TOC
1 - Combustion Installations	Coal-Fired Electric Steam Generating Units	Subpart HHHH								(a)								
	Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978	Subpart Da	x	x	x		x			x								
	Fossil-Fuel-Fired Steam Generators for Which Construction is Commenced After August 17, 1971	Subpart D	x	x	x		x											
	Industrial-Commercial-Institutional Steam Generating Units	Subpart Db	x	x	x		x											
	Onshore Natural Gas Processing: SO2Emissions	Subpart LLL		x														
	Small Industrial-Commercial-Institutional Steam Generating Units	Subpart Dc	x	x														
	Stationary Combustion Turbines	Subpart KKKK		x	x													
	Stationary Compression Ignition Internal Combustion Engines	Subpart IIII	x		x													
	Stationary Gas Turbines	Subpart GG		x	x													
2 - Petroleum Industry	Bulk Gasoline Terminals	Subpart XX												(b)				
	Equipment Leaks of VOC in Petroleum Refineries	Subpart GGG												(b)				
	Petroleum Refineries	Subpart J	x	x		x												
	Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After June 11, 1973, and Prior to May 19, 1978	Subpart K												(b)				

Proposed Activities to be Listed in terms of Section 21 of the RSA NEM:AQA	Stationary Source for which NSPS are Issued by the US-EPA	Relevant Subpart	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	Pb	VOCs	Flourides	TRS	NMOC	TOC
	Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984	Subpart Ka												(b)				
	VOC Emissions From Petroleum Refinery Wastewater Systems	Subpart QQQ												(b)				
	Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984	Subpart Kb												(b)				
4 - Metallurgical Industry	Ferroalloy Production Facilities	Subpart Z	x			x	x											
	Lead-Acid Battery Manufacturing Plants	Subpart KK											x					
	Metallic Mineral Processing Plants	Subpart LL	x				x											
	Nonmetallic Mineral Processing Plants	Subpart OOO	x				x											
	Primary Aluminum Reduction Plants	Subpart S					x								x			
	Primary Copper Smelters	Subpart P	x	x			x											
	Primary Emissions from Basic Oxygen Process Furnaces for Which Construction is Commenced After June 11, 1973	Subpart N	x				x											
	Primary Lead Smelters	Subpart R	x	x			x											
	Primary Zinc Smelters	Subpart Q	x	x			x											
	Secondary Brass and Bronze Production Plants	Subpart M	x				x											
	Secondary Emissions from Basic Oxygen Process Steelmaking Facilities for Which Construction is Commenced After January 20, 1983	Subpart Na	x				x											
	Secondary Lead Smelters	Subpart L	x				x											
	Steel Plants: Electric Arc Furnaces and Argon-Oxygen Decarburization Vessels Constructed After August 17, 1983	Subpart AAa	x				x											
	Steel Plants: Electric Arc Furnaces Constructed After October 21, 1974, and On or Before August 17,	Subpart AA	x				x											

Proposed Activities to be Listed in terms of Section 21 of the RSA NEM:AQA	Stationary Source for which NSPS are Issued by the US-EPA	Relevant Subpart	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	Pb	VOCs	Flourides	TRS	NMOC	TOC
	1983																	
5 - Mineral Processing Industry	Calciners and Dryers in Mineral Industries	Subpart UUU	x				x											
	Coal Preparation Plants	Subpart Y	x				x											
	Glass Manufacturing Plants	Subpart CC	x				x											
	Lime Manufacturing Plants	Subpart HH	x				x											
	Phosphate Rock Plants	Subpart NN	x				x											
	Portland Cement Plants	Subpart F	x				x											
6 - Organic Chemical Industry	Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry	Subpart VV												(b)				
	Synthetic Fiber Production Facilities	Subpart HHH												x				
	Volatile Organic Compound (VOC) Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations	Subpart NNN																x
	Volatile Organic Compound (VOC) Emissions from the Polymer Manufacturing Industry	Subpart DDD																x
	Volatile Organic Compound (VOC) Emissions From the Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Unit Processes	Subpart III																x
	Volatile Organic Compound Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Reactor Processes	Subpart RRR																x
7 - Inorganic Chemical Industry	Ammonium Sulfate Manufacture	Subpart PP	x				x											
	Nitric Acid Plants	Subpart G			x													
	Phosphate Fertilizer Industry: Diammonium Phosphate Plants	Subpart V													x			
	Phosphate Fertilizer Industry: Granular Triple Superphosphate Storage Facilities	Subpart X													x			
	Phosphate Fertilizer Industry: Superphosphoric Acid Plants	Subpart U													x			
	Phosphate Fertilizer Industry: Triple Superphosphate Plants	Subpart W													x			

Proposed Activities to be Listed in terms of Section 21 of the RSA NEM:AQA	Stationary Source for which NSPS are Issued by the US-EPA	Relevant Subpart	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	Pb	VOCs	Flourides	TRS	NMOC	TOC
	Phosphate Fertilizer Industry: Wet-Process Phosphoric Acid Plants	Subpart T													x			
	Sulfuric Acid Plants	Subpart H		x				x										
	Sulfuric Acid Production Units	Subpart Cd						x										
10 - Incineration Processes Including Hazardous Waste	Commercial and Industrial Solid Waste Incineration Units for Which Construction Is Commenced After November 30, 1999 or for Which Modification or Reconstruction Is Commenced on or After June 1, 2001	Subpart CCCC	x	x	x	x	x		x	x	x	x	x					
	Commercial and Industrial Solid Waste Incineration Units that Commenced Construction On or Before November 30, 1999	Subpart DDDD	x	x	x	x	x		x	x	x	x	x					
	Hospital/Medical/Infectious Waste Incinerators	Subpart Ce	x	x	x	x			x	x	x	x	x					
	Hospital/Medical/Infectious Waste Incinerators for Which Construction is Commenced After June 20, 1996	Subpart Ec	x	x	x	x	x		x	x	x	x	x					
	Incinerators	Subpart E	x															
	Large Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996	Subpart Eb	x	x	x		x	x	x	x	x	x	x					
	Large Municipal Waste Combustors That are Constructed on or Before September 20, 1994	Subpart Cb	x	x	x		x		x	x	x	x	x					
	Municipal Waste Combustors for Which Construction is Commenced After December 20, 1989 and on or Before September 20, 1994	Subpart Ea	x	x	x		x		x		x							
	Other Solid Waste Incineration Units for Which Construction is Commenced After December 9, 2004, or for Which Modification or Reconstruction is Commenced on or After June 16, 2006	Subpart EEEE	x	x	x	x	x		x	x	x	x	x					
	Other Solid Waste Incineration Units That Commenced Construction On or Before December 9, 2004	Subpart FFFF	x	x	x	x	x		x	x	x	x	x					

Proposed Activities to be Listed in terms of Section 21 of the RSA NEM:AQA	Stationary Source for which NSPS are Issued by the US-EPA	Relevant Subpart	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	Pb	VOCs	Flourides	TRS	NMOC	TOC
	Small Municipal Waste Combustion Units Constructed on or Before August 30, 1999	Subpart BBBB	x	x			x		x	x	x	x	x					
	Small Municipal Waste Combustion Units for Which Construction is Commenced After August 30, 1999 or for Which Modification or Reconstruction is Commenced After June 6, 2001	Subpart AAAA	x	x	x		x		x	x	x	x	x					
11 - Disposal of Hazardous and General Waste	Municipal Solid Waste Landfills	Subpart Cc															(b)	
	Municipal Solid Waste Landfills	Subpart WWW	x				x										x	
12 - Wood Products Industry	Kraft Pulp Mills	Subpart BB	x				x									x		
Considered for inclusion as controlled emitters	Hot Mix Asphalt Facilities	Subpart I	x															
	Asphalt Processing and Asphalt Roofing Manufacture	Subpart UU	x				x											
	Automobile and Light Duty Truck Surface Coating Operations	Subpart MM												x				
	Beverage Can Surface Coating Industry	Subpart WW												x				
	Flexible Vinyl and Urethane Coating and Printing	Subpart FFF												x				
	Grain Elevators	Subpart DD	x				x											
	Graphic Arts Industry: Publication Rotogravure Printing	Subpart QQ												x				
	Industrial Surface Coating: Large Appliances	Subpart SS												x				
	Industrial Surface Coating: Surface Coating of Plastic Parts for Business Machines	Subpart TTT												x				
	Magnetic Tape Coating Facilities	Subpart SSS												(b)				
	Metal Coil Surface Coating	Subpart TT												x				
	New Residential Wood Heaters	Subpart AAA	x															
	Petroleum Dry Cleaners	Subpart JJJ												(b)				
	Polymeric Coating of Supporting Substrates Facilities	Subpart VVV												(b)				
	Pressure Sensitive Tape and Label Surface Coating Operations	Subpart RR												x				
	Surface Coating of Metal Furniture	Subpart EE												x				

Proposed Activities to be Listed in terms of Section 21 of the RSA NEM:AQA	Stationary Source for which NSPS are Issued by the US-EPA	Relevant Subpart	PM	SO_2	NO_x	CO	Opacity	sulfuric acid mist	HCl	Hg	Dioxins/ Furans	Cd	Pb	VOCs	Flourides	TRS	NMOC	TOC
	Sewage Treatment Plants	Subpart O	x				x											
Classification uncertain	Equipment Leaks of VOC From Onshore Natural Gas Processing Plants.	Subpart KKK												(b)				
	Rubber Tire Manufacturing Industry	Subpart BBB												x				
	Standard of Performance for Wool Fiberglass Insulation Manufacturing Plants	Subpart PPP	x															

Abbreviations: TOC – total organic compounds; NMOC – non-methane organic compounds; TRS – total reduced sulphur

Notes:

(a) annual state caps set for mercury

(b) emission standards not specified but controls specified for the control of these pollutants

9 APPENDIX B – SOURCE CATEGORIES FOR WHICH MAXIMUM AVAILABLE CONTROL TECHNOLOGIES (MACT) ARE SPECIFIED BY THE US-EPA UNDER THE NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) REQUIREMENTS OF THE CLEAN AIR ACT

