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INDUSTRIAL REGULATION AND SUSTAINABLE DEVELOPMENT

A Report to the National Society for Clean Air and Environmental Protection

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June 2001

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Introduction

This report is produced for the NCSA's Commission on Industrial Regulation and Sustainable Development. The objective of this report is to describe the existing regulatory regimes and other policy instruments that affect industry in Great Britain in order to inform its deliberations and to underpin its recommendations for change. It is primarily descriptive and highlights those aspects of the existing regime that contribute to sustainable development and might be capable of being built upon and any aspects that conflict with or impede sustainable development.

Sustainable Development as a Framework for Assessment

There are a number of different potential frameworks for assessing the development and current status of industrial regulation. These include an historical perspective, or an assessment based on individual media. However, this analysis will also use principles derived from analysis of the concept of sustainable development to underpin a framework for assessment. This analysis will in addition draw upon other frameworks, including the historical in order to provide an understanding of why the regulations governing industrial activity are as they are.

It must not be assumed that all industrial regulation necessarily contributes towards sustainable development. Indeed, it will be seen that significant components of such regulation date from before the term 'sustainable development' was in common usage. Ultimately sustainable development requires a holistic and long term view to be taken of environmental protection, while improving social conditions and enabling economic growth to continue. Most industrial regulation has not been holistic or long term. Indeed, much of it can be considered as fragmentary. However, recent developments at integrated approaches to regulation have begun to overcome this problem.

This analysis will address the following principles of sustainable development in particular:

- *The requirement for inter-generational equity*. This principle addresses the needs of future generations, in that the activities of the present generation should not damage or deplete the environment in a way that compromises the ability of future populations to meet their needs. This is a long-term perspective. Such activities might include land contamination or excessive use of non-renewable resources.

- *The requirement for intra-generational equity*. This principle addresses the problems of undue inequality as it exists today. Much of this concerns the relationship between the developing and developed world. However, it also includes inequalities within our own society. Activities, such as those that pollute the environment, should not unduly disadvantage sections of the population.

- *The principle of carrying capacity*. This concept has developed within the sustainable development debate to determine how much activity (eg pollution, resource use, etc) the environment can take before long-term damage results. Often activities within such a carrying capacity are defined as 'sustainable'. This principle has been an important driver in much recent industrial regulation.

- *The precautionary principle*. This principle addresses the problem of what action should be taken when we are not certain of the consequences of specific activities. This is a highly controversial principle (at least in its practical interpretation), but it has also been important for industrial regulations.

- *The polluter pays principle*. This is a principle of process, whereby costs incurred to the environment are met by those that impose those costs. While the principle usually refers to the 'polluter' it may include any form of environmental costs (eg resource use). The intention is to ensure that more environmentally friendly industrial activities are not at a disadvantage to those that may 'free-load' on the environment. Some forms of economic instruments are based on this principle.

- *The need for integration.* This is not so much a principle, but a process. The need for a holistic approach to achieving sustainable development has been reflected in increasing levels of integration. This concerns both the integration of industrial environmental protection regulations themselves and also the integration of environmental protection into other sectoral policies.

While the principles outlined above provide a conceptual framework for analysing industrial regulation, they are not necessarily immediately apparent to industrial managers making day to day decisions concerning the operation of their installations. As a result this analysis will follow a simplified process model in which the principles of sustainable development can be elucidated. This model has four steps:

- *Construction of the industrial installation*. At this stage decisions may be made taking account of many different aspects of the operation of an installation.

- *Use of materials*. An industrial processes uses raw materials. These may include energy, water, primary extracted ores, recycled materials, etc.

- *'Unintended' by products*. The operation of a process may result in various forms of pollution (including solid waste).

- *Product out-puts*. Processes produce products. These may be manufactured goods, chemicals, energy, etc, and will have their own environmental impacts when in use or discarded. These effects are not directly under the control of the operator of the installation.

Industrial regulation controls all four of these phases of activity[1] and the way that the regulatory framework relates to each phase is summarised in Figure 1. The EU's 1992 Fifth Environmental Action Programme[2] recognised these different strands to improving sustainable performance of industry and a range of measures were subsequently adopted, as will be seen below. Some regulations are focused on one specific area (eg limiting emissions of one pollutant), while others may link these

[1] For a more comprehensive survey of UK and EU environmental legislation and its impacts on industry see The IEEP Manual of Environmental Policy: the EU and Britain, published by Elsevier.
[2] Towards Sustainability: A European Community Programme of Policy and Action in relation to the Environment and Sustainable Development. COM(92) 23.

phases together (eg reducing raw material use by reducing waste production). All may be assessed in the light of the sustainable development principles described above.

The regulatory framework described below will show how the objectives of sustainable development have been, over time, incorporated into decision making. However, it is important to stress that whatever regulation exists, its contribution to sustainable development will only be as good as the actual decisions that are taken. Thus sufficient capacity (staff numbers, experience, etc) of regulators and industrial companies forms an essential prerequisite for the effective implementation of this framework.