NESHAP (MACT) STANDARD Source Categories Affected	CFR Sub Parts	Final Federal Register Date & Citation	Compliance Date
Aerospace	GG	09/01/1995 (60FR45948)	09/01/1998
Asbestos	40 CFR 61 Subpart M	40 CFR 61.140	
Asphalt Processing and Asphalt Roofing Manufacturing	LLLLL	04/29/03 (68 FR 22975)	05/01/2006
Auto & Light Duty Truck* (surface coating)	IIII	04/26/04 (69FR22601)	04/26/07
Benzene Waste Operations	40 CFR 61 Subpart FF	12/04/2003 (68FR67931)	12/04/2006
Boat Manufacturing	VVVV	8/22/01 (66FR44217)	8/22/04
Brick and Structural Clay Products Manufacturing Clay Ceramics Manufacturing	JJJJJ KKKKK	05/16/03 (68FR26689)	 5/16/06
Cellulose Products Manufacturing Miscellaneous Viscose Processes Cellulose Food Casing Rayon Cellulosic Sponge Cellophane Cellulose Ethers Production Caroxymethyl Cellulose Methyl Cellulose Cellulose Ethers	UUUU	06/11/2002 (67FR40043)	06/11/2005
Chromium Electroplating Chromic Acid Anodizing Decorative Chromium Electroplating Hard Chromium Electroplating	N	01/25/95 (60FR4948)	01/25/96 deco 01/25/97 others
Clean Air Mercury Rule	40 CFR 60 Subparts Da and HHHH	05/18/05 (70 FR 28606)	
Coke Ovens: Pushing, Quenching,& Battery Stacks*	CCCCC	4/14/03 (68FR18007)	4/14/06
Coke Ovens Charging, Top Side, and Door Leaks	L	10/27/93 (58FR57898)	Contact Project Lead
Combustion Sources at Kraft, Soda, and Sulfite Pulp & Paper Mills (Pulp and Paper MACT II)	MM	01/12/2001 (66FR3180)	01/12/2004
Commercial Sterilizers Commercial Sterilization Facilities	O	12/06/1994 (59FR62585)	12/06/1998
Degreasing Organic Cleaners Halogenated Solvent Cleaners	T	12/02/1994 (59FR61801)	12/02/1997
Dry Cleaning Commercial drycleaning dry-to-dry Commercial drycleaning transfer machines Industrial drycleaning dry-to-dry Industrial drycleaning transfer machines	40 CFR 63 Subpart M	09/22/93 (58FR49354)	09/23/96
Engine Test Cells/Stands (Combined with Rocket Testing Facilities)	PPPPP	05/27/03 (68FR28774)	see FR
Fabric Printing, Coating & Dyeing	OOOO	05/29/03	05/29/06

NESHAP (MACT) STANDARD Source Categories Affected	CFR Sub Parts	Final Federal Register Date & Citation	Compliance Date
		68FR32171	
Ferroalloys Production	XXX	05/20/99 (64FR27450)	05/20/01
Flexible Polyurethane Foam Fabrication Operation	MMMMM	04/14/03 (68FR18061)	04/14/04
Flexible Polyurethane Foam Production	III	10/07/1998 (63FR53980)	10/08/2001
Friction Products Manufacturing	QQQQQ	10/18/02 (67FR64497)	10/18/05
Gasoline Distribution (Stage 1)	R	12/14/94 (59FR64303)	12/15/97
General Provisions	A	*	*
Generic MACT I-Acetal Resins	YY UU	6/29/99 (64FR34853)	06/29/02
Generic MACT I-Hydrogen Floride	YY UU	6/29/99 (64FR34853)	06/29/02
Generic MACT I-Polycarbonates Production	YY UU	6/29/99 (64FR34853)	06/29/02
Generic MACT I-Acrylic/Modacrylic Fibers	YY UU	6/29/99 (64FR34853)	06/29/02
Generic MACT II-Spandex Production	YY UU	07/12/2002 (67FR46257)	07/12/2005
Generic MACT II-Carbon Black Production	YY UU	07/12/2002 (67FR46257)	07/12/2005
Generic MACT II-Ethylene Processes	YY UU	07/12/2002 (67FR46257)	07/12/2005
Hazardous Waste Combustion Hazardous Waste Incinerators (A) Hazardous Waste Incinerators (M)	Parts 63,261 and 270	09/30/99 (64FR52827)	09/30/03
Hazardous Organic NESHAP (Synthetic Organic Chemical Manufacturing Industry)	F, G, H, I	04/22/94 (59FR19402)	F/G-05/14/01 H-05/12/99 New Sources 05/12/1998
Hydrochloric Acid Production Fumed Silica Production	NNNNN	4/17/03 (68FR19075)	4/17/06
Industrial, Commercial and Institutional Boilers and Process Heaters	DDDDD	09/13/04 (69FR55217)	09/13/07
Industrial Cooling Towers	Q	09/08/1994 (59FR46339)	03/08/1995
Integrated Iron and Steel	FFFFF	5/20/03 (68FR27645)	5/20/06
Iron and Steel Foundries*	EEEEE	4/22/04 (69FR21905)	4/22/07
Large Appliances (surface coating)	NNNN	7/23/02 (67FR48253)	07/23/05
Leather Finishing Operations	TTTT	02/27/02 (67FR915510)	02/27/05
Lime Manufacturing	AAAAA	01/05/2004 (69FR393)	01/05/2007
Magnetic Tape (surface coating)	EE	12/15/94 (59FR64580)	without new control devices 12/15/96 with new control devices 12/15/97
Manufacturing Nutritional Yeast (formerly Bakers Yeast)	CCCC	5/21/01 (66FR27876)	5/21/04
Marine Vessel Loading Operations	Y	09/19/95 (60FR48388)	MACT-09/19/99 RACT-09/19/98
Mercury Cell Chlor-Alkali Plants	IIIII	12/19/03 (68FR70903)	12/19/06

NESHAP (MACT) STANDARD Source Categories Affected	CFR Sub Parts	Final Federal Register Date & Citation	Compliance Date
Metal Can (surface coating)	KKKK	11/13/03 (68FR64431)	11/13/2006
Metal Coil (surface coating)	SSSS	06/10/2002 (67FR39793)	06/10/2005
Metal Furniture (surface coating)	RRRR	05/23/03 (68FR28605)	05/23/06
Mineral Wool Production	DDD	06/01/1999 (64FR29489)	06/01/2002
Misc. Coating Manufacturing	HHHHH	12/11/2003 (68FR69163)	12/11/2006
Misc. Metal Parts and Products (surface coating) Asphalt/Coal Tar Application to Metal Pipes	MMMM	01/02/2004 (69FR129)	01/02/2007
Misc. Organic Chemical Production and Processes (MON) Alkyd Resins Production Ammonium Sulfate Production Benzyltrimethylammonium Chloride Prod. Carbonyl Sulfide Production Chelating Agents Production Chlorinated Paraffins Production Ethyllidene Norbomene Production Explosives Production Hydrazine Production Maleic Anhydride Copolymers Production Manufacture of Paints, Coatings, & Adhesives OBPA/1, 3-diisocyanate Production Photographic Chemicals Production Phthalate Plasticizers Production Polyester Resins Production Polymerized Vinylidene Chloride Prod. Polymethyl Methacrylate Resins Prod. Polyvinyl Acetate Emulsions Prod. Polyvinyl Alcohol Production Polyvinyl Butyral Production Quaternary Ammonium Comp. Prod. Rubber Chemicals Production Symmetrical Tetrachloropyridine Production	FFFF	11/10/2003 (68FR63851)	11/10/2006
Municipal Solid Waste Landfills	AAAA	01/16/03 68FR2227	contact project lead
Natural Gas Transmission and Storage	HHH	06/17/99 (64FR32610)	06/17/02
Off-Site Waste Recovery Operations	DD	07/01/96 (61FR34140)	02/01/2000
Oil & Natural Gas Production	HH	06/17/99 (64FR32609)	06/17/02
Organic Liquids Distribution (non-gasoline)	EEEE	02/03/2004 (69FR5038)	02/03/2007
Paper and Other Web (surface coating)	JJJJ	12/04/2002 (67FR72329)	12/04/2005
Pesticide Active Ingredient Production 4-Chlror-2-Methyl Acid Production 2,4 Salts & Esters Production 4,6-dinitro-o-cresol Production Butadiene Furfural Cotrimer Captafol Production Captan Production Chloroneb Production Chlorothalonil Production Dacthal (tm) production Sodium Pentachlorophenate Production	MMM	06/23/99 (64FR33549)	12/23/03

NESHAP (MACT) STANDARD Source Categories Affected	CFR Sub Parts	Final Federal Register Date & Citation	Compliance Date
Tordon (tm) Acid Production			
Petroleum Refineries	CC	08/18/95 (60FR43244)	08/18/98
Petroleum Refineries Catalytic Cracking Catalytic Reforming Sulfur Plant Units Associated Bypass Lines	UUU	04/11/2002 (67FR17761)	04/11/2005
Pharmaceuticals Production	GGG	09/21/98 (63FR50280)	09/21/01
Phosphoric Acid Phosphate Fertilizers	AA BB	06/10/1999 (64FR31358)	06/10/2002
Plastic Parts (surface coating)	PPPP	4/19/04 (69FR20968)	4/19/07
Plywood and Composite Wood Products (formerly Plywood and Particle Board Manufacturing)	DDDD	7/30/04 (69FR45943)	xxxx
Polyether Polyols Production	PPP	06/01/1999 (64FR29419)	06/01/2002
Polymers & Resins I Butyl Rubber Epichlorohydrin Elastomers Ethylene Propylene Rubber Hypalon (TM) Production Neoprene Production Nitrile Butadiene Rubber Polybutadiene Rubber Polysulfide Rubber Styrene-Butadiene Rubber & Latex	U	09/05/1996 (61FR46906)	07/31/97
Polymers & Resins II Epoxy Resins Production Non-Nylon Polyamides Production	W	03/08/1995 (60FR12670)	03/03/1998
Polymers & Resins III Amino Resins Phenolic Resins	OOO	01/20/2000 65FR3275	01/20/2003
Polymers & Resins IV Acrylonitrile-Butadiene-Styrene Methyl Methacrylate-Acrylonitrile+ Methyl Methacrylate-Butadiene++ Polystrene Styrene Acrylonitrile Polyethylene Terephthalate Nitrile Resins	JJJ	09/12/1996 (61FR48208)	07/31/97
Polyvinyl Chloride and Copolymers Production	J	07/10/2002 (67FR45885)	07/10/2005
Portland Cement Manufacturing	LLL	06/14/99 (64FR31898)	06/10/2002
Primary Aluminum	LL	10/07/1997 (62FR52384)	10/07/1999
Primary Lead Smelting	TTT	06/04/1999 (64FR30194)	05/04/2001
Primary Copper	QQQ	06/12/2002 (67FR40477)	06/12/2005
Primary Magnesium Refining	TTTTT	10/10/2003 (68FR58615)	10/10/2004
Printing and Publishing (surface coating)	KK	05/30/96 (61FR27132)	05/30/99
Publicly Owned Treatment Works (POTW)	VVV	10/26/99	10/26/02

NESHAP (MACT) STANDARD Source Categories Affected	CFR Sub Parts	Final Federal Register Date & Citation	Compliance Date
		64FR57572	
Pulp & Paper (non-combust)MACT	S	04/15/98 (63FR18504) 03/08/1996 (61FR9383)	04/15/01 04/16/01
Reciprocating Internal Combustion Engines (RICE) (NESHAP/NSPS)	ZZZZ	6/15/04 (69FR33473)	6/15/07
Refractory Products Manufacturing	SSSSS	04/16/03 (68FR18729)	New or Reconstructed 04/16/03 Existing 4/17/06
Reinforced Plastic Composites Production	WWWW	04/21/03 (68FR19375)	4/21/06
Rubber Tire Manufacturing	XXXX	07/09/2002 (67FR45598)	07/11/2005
Secondary Aluminum	RRR	03/23/00 (65FR15689)	Existing Sources 3/24/2003 New Sources 3/23/2000 or Startup
Secondary Lead Smelters	X	06/23/95 (60FR32587)	06/23/97
Semiconductor Manufacturing	BBBBB	05/22/03 (68FR30848)	05/22/06
Shipbuilding & Ship Repair (surface coating)	II	12/15/95 (60FR64330)	12/16/96
Site Remediation	GGGGG	10/08/2003 (68FR58171)	10/08/2006
Solvent Extraction for Vegetable Oil Production	GGGG	04/12/2001 (66FR19006)	04/12/2004
Stationary Combustion Turbines	YYYY	03/05/2004 (69FR10511)	03/05/2007
Steel Pickling-HCL Process	CCC	06/22/99 (64FR33202)	06/22/01
Taconite Iron Ore Processing	RRRRR	10/30/03 (68FR61867)	10/30/06
Tetrahydrobenzaldehyde Manufacture (Formerly Butadiene Dimers Production)	F	05/12/1998 (63FR26078)	05/12/2001
Wet Formed Fiberglass Mat Production	HHHH	04/11/2002 (67FR17823)	04/11/2005
Wood Building Products (surface coating) (formerly Flat Wood Paneling Products)	QQQQ	05/28/03 (68FR31746)	05/28/06
Wood Furniture (surface coating)	JJ	12/07/1995 (60FR62930)	11/21/97
Wool Fiberglass Manufacturing	NNN	06/14/99 (64FR31695)	06/14/02

10 APPENDIX C – HAZARDOUS AIR POLLUTANTS LISTED BY THE US-EPA FOR REGULATION BY NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) UNDER THE CLEAN AIR ACT

Chemical Name	CAS Number	Chemical Name	CAS Number	Chemical Name	CAS Number
Acetaldehyde	75070	Dimethyl carbamoyl chloride	79447	Parathion	56382
Acetamide	60355	Dimethyl formamide	68122	Pentachloronitrobenzene (Quintobenzene)	82688
Acetonitrile	75058	1,1-Dimethyl hydrazine	57147	Pentachlorophenol	87865
Acetophenone	98862	Dimethyl phthalate	131113	Phenol	108952
2-Acetylaminofluorene	53963	Dimethyl sulfate	77781	p-Phenylenediamine	106503
Acrolein	107028	4,6-Dinitro-o-cresol, and salts	534521	Phosgene	75445
Acrylamide	79061	2,4-Dinitrophenol	51285	Phosphine	7803512
Acrylic acid	79107	2,4-Dinitrotoluene	121142	Phosphorus	7723140
Acrylonitrile	107131	1,4-Dioxane (1,4-Diethyleneoxide)	123911	Phthalic anhydride	85449
Allyl chloride	107051	1,2-Diphenylhydrazine	122667	Polychlorinated biphenyls (Aroclors)	1336363
4-Aminobiphenyl	92671	Epichlorohydrin (l-Chloro-2,3-epoxypropane)	106898	1,3-Propane sultone	1120714
Aniline	62533	1,2-Epoxybutane	106887	beta-Propiolactone	57578
o-Anisidine	90040	Ethyl acrylate	140885	Propionaldehyde	123386
Asbestos	1332214	Ethyl benzene	100414	Propoxur (Baygon)	114261
Benzene (including benzene from gasoline)	71432	Ethyl carbamate (Urethane)	51796	Propylene dichloride (1,2-Dichloropropane)	78875
Benzidine	92875	Ethyl chloride (Chloroethane)	75003	Propylene oxide	75569
Benzotrichloride	98077	Ethylene dibromide (Dibromoethane)	106934	1,2-Propylenimine (2-Methyl aziridine)	75558
Benzyl chloride	100447	Ethylene dichloride (1,2-Dichloroethane)	107062	Quinoline	91225
Biphenyl	92524	Ethylene glycol	107211	Quinone	106514
Bis(2-ethylhexyl)phthalate (DEHP)	117817	Ethylene imine (Aziridine)	151564	Styrene	100425
Bis(chloromethyl)ether	542881	Ethylene oxide	75218	Styrene oxide	96093
Bromoform	75252	Ethylene thiourea	96457	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746016
1,3-Butadiene	106990	Ethylidene dichloride (1,1-Dichloroethane)	75343	1,1,2,2-Tetrachloroethane	79345
Calcium cyanamide	156627	Formaldehyde	50000	Tetrachloroethylene (Perchloroethylene)	127184
Captan	133062	Heptachlor	76448	Titanium tetrachloride	7550450
Carbaryl	63252	Hexachlorobenzene	118741	Toluene	108883
Carbon disulfide	75150	Hexachlorobutadiene	87683	2,4-Toluene diamine	95807
Carbon tetrachloride	56235	Hexachlorocyclopentadiene	77474	2,4-Toluene diisocyanate	584849
Carbonyl sulfide	463581	Hexachloroethane	67721	o-Toluidine	95534

Chemical Name	CAS Number	Chemical Name	CAS Number	Chemical Name	CAS Number
Catechol	120809	Hexamethylene-1,6-diisocyanate	822060	Toxaphene (chlorinated camphene)	8001352
Chloramben	133904	Hexamethylphosphoramide	680319	1,2,4-Trichlorobenzene	120821
Chlordane	57749	Hexane	110543	1,1,2-Trichloroethane	79005
Chlorine	7782505	Hydrazine	302012	Trichloroethylene	79016
Chloroacetic acid	79118	Hydrochloric acid	7647010	2,4,5-Trichlorophenol	95954
2-Chloroacetophenone	532274	Hydrogen fluoride (Hydrofluoric acid)	7664393	2,4,6-Trichlorophenol	88062
Chlorobenzene	108907	Hydroquinone	123319	Triethylamine	121448
Chlorobenzilate	510156	Isophorone	78591	Trifluralin	1582098
Chloroform	67663	Lindane (all isomers)	58899	2,2,4-Trimethylpentane	540841
Chloromethyl methyl ether	107302	Maleic anhydride	108316	Vinyl acetate	108054
Chloroprene	126998	Methanol	67561	Vinyl bromide	593602
Cresols/Cresylic acid (isomers and mixture)	1319773	Methoxychlor	72435	Vinyl chloride	75014
o-Cresol	95487	Methyl bromide (Bromomethane)	74839	Vinylidene chloride (1,1-Dichloroethylene)	75354
m-Cresol	108394	Methyl chloride (Chloromethane)	74873	Xylenes (isomers and mixture)	1330207
p-Cresol	106445	Methyl chloroform (1,1,1-Trichloroethane)	71556	o-Xylenes	95476
Cumene	98828	Methyl hydrazine	60344	m-Xylenes	108383
2,4-D, salts and esters	94757	Methyl iodide (Iodomethane)	74884	p-Xylenes	106423
DDE	3547044	Methyl isobutyl ketone (Hexone)	108101	Antimony Compounds	0
Diazomethane	334883	Methyl isocyanate	624839	Arsenic Compounds (inorganic including arsine)	0
Dibenzofurans	132649	Methyl methacrylate	80626	Beryllium Compounds	0
1,2-Dibromo-3-chloropropane	96128	Methyl tert butyl ether	1634044	Cadmium Compounds	0
Dibutylphthalate	84742	4,4-Methylene bis(2-chloroaniline)	101144	Chromium Compounds	0
1,4-Dichlorobenzene(p)	106467	Methylene chloride (Dichloromethane)	75092	Cobalt Compounds	0
3,3-Dichlorobenzidene	91941	Methylene diphenyl diisocyanate (MDI)	101688	Coke Oven Emissions	0
Dichloroethyl ether (Bis(2-chloroethyl)ether)	111444	4,4¬-Methylenedianiline	101779	Cyanide Compounds1	0
1,3-Dichloropropene	542756	Naphthalene	91203	Glycol ethers2	0
Dichlorvos	62737	Nitrobenzene	98953	Lead Compounds	0
Diethanolamine	111422	4-Nitrobiphenyl	92933	Manganese Compounds	0
N,N-Diethyl aniline (N,N-Dimethylaniline)	121697	4-Nitrophenol	100027	Mercury Compounds	0
Diethyl sulfate	64675	2-Nitropropane	79469	Fine mineral fibers3	0
3,3-Dimethoxybenzidine	119904	N-Nitroso-N-methylurea	684935	Nickel Compounds	0
Dimethyl aminoazobenzene	60117	N-Nitrosodimethylamine	62759	Polycylic Organic Matter4	0
3,3'-Dimethyl benzidine	119937	N-Nitrosomorpholine	59892	Radionuclides (including radon)5	0

Chemical Name	CAS Number	Chemical Name	CAS Number	Chemical Name	CAS Number
Selenium Compounds	0				

11 APPENDIX D – CATEGORIES OF INDUSTRIAL ACTIVITIES LISTED IN ANNEX 1 OF THE EU INTEGRATED POLLUTION PREVENTION AND CONTROL DIRECTIVE 96/61/EC

1. Installations or parts of installations used for research, development and testing of new products and processes are not covered by this Directive.

2. The threshold values given below generally refer to production capacities or outputs. Where one operator carries out several activities falling under the same subheading in the same installation or on the same site, the capacities of such activities are added together.

1. Energy industries

1.1. Combustion installations with a rated thermal input exceeding 50 MW (1)

1.2. Mineral oil and gas refineries

1.3. Coke ovens

1.4. Coal gasification and liquefaction plants

2. Production and processing of metals

2.1. Metal ore (including sulphide ore) roasting or sintering installations

2.2. Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2,5 tonnes per hour

2.3. Installations for the processing of ferrous metals:

(a) hot-rolling mills with a capacity exceeding 20 tonnes of crude steel per hour

(b) smitheries with hammers the energy of which exceeds 50 kilojoule per hammer, where the calorific power used exceeds 20 MW

(c) application of protective fused metal coats with an input exceeding 2 tonnes of crude steel per hour

2.4. Ferrous metal foundries with a production capacity exceeding 20 tonnes per day

2.5. Installations

(a) for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes

(b) for the smelting, including the alloyage, of non-ferrous metals, including recovered products, (refining, foundry casting, etc.) with a melting capacity exceeding 4 tonnes per day for lead and cadmium or 20 tonnes per day for all other metals

2.6. Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m3

3. Mineral industry

3.1. Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day

3.2. Installations for the production of asbestos and the manufacture of asbestos-based products

3.3. Installations for the manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day

3.4. Installations for melting mineral substances including the production of mineral fibres with a melting capacity exceeding 20 tonnes per day

3.5. Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, and/or with a kiln capacity exceeding 4 m3 and with a setting density per kiln exceeding 300 kg/m3

4. Chemical industry

Production within the meaning of the categories of activities contained in this section means the production on an industrial scale by chemical processing of substances or groups of substances listed in Sections 4.1 to 4.6

4.1. Chemical installations for the production of basic organic chemicals, such as:

(a) simple hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic)

(b) oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins

(c) sulphurous hydrocarbons

(d) nitrogenous hydrocarbons such as amines, amides, nitrous compounds, nitro compounds or nitrate compounds, nitriles, cyanates, isocyanates

(e) phosphorus-containing hydrocarbons

(f) halogenic hydrocarbons

(g) organometallic compounds

(h) basic plastic materials (polymers synthetic fibres and cellulose-based fibres)

(i) synthetic rubbers

(j) dyes and pigments

(k) surface-active agents and surfactants

4.2. Chemical installations for the production of basic inorganic chemicals, such as:

(a) gases, such as ammonia, chlorine or hydrogen chloride, fluorine or hydrogen fluoride, carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide, carbonyl chloride

(b) acids, such as chromic acid, hydrofluoric acid, phosphoric acid, nitric acid, hydrochloric acid, sulphuric acid, oleum, sulphurous acids

(c) bases, such as ammonium hydroxide, potassium hydroxide, sodium hydroxide

(d) salts, such as ammonium chloride, potassium chlorate, potassium carbonate, sodium carbonate, perborate, silver nitrate

(e) non-metals, metal oxides or other inorganic compounds such as calcium carbide, silicon, silicon carbide

4.3. Chemical installations for the production of phosphorous-, nitrogen- or potassium-based fertilisers (simple or compound fertilisers)

4.4. Chemical installations for the production of basic plant health products and of biocides

4.5. Installations using a chemical or biological process for the production of basic pharmaceutical products

4.6. Chemical installations for the production of explosives

5. Waste management

Without prejudice of Article 11 of Directive 75/442/EEC or Article 3 of Council Directive 91/689/EEC of 12 December 1991 on hazardous waste (1):

5.1. Installations for the disposal or recovery of hazardous waste as defined in the list referred to in Article 1 (4) of Directive 91/689/EEC, as defined in Annexes II A and II B (operations R1, R5, R6, R8 and R9) to Directive 75/442/EEC and in Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils (2), with a capacity exceeding 10 tonnes per day

5.2. Installations for the incineration of municipal waste as defined in Council Directive 89/369/EEC of 8 June 1989 on the prevention of air pollution from new municipal waste incineration plants (3) and Council Directive 89/429/EEC of 21 June 1989 on the reduction of air pollution from existing municipal waste-incineration plants (4) with a capacity exceeding 3 tonnes per hour

5.3. Installations for the disposal of non-hazardous waste as defined in Annex II A to Directive 75/442/EEC under headings D8 and D9, with a capacity exceeding 50 tonnes per day

5.4. Landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste

6. Other activities

6.1. Industrial plants for the production of:

(a) pulp from timber or other fibrous materials

(b) paper and board with a production capacity exceeding 20 tonnes per day

6.2. Plants for the pre-treatment (operations such as washing, bleaching, mercerisation) or dyeing of fibres or textiles where the treatment capacity exceeds 10 tonnes per day

6.3. Plants for the tanning of hides and skins where the treatment capacity exceeds 12 tonnes of finished products per day

6.4. (a) Slaughterhouses with a carcase production capacity greater than 50 tonnes per day

(b) Treatment and processing intended for the production of food products from:

- animal raw materials (other than milk) with a finished product production capacity greater than 75 tonnes per day

- vegetable raw materials with a finished product production capacity greater than 300 tonnes per day (average value on a quarterly basis)

(c) Treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on an annual basis)

6.5. Installations for the disposal or recycling of animal carcases and animal waste with a treatment capacity exceeding 10 tonnes per day

6.6. Installations for the intensive rearing of poultry or pigs with more than:

(a) 40 000 places for poultry

(b) 2 000 places for production pigs (over 30 kg), or

(c) 750 places for sows

6.7. Installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with a consumption capacity of more than 150 kg per hour or more than 200 tonnes per year

6.8. Installations for the production of carbon (hard-burnt coal) or electrographite by means of incineration or graphitization

12 APPENDIX E – AIR QUALITY MANAGEMENT IN THE UK

The Environment Act of 1995 provides the framework for local air quality management (LAQM) across England and Wales. The provisions of Part IV of the Act are largely enabling and give local authorities the flexibility to develop and implement local policies suited to local needs with the purpose of achieving the Air Quality Objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000, the Air Quality Regulations (England, Wales) 2000 and the Air Quality (amended) Regulations 2002. Tasks undertaken in LAQM include:

- Carrying out air quality reviews and assessments;
- Making out an order designating an air quality management area (AQMA)[17];
- Revoking or modifying and AQMA order;
- Preparing an action plan (aimed at meeting ambient air quality standards within designated AQMAs);
- Modifying any action plan; and
- Implementing any action in an action plan.

The UK local air quality management system has a key role to play in assisting the UK meet its objectives under the EU's Air Quality Framework and Daughter Directives which prescribe limit values for various pollutants which are member states must meet (as discussed previously).

During the air quality assessments, the main sources of pollution are identified and options and measures available to reduce the impact of such sources on ambient air quality identified. Local authorities are required to ensure that the measures to be included in the action plan are cost-effective and proportionate taking into account the contribution of pollution from different sources. They must also make sure they strike the right balance between the use of regulatory powers and other non-regulatory measures (e.g. voluntary initiatives, market incentives). Local authorities are also required to appraise and where possible quantify the wider environmental, economic and social consequences of each option and package of options.

It should be noted that some of the actions needed to improve air quality may well be outside the local authority's remit. For example, in instances where an industrial process regulated by the Environment Agency is contributing to air quality exceedances or where high levels of pollutants exist as a result of motorways regulated by the Highways Agency (or, in Wales, the National Assembly for Wales). Both the Highways and the Environment Agencies are committed to the local air quality management process and both are required to help local authorities develop their action plans (DEFRA, 2003).

Local authorities can control emissions from certain industrial processes (i.e. A2 and B installations) and other industrial operations which fall outside the provisions of LAPC by using the provisions of the Clean Air Act 1993. This Act includes powers to prohibit dark smoke from a chimney of any building, industrial or trade premises, and require notification of installation of industrial furnaces. In controlling domestic fuel burning local authorities may make use of the Clean Air Act of 1993 which enables them to declare smoke control areas within which people are required to adapt their fireplaces to burn smokeless fuel, restrict the burning of unauthorized fuels and restrict the sale of unauthorized fuels (DEFRA, 2003).

The Environment Agency thus makes a direct and significant contribution to local air quality management through its regulations of major industrial processes. It has identified Zones of Industrial Pollution Sources (ZIPS) in major industrial areas. In each ZIPS, the Agency is undertaking programmes of work to assess the contribution of IPC processes to local air quality and the extent to which further improvements are possible and cost effective. Such studies contribute to the air quality reviews and assessments being conducted by local authorities. There

[17] By 2003 over 100 local authorities across the UK had designated AQMAs in their areas. The majority of these were designated in respect of emissions from road transport with only a small percentage being designated in respect of industrial sources alone. Traffic management and other local transport schemes are therefore often key elements in air quality action plans.

are eleven ZIPS in England and Wales. The Environment Agency monitors and models air quality in each of the ZIPS, often in partnership with local authorities and industrial operators.

13 APPENDIX E – AIR QUALITY MANAGEMENT IN THE UK

RSA - PROPOSED LISTED ACTIVITIES (Hietkamp and Nkhwashu, 2005)	UK PPC REGULATION SECTORS	TECHNICAL (BAT) GUIDANCE DOCUMENT AVAILABILITY		
		Reference #	**Title**	**Current Status**
1. Combustion installations -The generation of electricity, where electricity output is >20 Megawatts [Ref: APPA, process 29] 29 Power generation 56 Bagasse incineration	**Energy Industries: (Chapter 1 of the Regulations)** Combustion Activities	UK IPPC S1.01	Combustion	Version 2.03 issued July 2005
		EC BREF	Energy Efficiency	Working draft BREF available
		EC BREF	Large Combustion Plant	BREF formally adopted
2. Petroleum industry The bulk storage of crude petroleum and liquid petroleum products, in storage facilities with individual capacity >1 000 cubic metres each. [Ref: APPA process 14]. 14 Hydrocarbon refining 25 Acid sludge processes NB: All petroleum processes will be listed because they are large scale processes and no small scale processes exist.	**Energy Industries: (Chapter 1 of the Regulations)** Gasification, Liquefaction and Refining Activities **SED (Solvent Emission Directive) Activities (Chapter 7 of the Regulations)**	EC BREF	Refineries	BREF formally adopted
3. Carbonisation and coal gasification 34 Coke and Gas processes 33 Producer gas processes 16 Tar processes 3 Gas liquor processes	**Other Activities (Chapter 6 of the Regulations)** Carbon Activities Tar and Bitumen Activities	UK IPPC S1.02	Carbonaceous material, Mineral Oil, Gas, Coke & Coal.	Consultation Draft Issue 3 July 2005
4. Metallurgical industry Gold Refining PGM Refining 32 Aluminium processes 52 Cadmium processes 50 Chrome processes 31 Copper processes 30 Iron and Steel processes 23 Lead processes 62 Mercury processes 53 Manganese processes 54 Metal recovery processes	**Production and Processing of Metals: (Chapter 2 of the Regulations)** Ferrous Metals	UK IPPC S2.01	Guidance for the Coke, Iron and Steel Sector	Issued June 2004
	Non-Ferrous Metals	UK IPPC S2.02	Guidance for non ferrous metals sector	Working draft, Version1, January 2002
	Surface Treating Metals and Plastic Materials	UK IPPC S2.03	Technical Guidance for Non-Ferrous Metals and the Production of Carbon and Graphite	Version 1, January 2002

RSA - PROPOSED LISTED ACTIVITIES (Hietkamp and Nkhwashu, 2005)	UK PPC REGULATION SECTORS	TECHNICAL (BAT) GUIDANCE DOCUMENT AVAILABILITY		
57 Metal spray processes 66 Metallurgical slag processes 27 Roasting processes 17 Zinc processes 60 Vanadium processes 55 Galvanising processes 63 Silicon processes 51 Magnesium processes 11 Arsenic processes 61 Antimony processes 40 Beryllium processes 71 Nickel processes		UK IPPC S2.04	Guidance for the Hot Rolling of Ferrous Metals and Associated Activities Sector	Updated, Feb 2004
		UK IPPC S2.07	Guidance for the Surface Treatment of Metals & Plastics by Electolytic & Chemical Processes	Issue 1, October 2004
		UK IPPC SG3	SoS's Guidance for the A2 Ferrous Foundries Sector (Jan 2006)	does not constitute statutory guidance in scotland
		UK IPPC SG4	SoS's Guidance for A2 Activities in the Non ferrous Metals Sector (Jan 2006)	does not constitute statutory guidance in scotland
		UK IPPC SG5	SoS's Guidance for the A2 Galvanizing Sector (September 2006)	does not constitute statutory guidance in scotland
		EC BREF	Iron and Steel production	BREF formally adopted, Revision started
		EC BREF	Smitheries and Foundries	BREF formally adopted
		EC BREF	Surface treatment of metals	BREF formally adopted
		EC BREF	Ferrous Metal processing	BREF formally adopted
		EC BREF	Non-Ferrous Metal processes	BREF formally adopted
5. Mineral processing industry 22 Cement processes 65 Glass processes 35 Ceramic processes 10 Oxide pigment processes 36 Lime, Dolomite and Magnetite processes 28 Asbestos processes 59 Bulk storage and handling of ore or coal	**Mineral Industries: (Chapter 3 of the Regulations)** Production of Cement and Lime Activities Involving Asbestos Manufacturing Glass and Glass Fibre	UK IPPC S3.01	Guidance for the Cement and Lime Sector	Working draft, Version 1, April 2001
		UK IPPC S3.03	Guidance for the Glass Manufacturing Sector (A1 processes)	Working draft, Version 1, October 2001
		UK IPPC S3.04	Mineral Fibres	In Progress

RSA - PROPOSED LISTED ACTIVITIES (Hietkamp and Nkhwashu, 2005)	UK PPC REGULATION SECTORS	TECHNICAL (BAT) GUIDANCE DOCUMENT AVAILABILITY		
The storage and handling of ore or coal at dumps designed to hold 100 000 tons or more and not situated on the premises of a mine or works as defined in the Mines and Works Act, 1956 [Ref: APPA, process 59].	Production of Other Mineral Fibres	UK IPPC SG2	SoS's Guidance for Glass Manufacturing Activities with Melting Capacity More than 20 Tonnes per Day (September 2006)	does not constitute statutory guidance in Scotland
	Other Mineral Activities	UK IPPC SG7	SoS's Guidance for the A2 Ceramics Sector including Heavy Clay, Refractories, Calcining Clay and Whiteware (March 2004)	does not constitute statutory guidance in scotland
	Ceramic Production	EC BREF	Glass manufacture	BREF available, Revision started
		EC BREF	Cement and Lime production	BREF formally adopted, Revision started
		EC BREF	Management of Tailings and Waste-Rock in Mining Activities	BREF finalized by not yet adopted
		EC BREF	Ceramics	BREF finalized by not yet adopted
6. Organic chemical industry All of the following processes independent of scale 19 Pyridine processes 49 Anhydride processes 18 Benzene processes 45 Acetylene processes 48 Aldehyde processes 46 Amine processes 70 Acrylonitrile processes Plastics (subsection) Monomer production (subsection) 72 Vinyl chloride monomer processes	**The Chemical Industry: (Chapter 4 of the Regulations)**	UK IPPC S4.01	Large volume organic chemicals sector	Issue 4 April 2003
	Organic Chemicals	UK IPPC S4.02	Speciality Organics	Issue 6 April 2003
	Inorganic Chemicals	UK IPPC S4.03	Inorganic Chemicals	Consultation Draft v1.1,
	Chemical Fertiliser Production			Deadline 24th Sep 04
	Plant Health Products and Biocides	UK IPPC S4.05	Organic fine chemicals inc pharmaceuticals, biocides, explosives, dyes and surfactants	Withdrawn (see S4.01)
	Pharmaceutical Production	UK IPPC S4.06	Polymers	Withdrawn
	Explosives Production	UK IPPC S4.07	Carbon Disulphide	Withdrawn
	Manufacturing Activities Involving Carbon Disulphide or Ammonia	UK IPPC SG6	SoS's Guidance for the A2 Surface Treatment Using Organic Solvents Sector (October 2003)	does not constitute statutory guidance in scotland
	Storage of Chemicals in Bulk	EC BREF	Emissions from storage of bulk or dangerous materials	BREF formally adopted
		EC BREF	Common waste water and waste gas treatment and management systems in the chemical sector	BREF formally adopted

RSA - PROPOSED LISTED ACTIVITIES (Hietkamp and Nkhwashu, 2005)	UK PPC REGULATION SECTORS	TECHNICAL (BAT) GUIDANCE DOCUMENT AVAILABILITY		
		EC BREF	Speciality inorganic chemicals	BREF finalized by not yet adopted
		EC BREF	Organic fine chemicals	BREF formally adopted
		EC BREF	Polymers	BREF finalized by not yet adopted
		EC BREF	Chlor-Alkali manufacture	BREF formally adopted
		EC BREF	Large Volume Organic Chemicals	BREF formally adopted
		EC BREF	Large Volume Inorganic Chemicals - Ammonia, Acids & Fertilisers	BREF finalized by not yet adopted
		EC BREF	Large Volume Inorganic Chemicals - Solid & Others	BREF finalized by not yet adopted
7. Inorganic chemical industry All of the following processes independent of scale 5 Ammonium sulphate and Ammonium chloride processes 12 Carbon disulphide processes 38 Caustic soda 20 Bromine processes 47 Calcium carbide processes 24 Fluorine processes 2 Phosphate fertilizer processes 6 Chlorine processes 7 Hydrochloric acid processes 44 Hydrogen cyanide 1 Sulphuric acid processes 8 Sulphide processes 13 Sulphocyanide processes 4 Nitric acid processes 42 Phosphorus processes 26 Alkali processes 43 Ammonia processes 58 Macadam preparation 37 Sulphite reduction processes 15 Bisulphite processes 41 Selenium processes				
8. Explosives Industry The manufacturing of explosives including ammunition independent of scale				
9. Pharmaceuticals production				
10. Incineration processes including hazardous waste	**Waste Management (Chapter 5 of the Regulations)**			

RSA - PROPOSED LISTED ACTIVITIES (Hietkamp and Nkhwashu, 2005)	UK PPC REGULATION SECTORS	TECHNICAL (BAT) GUIDANCE DOCUMENT AVAILABILITY		
The use, recycling, handling, treatment, storage or final disposal of hazardous wastes (NEMA chapter 4 (23) 39 Incineration processes	Disposal of Waste by Incineration Disposal of Waste by Landfill Disposal of Waste other than by Incineration or Landfill Recovery of Waste Production of Fuel from Waste	UK IPPC S5.01	Guidance for the Incineration of Waste and Fuel Manufactured from or including Waste Correction January 2005	Issue 1, July 2004
		UK IPPC S5.02	Guidance for the Landfill Sector	Withdrawn
		UK IPPC S5.03	BAT for Waste Treatment	Not Available
11. The disposal of hazardous and general waste The disposal of hazardous waste The disposal of general waste Ref: The final disposal of general waste covering an area in excess of 100 square meters or 200 cubic metres of airspace (NEMA chapter 4 (23).		UK IPPC S5.06	Guidance for the Recovery and Disposal of Hazardous and Non-Hazardous Waste	Version 3 October 2003
		UK IPPC SG9	SoS's Guidance for A2 Roadstone Coating, Mineral and Other Processes that Burn Recovered Fuel Oil (April 2005)	does not constitute statutory guidance in scotland
		UK IPPC S(A2)5.07	Hazardous Waste Incineration A2	Not Started
		EC BREF	Waste Incineration	BREF formally adopted
		EC BREF	Waste Treatments	BREF formally adopted
		EC BREF	[Previously Waste Recovery/Disposal activities]	
12. Wood products industry 68 Pulp and paper processes 9 Alkali waste processes 67 Wood burning and wood drying processes	**Other Activities (Chapter 6 of the Regulations)** Paper, Pulp and Board Manufacturing Activities Timber Activities	UK IPPC S6.01	Technical Guidance for the Pulp and Paper Sector	Complete/Published, Version 2, 7 November 2000
		UK IPPC SG1	SoS's Guidance for the Particleboard, Oriented Strand Board and Dry Process Fibreboard Sector (September 2006)	does not constitute statutory guidance in scotland
		EC BREF	Pulp and Paper manufacture	BREF formally adopted, Revision started
13. Production and formulation of pesticides Independent of scale	**The Chemical Industry: (Chapter 4 of the Regulations)** Plant Health Products and Biocides			
14. Animal matter processing	**Other Activities (Chapter 6 of the Regulations)**			

RSA - PROPOSED LISTED ACTIVITIES (Hietkamp and Nkhwashu, 2005)	UK PPC REGULATION SECTORS	TECHNICAL (BAT) GUIDANCE DOCUMENT AVAILABILITY		
Processes for the rendering cooking, drying, dehydrating, digesting, evaporation or protein concentrating of any animal matter not intended for human consumption [Ref: APPA, process 59]. (The description needs to be extended to cover large slaughter houses and large tanning plants). 69 Animal matter reduction processes	The Treatment of Animal and Vegetable Matter and Food Industries	UK IPPC S6.08	Tanneries	Complete/Published, Version 3, May 2002
		UK IPPC SG8	SoSs Guidance for the A2 Rendering Sector (October 2004)	does not constitute statutory guidance in scotland
		UK IPPC SG10	SoS's Guidance for the A2 Animal carcass incineration with capacity of less than 1 tonne per hour	does not constitute statutory guidance in scotland
		EC BREF	Tanning of hides and skins	BREF formally adopted
		EC BREF	Slaughterhouses and Animal By-products	BREF formally adopted
Several other industrial activities proposed for regulation under the AQA as "controlled emitters"	**Other Activities (Chapter 6 of the Regulations)** Coating Activities, Printing and Textile Treatments The Manufacture of Dyestuffs, Printing Ink and Coating Materials Activities Involving Rubber Intensive Farming	UK IPPC S6.05	Guidance for Textile Sector	Issue 2 July 2002
		EC BREF	Textile processing	BREF formally adopted
		UK SRG 6.02	Odour management at Intensive Livestock Installations	May-05
		UK IPPC S0.01	General Sector Guidance	Complete/Published, Version 2, June 2001
		UK IPPC S6.11b	Guidance for the Poultry Processing Sector	Issue 3: Modified on 1st Oct 2003
		UK IPPC S6.10	Guidance for Food and Drink Sector	Issue 1: Modified on 25th Oct 2003
		UK IPPC S6.12	Guidance for the Red Meat Processing (Cattle, Sheep and Pigs) Sector	Issue 1: Modified on 3rd Oct 2003
		UK IPPC S6.13	Guidance for the Dairy and Milk Processing Sector	Issue 1: Modified on 26th Oct 2003
		EC BREF	Intensive Livestock Farming	BREF formally adopted
		EC BREF	Cooling Systems	BREF formally adopted
		EC BREF	Food, Drink and Milk processes	BREF formally adopted
		EC BREF	Surface treatments using solvents	BREF finalized by not yet adopted

14 APPENDIX F – SCHEDULE OF NSW EPA – LICENSED ACTIVITIES

Schedule 1 of the *Protection of the Environment Operations Act 1997:*

Part 1 - Activities premises-based

Activity	Description / Threshold
Agricultural produce industries	Agricultural produce industries that process agricultural produce (including dairy products, seeds, fruit, vegetables or other plant material) and that crush, juice, grind, gin, mill or separate more than 30,000 tonnes of produce per year.
Aircraft (helicopter) facilities	Aircraft (helicopter) facilities (including terminals, buildings for the parking, servicing or maintenance of helicopters, installations or movement areas) for the landing, taking-off or parking of helicopters (other than facilities used exclusively for emergency aeromedical evacuation, retrieval or rescue) if the facilities: (1) have an intended use of more than 30 flight movements per week (including taking-off or landing), and (2) are located within 1 kilometre of a dwelling not associated with the facilities.
Aquaculture or mariculture for the commercial production	Aquaculture or mariculture for the commercial production (breeding, hatching, rearing or cultivation) of marine, estuarine or freshwater organisms, including aquatic plants or animals (such as fin fish, crustaceans, molluscs or other aquatic invertebrates), but not including oysters, involving: (a) supplemental feeding in tanks or artificial waterbodies, and (b) the discharge of effluent, liquid sludge or other waste water into natural waterbodies (such as rivers, streams, lakes, lagoons, swamps, wetlands, watercourses (including natural watercourses that have been artificially modified) or tidal waters (including the sea)), whether or not the discharge is by means of a pipe, drain, drainage depression, canal or other artificial form of conveyance.
Bitumen pre-mix or hot-mix industries	Bitumen pre-mix or hot-mix industries where crushed or ground rock is mixed with bituminous or asphaltic materials and that have an intended production capacity of more than 150 tonnes per day or 30,000 tonnes per year. This activity does not include works of a temporary nature exclusively providing product for a construction site and located on or adjacent to that site for a period of less than 12 months.
Breweries or distilleries	Breweries or distilleries that produce alcohol or alcoholic products and that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year. Cement works (including works involving the production of quicklime) that: (1) use argillaceous and calcareous materials in the production of cement clinker, or (2) grind cement clinker with an intended processing capacity exceeding 150 tonnes per day or 30,000 tonnes per year, or (3) have an intended combined handling capacity exceeding 150 tonnes per day or 30,000 tonnes per year in bulk of cement, fly ash, powdered lime, or any other similar dry cement products.
Ceramic works	Ceramic works with an intended production capacity of more than 150 tonnes per day or 30,000 tonnes per year of products such as bricks, tiles, pipes, pottery goods, refractories, or glass manufactured through a firing process.
Chemical industries or works for the commercial production of, or research into, chemical substances	Chemical industries or works for the commercial production of, or research into, chemical substances at: (1) the following industries or works: (a) agricultural fertiliser industries that produce more than 20,000 tonnes per year of inorganic plant fertilisers, or (b) battery industries that manufacture or reprocess batteries containing acid or alkali and metal plates and use or recover more than 30 tonnes of metal per year, or (c) carbon black industries that manufacture more than 5,000 tonnes per year of carbon black, or (d) explosive or pyrotechnics industries that manufacture explosives for purposes including industrial, extractive industries and mining uses, ammunition, fireworks, or fuel propellants (except the production of explosives at mines), or (e) paints, paint solvents, pigments, dyes, printing inks, industrial polishes, adhesives or sealants manufacturing industries that manufacture more than 5,000 tonnes per year of products, or (f) petrochemical industries that manufacture more than 2,000 tonnes per year of petrochemicals and petrochemical products, or (g) pesticides, fungicides, herbicides, rodenticides, nematocides, miticides, fumigants and related products industries that: (i) manufacture materials classified as toxic in the *Australian Dangerous Goods Code* , or (ii) manufacture more than 2,000 tonnes per year of products, or (h) pharmaceutical or veterinary products industries that manufacture or use materials classified as toxic in the *Australian Dangerous Goods Code* , or (i) plastics industries that: (i) manufacture more than 2,000 tonnes per year of synthetic plastic resins, or (ii) reprocess more than 5,000 tonnes of plastics per year other than by a simple melting and reforming process, or (j) rubber industries or works that: (i) manufacture more than 2,000 tonnes per year of synthetic rubber, or (ii) manufacture, retread, recycle or process more than 5,000 tonnes per year of rubber products or rubber tyres, or (k) soap or detergent industries (including domestic, institutional or industrial soaps or detergent industries)

Activity	Description / Threshold
	that manufacture: (i) more than 100 tonnes per year of products containing substances classified as toxic in the *Australian Dangerous Goods Code* , or (ii) more than 5,000 tonnes per year of any other products (excluding simple blending), or (2) industries or works, other than those in (1) above: (a) that manufacture, blend, recover or use substances classified as explosive, toxic or radioactive in the *Australian Dangerous Goods Code* , or (b) that manufacture or use more than 1,000 tonnes per year of substances classified (but other than as explosive, toxic or radioactive) in the *Australian Dangerous Goods Code* , or (c) that crush, grind or mill more than 10,000 tonnes per year of chemical substances. This designation of chemical industries or works does not include those where chemical substances listed in the NSW *Dangerous Goods (General) Regulation 1999* are stored in quantities below the licence level set out in that Regulation.
Chemical storage facilities	Chemical storage facilities that store or package chemical substances in containers, bulk storage facilities, stockpiles or dumps with a total storage capacity exceeding: (1) 20 tonnes of pressurised gas, or (2) 200 tonnes of liquefied gases, or (3) 2,000 tonnes of any chemical substances.
Coal mines	Coal mines that mine, process or handle coal and are: (1) underground mines, or (2) open cut mines that: (a) have an intended production or processing capacity of more than 500 tonnes per day of coal or carbonaceous material, or (b) have disturbed, are disturbing or will disturb a total surface area of more than 4 hectares of land by: (i) clearing or excavating, or (ii) constructing dams, ponds, drains, roads, railways or conveyors, or (iii) storing or depositing overburden, coal or carbonaceous material or tailings.
Coal works that store or handle coal or carbonaceous material	Coal works that store or handle coal or carbonaceous material (including any coke works, coal loader, conveyor, washery or reject dump) at an existing coal mine or on a separate coal industry site, and that: (1) have an intended handling capacity of more than 500 tonnes per day of coal or carbonaceous material, or (2) store more than 5,000 tonnes of coal or carbonaceous reject material except where the storage is within a closed container or building.
Composting and related processing or treatment facilities	Composting and related processing or treatment facilities (including facilities that mulch or ferment organic waste, or that are involved in the preparation of mushroom growing substrate, or in a combination of any such activities) that: (1) receive over 200 tonnes per year of animal waste, food waste, sludge or biosolids, or (2) receive over 5,000 tonnes per year of wood waste, garden waste, or natural fibrous material, or (3) receive any organic waste and are located within 500 metres of any residentially zoned land, or within 250 metres of a school or hospital or a dwelling not associated with the facility.
Concrete works	Concrete works that produce pre-mixed concrete or concrete products and have an intended production capacity of more than 30,000 tonnes per year of concrete or concrete products.
Contaminated soil treatment works	Contaminated soil treatment works for on-site or off-site treatment (including, in either case, incineration or storage of contaminated soil but excluding excavation for treatment at another site) that: (1) handle more than 1,000 cubic metres per year of contaminated soil not originating from the site on which the works are located, or (2) handle contaminated soil originating exclusively from the site on which the works are located and: (a) incinerate more than 1,000 cubic metres per year of contaminated soil, or (b) treat otherwise than by incineration and store more than 30,000 cubic metres of contaminated soil, or (c) disturb more than an aggregate area of 3 hectares of contaminated soil. For the purposes of this item, "contaminated soil" means soil that contains a substance at a concentration above the concentration at which the substance is normally present in soil from the same locality, being a presence that presents a risk of harm to human health or any other aspect of the environment. In this context, harm to the environment includes any direct or indirect alteration of the environment that has the effect of degrading the environment.
Crushing, grinding or separating works	Crushing, grinding or separating works that: (1) process materials including sand, gravel, rock, minerals, slag, road base or demolition material (such as concrete, bricks, tiles, asphaltic material, metal or timber) by crushing, grinding or separating into different sizes, and (2) have an intended processing capacity of more than 150 tonnes per day or 30,000 tonnes per year.
Dredging works	Dredging works being works in which materials of more than 30,000 cubic metres per year are obtained from the bed, banks or foreshores of any waters. See also Extractive industries.
Drum or container reconditioning works	Drum or container reconditioning works that recondition, recycle or store: (1) packaging containers (including metal, plastic or glass drums, bottles or cylinders) previously used for the transport or storage of substances classified as poisonous or radioactive in the *Australian Dangerous Goods Code* , or (2) more than 100 metal drums per day, unless the works (including associated drum storage) are wholly contained within a building.

Activity	Description / Threshold
Electricity generating works	Electricity generating works (including associated water storage, ash and waste management facilities) that: (1) supply or are capable of supplying more than 30 megawatts of electrical power from energy sources (including coal, gas, bio-material or hydro-electric stations), but not including from solar powered generators, or (2) are within the metropolitan area of Sydney, Newcastle and Wollongong (being the area bounded by and including the local government areas of Newcastle, Maitland, Singleton, Hawkesbury, Blue Mountains, Wollondilly, Wollongong, Shellharbour and Kiama) and incorporate electricity generating plant (other than emergency standby plant that operates for less than 200 hours per year) and are based on or use: (a) gas turbines, which burn or are capable of burning, in the aggregate, fuel at a rate of more than 20 megawatts on a net thermal energy basis, or (b) internal combustion piston engines, which burn or are capable of burning, in the aggregate, fuel at a rate of more than 3 megawatts on a net thermal energy basis.
Extractive industries	Extractive industries: (1) that obtain extractive materials by methods including excavating, dredging, blasting, tunnelling or quarrying or that store, stockpile or process extractive materials, and (2) that obtain, process or store for sale or re-use an intended quantity of more than 30,000 cubic metres per year of extractive material. See also Dredging works.
Freeway or tollway construction	Freeway or tollway construction, being the construction of new, re-routed or additional carriageways, that as a result will have: (1) physically separated carriageways for traffic moving in different directions, and (2) at least 4 lanes (other than lanes used for entry or exit), and (3) no access for traffic between interchanges, for at least 1 kilometre of their length in the Metropolitan area or for at least 5 kilometres of their length in any other area. The Metropolitan area is the area of Sydney, Newcastle, Central Coast and Wollongong bounded by and including the local government areas of Newcastle, Lake Macquarie, Wyong, Gosford, Hawkesbury, Blue Mountains, Penrith, Liverpool, Camden, Campbelltown, Wollongong and Shellharbour. This item does not include maintenance of any such freeway or tollway. Irrigated agriculture, being the irrigation activities of an irrigation corporation within the meaning of the *Irrigation Corporations Act 1994* , but not including the irrigation activities of individual irrigators in areas administered by any such irrigation corporation.
Livestock intensive industries	Livestock intensive industries being: (1) feedlots that are intended to accommodate in a confinement area and rear or fatten (wholly or substantially) on prepared or manufactured feed more than 1,000 head of cattle, 4,000 sheep or 400 horses (excluding facilities for drought or similar emergency relief), or (2) piggeries that are intended to accommodate more than 2,000 pigs or 200 breeding sows, or (3) poultry farms that are intended to accommodate, for commercial production, more than 250,000 birds, or (4) dairies that are intended to accommodate more than 800 animals in milk production, or (5) saleyards having an annual throughput exceeding 50,000 cattle or 200,000 animals of any type (including cattle) for the purposes of sale, auction or exchange or for transportation by road, rail or ship.
Livestock processing industries	Livestock processing industries comprising commercial operations that: (1) slaughter animals (including poultry) with an intended processing capacity of more than 3,000 kilograms live weight per day, or (2) manufacture products derived from the slaughter of animals including: (a) tanneries or fellmongeries, or (b) rendering or fat extraction plants with an intended production capacity of more than 200 tonnes per year of tallow, fat or their derivatives or proteinaceous matter, or (c) plants with an intended production capacity of more than 5,000 tonnes per year of products including hides, adhesives, pet food, gelatine, fertiliser or meat products, or (3) scour, top or carbonise greasy wool or fleeces with an intended production capacity of more than 200 tonnes per year.
Logging operations	Logging operations carried out on State forests or Crown timber lands, being: (1) the cutting and removal of timber (being sawlogs or pulplogs) from a compartment, where: (a) at least 20% of the compartment has a slope greater than 18 degrees, and (b) at least 30 timber stems (at least 40 cm in diameter at breast height) are to be cut and removed from each hectare of the compartment when averaged over the net harvestable area of the compartment, or (2) the construction of new access roads within a compartment for cutting and removal of timber as referred to in paragraph (1), or (3) the construction of new access roads for hauling timber from more than one compartment. This item does not include any activity on a timber plantation and does not include any activity west of the Great Dividing Range. For the purposes of this item, the area west of the Great Dividing Range is to follow the boundaries of the relevant State Forests Management Areas and is to be as set out in a map published by the EPA.
	Marinas and boat repair facilities comprising: (1) pontoons, jetties, piers or other structures (whether water-based or land-based) designed or utilised to provide moorings or dry storage (other than swing moorings) for 80 or more vessels (excluding rowing boats, dinghies or other small craft), or (2) works such as slipways, hoists or facilities for the repair and maintenance of vessels (other than boat repair facilities that are not adjacent to waters) at which 5 or more vessels (being vessels other than rowing boats, dinghies or other small craft) or any vessel 25 metres or longer is handled or capable of being handled

Activity	Description / Threshold
	at any one time. For the purposes of this item, "waters" has the same meaning as it has in paragraph (a) of the definition of "waters" in the Dictionary to this Act.
Mineral processing or metallurgical works for the commercial production or extraction of ores	Mineral processing or metallurgical works for the commercial production or extraction of ores (using methods including chemical, electrical, magnetic, gravity or physico-chemical) or the refinement or processing of metals involving smelting, casting, metal coating or metal products recovery that: (1) process into ore concentrates an intended capacity of more than 150 tonnes per day of material, or (2) smelt, process, coat, reprocess or recover an intended capacity of more than 10,000 tonnes per year of ferrous or non-ferrous metals, alloys or their ore-concentrates, or (3) crush, grind, shred, sort or store: (a) more than 150 tonnes per day, or 30,000 tonnes per year, of scrap metal and are not wholly contained within a building, or (b) more than 50,000 tonnes per year and are wholly contained within a building.
Mines that mine, process or handle minerals	Mines that mine, process or handle minerals (being minerals within the meaning of the *Mining Act 1992* other than coal) and that have disturbed, are disturbing or will disturb a total surface area of more than 4 hectares of land associated with a mining lease or mineral claim or subject to a section 8 notice under the *Mining Act 1992* by: (1) clearing or excavating, or (2) constructing dams, ponds, drains, roads, railways or conveyors, or (3) storing or depositing overburden, ore or its products or tailings.
Paper, pulp or pulp products industries	Paper, pulp or pulp products industries that manufacture paper, paper pulp or pulp products and that have an intended production capacity of more than: (1) 30,000 tonnes per year, or (2) 70,000 tonnes per year if at least 90% of the raw material used is recycled material and no bleaching or de-inking is undertaken.
Petroleum works	Petroleum works that: (1) produce, other than in the course of exploratory activities, crude petroleum or shale oil, or (2) produce more than 5 petajoules per year of natural gas or methane, or (3) refine crude petroleum, shale oil or natural gas, or (4) manufacture more than 100 tonnes per year of petroleum products (including aviation fuel, petrol, kerosene, mineral turpentine, fuel oils, lubricants, wax, bitumen, liquefied gas and the precursors to petrochemicals, such as acetylene, ethylene, toluene and xylene), or (5) store petroleum and natural gas products with an intended storage capacity in excess of: (a) 200 tonnes of liquefied gases, or (b) 2,000 tonnes of any petroleum products, or (6) dispose of oil waste or petroleum waste or process or recover more than 20 tonnes of oil waste or petroleum waste per year.
Railway systems activities	Railway systems activities (1) A railway systems activity is any one or more of the following: (a) installation of track, (b) on-site repair of track, (c) on-site maintenance of track, (d) on-site upgrading of track, (e) construction or significant alteration of any of the following, but only if it is connected with an activity listed in paragraphs (a)–(d): (i) over track structures, (ii) cuttings, (iii) drainage works, (iv) track support, (v) earthworks, (vi) fencing, (vii) tunnels, (viii) bridges, (ix) level crossings, (f) operation of rolling stock on track.
Sewage treatment systems	Sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that have an intended processing capacity of more than 2,500 persons equivalent capacity or 750 kilolitres per day and that involve the discharge or likely discharge of wastes or by-products to land or waters.
Shipping facilities (bulk) for loading or unloading	Shipping facilities (bulk) for loading or unloading, in bulk, agricultural crop products, rock, ores, minerals or chemicals into or from vessels (but not where any material is wholly contained within a shipping container), being wharves or associated facilities with an intended capacity exceeding 500 tonnes per day or 50,000 tonnes per year.
Waste activities	Waste activities (1) Hazardous, industrial or Group A waste generation or storage, being any activity that: (a) is carried on for business or other commercial purposes, and (b) involves the generating or storage of any one or more of the following types of waste: (i) hazardous waste, (ii) industrial waste, (iii) Group A waste. (2) The following activities are not waste activities for the purposes of this item: (a) the generating or on site storage of contaminated soil, recyclable oil or stabilised asbestos waste in bonded matrix, (b) the generating or on site storage of hazardous waste, industrial waste or Group A waste in or at a concrete batching plant, (c) the generating of not more than 10 tonnes per year, or the on site storage of less than 2 tonnes at any one time, of hazardous waste, industrial waste or Group A waste by any of the following: local authorities, dry cleaners, printers, photographic and processing laboratories, pharmacies, hairdressers, businesses carrying

Activity	Description / Threshold
	out any skin penetration procedure to which Part 3 of the *Public Health Regulation 1991* applies, veterinary surgeons, nursing homes, funeral parlours, painters, builders, machinery and vehicle repair and servicing workshops, panel beaters, jewellers, educational institutions, hotels, clubs, restaurants and related hospitality industries, (d) the generating of not more than 2 tonnes per year, or the on site storage of less than 500 kilograms at any one time, of hazardous waste, industrial waste or Group A waste by any of the following: • dental or doctors surgeries, • hospitals, pathology laboratories or pre-term clinics, • farming operations, • landscaping or fire hazard reduction works (such as those carried out by local and public authorities), (e) the generating of not more than 10 tonnes per year, or the on site storage of less than 2 tonnes at any one time, of hazardous waste, industrial waste or Group A waste in the form of oil, paint, lacquer, varnish, resin, ink, dye, pigments, adhesives, hydrocarbons or emulsions, (f) the storage of no more than 40,000 litres at any one time of non-hazardous waste hydrocarbon oil prior to its being burnt as fuel on the premises on which it was stored.
Waste facilities	Waste facilities (1) A waste facility that is of any one or more of the following classes: (a) hazardous, industrial, Group A or Group B waste processing facilities, being waste facilities that treat, process or reprocess hazardous waste, industrial waste, Group A waste or Group B waste (or any combination of those types of waste), except those: (i) that only treat, process or reprocess sewage, or gases specified as Dangerous Goods Class 2 in the 6th edition of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* , in force as at 1 January 1998, or (ii) that only treat, process or reprocess waste that is generated on site, (b) hazardous, industrial, Group A or Group B waste disposal facilities, being waste facilities that dispose of hazardous waste, industrial waste, Group A waste or Group B waste (or any combination of those types of waste), except those: (i) that only lawfully discharge waste into a sewer, or (ii) that are located outside the Sydney metropolitan area or the extended regulated area and: (A) where the only hazardous, industrial, Group A or Group B waste that is disposed of is asbestos waste, or (B) are operated by a local authority and where the only hazardous, industrial, Group A or Group B waste that is disposed of is asbestos waste, liquid grease trap waste or clinical waste, (c) used tyre processing or disposal facilities, being waste facilities that: (i) treat, process or dispose of more than 5,000 tonnes per year of used, rejected or unwanted tyres (including shredded tyres and tyre pieces), or (ii) store such tyres at any one time in quantities of more than 50 tonnes, (d) waste storage, transfer, separating or processing facilities, being waste facilities that store or transfer, or recover by way of separating or processing, more than 30,000 tonnes of waste per year, (e) waste incineration facilities, being waste facilities that treat or process: (i) any quantity of chemical waste, or (ii) any quantity of cytotoxic waste, or (iii) more than 25 tonnes per year of clinical waste, or (iv) more than 25 tonnes per year of quarantine waste, or (v) more than 1 tonne per hour of any other type of waste, (f) landfill or application sites within the Sydney metropolitan or extended regulated areas, being landfill or application sites that are located in the Sydney metropolitan area or the extended regulated area, except those: (i) that receive only coal washery rejects or slags at a rate of not more than 20,000 tonnes per year, or (ii) that are situated on residential premises, or on land used principally for farming operations, and only if the disposal of waste is carried out on site, or (iii) that receive no more than 20,000 tonnes of inert waste only over any period of time, and only if the disposal of the waste is incidental or ancillary to the land being used for a purpose other than as a landfill or application site (eg the construction of buildings or roads or other similar types of infrastructure development), (g) landfill or application sites in environmentally sensitive areas, being landfill or application sites that are located in an environmentally sensitive area described in Technical Appendix 8 of the Waste Guidelines, except those: (i) that are within an environmentally sensitive area by reason only of being located within 250 metres of a residential zone or of a dwelling, school or hospital not associated with the landfill or application site and: (A) receive only coal washery rejects or slags at a rate of not more than 20,000 tonnes per year, or (B) were in operation as at 30 June 1997 and receive no more than 200 tonnes of waste per year, or (ii) that are situated on residential premises, or on land used principally for farming operations, and only if the disposal of waste is carried out on site, (h) solid waste landfill or application sites, being landfill or application sites that receive over 5,000 tonnes per year of solid waste or solid waste and inert waste, (i) coal washery rejects or slags landfill or application sites, being landfill or application sites that receive over 20,000 tonnes per year of coal washery rejects or slags (or both), (j) large-scale landfill or application sites, being landfill or application sites that receive over 20,000 tonnes per year of any waste. (2) For the purposes of this item, the following are taken not to be waste: (a) virgin excavated natural material, (b) non-hazardous bulk agricultural or crop waste that is not putrescible, (c) effluent. (3) The following premises are not waste facilities for the purposes of this item: (a) premises where coal washery rejects or slags (and no other type of waste) is disposed of on site, (b) premises where only coal washery rejects or slags are used solely for the purposes of road or railway construction,

Activity	Description / Threshold
	(c) premises where biosolids (and no other type of waste) are disposed of on site, (c1) premises on which: (i) no more than 40,000 litres per annum of non-hazardous waste hydrocarbon oil is burnt as fuel, and (ii) no other activity that would render the premises a waste facility is carried on, (d) premises (other than premises in the extended regulated area, the local government area of Blue Mountains or Wollondilly or the Sydney metropolitan area) on which any one or more of the following types of organic waste (and no other type of waste) is applied to land for agricultural or environmental rehabilitation purposes: (i) animal waste, (ii) food waste, (iii) natural organic fibrous materials waste, (iv) wood waste, (v) a type of waste specified in paragraph (d1) (i)–(vii), (vi) any mixture of the types of wastes specified in subparagraphs (i)–(v), (d1) premises (being premises in the extended regulated area, the local government area of Blue Mountains or Wollondilly or the Sydney metropolitan area) on which any one or more of the following types of organic waste (and no other type of waste) is applied to land for agricultural or environmental rehabilitation purposes: (i) garden waste, (ii) biosolids categorised as Unrestricted Use in accordance with the criteria set out in the Biosolids Guidelines, (iii) biosolids categorised as Restricted Use 1, 2 or 3 in accordance with the criteria set out in the Biosolids Guidelines (but only if they are applied to the land in accordance with those Guidelines), (iv) liquid food waste, (v) manure, (vi) treated grease trap waste from the preparation or manufacturing of food, (vii) any mixture of the types of wastes specified in subparagraphs (i)–(vi), (e) mines referred to in this Part, where the only waste disposed of on the premises is either or both of the following: (i) tailings, waste rock or inert waste generated on the premises, (ii) any other type of waste that is authorised, under the licence for the premises, to be disposed of on the premises, (f) electricity generating works referred to in this Part, where the only waste disposed of on the premises is either or both of the following: (i) ash generated on the premises, (ii) any other type of waste that is authorised, under the licence for the premises, to be disposed of on the premises, (g) other premises referred to in this Part that are used solely for the purposes of disposing of any of the following types of waste: (i) non-hazardous tailings or waste rock generated on or at any mine, (ii) non-hazardous ash generated from any electricity generating works. Wood or timber milling or processing works (other than a joinery, builders' supply yard or home improvement centre) that saw, machine, mill, chip, pulp or compress timber or wood and that: (1) have an intended processing capacity of more than 6,000 cubic metres of timber (or timber products) per year and burn waste (other than as a source of fuel), or (2) have an intended processing capacity of more than 50,000 cubic metres of timber (or timber products) per year.
Wood preservation works	Wood preservation works that treat or preserve timber using chemical substances (containing copper, chromium, arsenic, creosote or any substance classified in the *Australian Dangerous Goods Code*) and that have an intended processing capacity of more than 10,000 cubic metres of timber per year.

Part 2 - Activities not premises-based

Mobile plant scheduled activities being the carrying on of any activity referred to in Part 1 of this Schedule (other than the activities described as waste activities or waste facilities) by mobile plant.

Mobile waste processing —being the treatment or processing of hazardous waste, industrial waste or Group A waste (or any combination of those types of waste) by mobile plant and that is carried on for business or commercial purposes.

Transporting of waste —being the activities of persons who transport any one or more of the following types of waste for fee or reward (including occupiers of waste facilities, and persons who carry on waste activities, that are licensed under this Act and who transport any such waste to or from those facilities):
(a) transport of hazardous waste, industrial waste, Group A waste, Group B waste or Group C waste (or of any combination of those types of waste) in loads exceeding 200 kilograms, except if it consists only of stabilised asbestos waste in bonded matrix,

(b) transport of used, rejected or unwanted tyres (including shredded tyres and tyre pieces) in loads over 2 tonnes.
For the purposes of this item, the following are excluded:
(a) persons who transport waste in their capacity as employees,
(b) any waste that is transported in connection with an emergency situation or an accident.

15 APPENDIX G – EMISSION MONITORING METHODS SPECIFIED BY THE NSW EPA, AUSTRALIA

The following test and emission monitoring methods and associated averaging periods and reference conditions are specified by the Australian State of NSW in its *Clean Air Regulations 2002 (as amended)* for application across all industry types:

Part 1 Test methods

Test methods and monitoring methods		
Air impurity	**Test method**	**Monitoring method**
Solid particles (Total)	TM-15	Not applicable
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	TM-11	CEM-2
Sulfur dioxide (SO_2)	TM-4	CEM-2
Hydrogen sulfide (H_2S)	TM-5	CEM-7
Total reduced sulfides (TRS)	TM-33	CEM-5
Sulfuric acid mist (H_2SO_4) or sulfur trioxide (SO_3) or both, as SO_3 equivalent	TM-3	Not applicable
Chlorine (Cl_2)	TM-7	Not applicable
Hydrogen chloride (HCl)	TM-8	Not applicable
Fluorine (F_2) or any compound containing fluorine, as total fluoride (HF) equivalent, except where emitted by a primary aluminium smelter while manufacturing aluminium from alumina	TM-9	Not applicable
Hydrogen fluoride (HF) emitted by a primary aluminium smelter while manufacturing aluminium from alumina	TM-10	Not applicable
Type 1 substances and Type 2 substances	TM-12, TM-13 and TM-14	Not applicable
Cadmium (Cd) or mercury	TM-12, TM-13 and TM-14	Not applicable
Dioxins or furans	TM-18	Not applicable
Carbon monoxide (CO)	TM-32	CEM-4
Volatile organic compounds, as n-propane equivalent	TM-34	CEM-8, CEM-9, CEM-10
Methanol	TM-35	CEM-8, CEM-9, CEM-10
Smoke (if determining whether a specified standard of concentration of opacity has been exceeded)	Not applicable	CEM-1
Smoke (if determining whether a specified Ringelmann standard has been exceeded)	TM-16	Not applicable
Smoke (if determining whether standard for emission of smoke from flares has been exceeded)	TM-37	Not applicable

Part 2 Averaging periods

Averaging periods	
Air impurity	**Averaging period**
Sulfuric acid mist (H_2SO_4) or sulfur trioxide (SO_3) or both, as SO_3 equivalent Fluorine (F_2), or any compound containing fluorine, as total fluoride (HF) equivalent (except where emitted by a primary aluminium smelter while manufacturing aluminium from alumina) Hydrogen Chloride (HCl) Cadmium (Cd) Dioxins or furans Mercury (Hg) Type 1 or Type 2 substances Solid particles (total)	1 hour, or the minimum sampling period specified in the relevant test method referred to in Part 1, whichever is the greater
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent Sulfur dioxide (SO_2) Hydrogen sulfide (H_2S) Total reduced sulfides (TRS) Chlorine (Cl_2)	1 hour block
Volatile organic compounds (VOCs), as n-propane equivalent Carbon monoxide (CO)	1 hour rolling
Hydrogen fluoride (HF) emitted by a primary aluminium smelter while manufacturing aluminium from alumina Methanol	24 hours
Smoke (if determining whether a specified standard of concentration of opacity has been exceeded)	6 minutes rolling

Part 3 Reference conditions

Reference conditions relating to Group 1, 2, 3 or 4		
Air impurity	**Activity or plant**	**Reference conditions**
All air impurities (except as listed below)	Any activity or plant	Dry, 273 K, 101.3 kPa
Smoke (if determining whether a specified standard of concentration of opacity has been exceeded)	Any activity or plant	Gas stream temperature above dew point. Path length corrected to stack exit diameter as per CEM-1
Solid particles (total)	Boilers or incinerators	Dry, 273 K, 101.3 kPa, 12% CO_2
Reference conditions relating to Group 5 or 6		
Air impurity	**Activity or plant**	**Reference conditions**
All air impurities (except as listed below)	Any activity or plant (except as listed below)	Dry, 273 K, 101.3 kPa
	Any fuel burning equipment using solid fuel	Dry, 273 K, 101.3 kPa, 7% O_2
	Any fuel burning equipment using gas or liquid fuel	Dry, 273 K, 101.3 kPa, 3% O_2
	Gas turbines	Dry, 273 K, 101.3 kPa, 15% O_2
Smoke (if determining whether a specified standard of concentration of opacity has been exceeded)	Any activity or plant	Gas stream temperature above dew point. Path length corrected to stack exit diameter as per CEM-1
Dioxins or furans	Incinerators that process waste	Dry, 273 K, 101.3kPa, 11% O_2