Land Use Controls

Controls on the activities of industry may result not just from the operation of the process itself (and its subsequent outputs), but also from a consideration of where such industry should be located and the way that the installation is constructed. This is a function of the land use planning system. Local authority development plans identify those locations where specific types of industrial development may be appropriate. In addressing these issues local authorities will consider current land use (eg existing industrial facilities), the views of local residents and wider infrastructure needs (eg additional road construction).

In seeking to operate a new industrial installation, an operator will need both to obtain planning permission and the relevant pollution permits (eg an IPPC authorisation). These will often be sought from different institutions (and even when the installation is small and granted a pollution permit by the local authority, different departments may undertake these functions).

The most obvious environmental regulation to affect developers is the requirement for an Environmental Impact Assessment[3]. This requires a range of types of development (sometimes with 'size' thresholds) to have an assessment of the impact of the construction and operation of the development on the environment, including, for example, effects on local residents. If potential adverse effects are noted, then the environmental statement should indicate how these might be avoided or mitigated.

Clearly an EIA will assess the potential impacts of pollutants from a proposed development. Thus the operator may be required to provide the same or similar information to both the local authority and the industrial regulator. The government has issued guidance[4] stating that 'local authorities should not seek to duplicate controls which are the statutory responsibility of other bodies', ie the planning system should not be used to make pollution control decisions. While communication between a local planning officer and staff in the Environment Agency or SEPA might assist mutual understanding of process operation, PPG23 is particularly concerned about links between planning and pollution control functions within local authorities, stating that 'local authorities must operate their various control systems at arm's length in accordance with the respective regulations and guidance'. Planning controls are seen as potentially complementary to pollution control, but the two systems are

[3] Directive on the assessment of the effects of certain public and private projects on the environment, 85/337/EEC, OJ L175, 5.7.85, amended by 97/11/EC, OJ L73, 14.3.97.
[4] DoE (1994). Planning Policy Guidance (PPG): 23. Planning and Pollution Control. HMSO, London.

separate. The broader role of industrial regulation within land use planning may change with the adoption of an EU strategic environmental assessment Directive[5]. This will certainly set industrial development policies in a broader context, although it is unclear what the practical implications on industrial activity might be in the UK.

Under the IPPC regime (see below), consideration is being given to some integration of the EIA process with the integrated environmental assessments needed to apply for an IPPC permit. With significant duplication of information between these documents, combining them would benefit the operator as well as provide more contextual information on the process to the planning authorities and the industrial regulator.

Industrial development poses problems for the interpretation of the principle of intra-generational equity. It is clear that housing around industrial developments is less desirable and may contain communities with lower than average incomes for those towns and cities. Thus, discussion at the 2000 Environment Agency annual general meeting concluded that 'environmental costs are borne disproportionately by the poor'[6]. On the positive side, of course, such industry is a major provider of employment. There is an obvious tendency to encourage new industrial development alongside existing developments. This could be for reasons of infrastructure support, environmental protection facilities and reducing the spread of loss of amenity. Ultimately equity issues will be the province of national and local authority policies, eg relating to urban regeneration, the precise regulatory impact on industry of these being difficult to determine.

Resource Use

Once an industrial installation is constructed and becomes operational it begins using resources. Resource use may be regulated under a range of different frameworks. Where resources are renewable any regulation should focus on whether use exceeds their regeneration. Where resources are not renewable, regulation may make different judgements about what level of depreciation is reasonable. There is clearly a link between resource use and economic growth and the challenge is to achieve the latter, while reducing the former. The European Commission's proposal for a Sixth Environmental Action Programme , for example, contains a specific objective of 'de-coupling the use of renewable and non-renewable resources from the rate of economic growth'.

One resource commonly used by most industrial installations is water. Some installations may abstract water directly from surface or groundwater sources, others may take water from water company supply systems. For the former, abstraction is regulated by the Environment Agency. The system of abstraction licences is currently under proposed review[7]. In particular older licences were often given with no time limit and proposals have been made to set time limits for all licences. Water use by industry does contribute to environmental problems of low flow rivers and lowering

[5] Directive on the assessment of the effects of certain plans and programmes on the environment. Provision joint text approved by the Conciliation Committee. PE-CONS 3619/01.
[6] Achieving Environmental Equality. Environment Agency, Bristol. 2000.
[7] Taking Water Responsibly - Government decisions following consultation on changes to the water abstraction licensing system in England and Wales. DETR and Welsh Office. 1999.

groundwater levels. However, the quantities involved are significantly less than abstraction for domestic or agricultural reasons. In Scotland SEPA does not have the abstraction regulation role that the Agency has in England and Wales. However, this is likely to change with the transposition of the EU water framework Directive into Scottish law.

Under the Integrated Pollution Control regime water use was not regulated and the Environment Agency and SEPA had no direct control over use from the mains. However, the IPPC[8] regime has introduced resource use as a principle for determining BAT. It is to be expected that efficient use of water will be an important consideration as installations are brought within this new regime.

The 2000 EU water framework Directive[9] also establishes statutory requirements to maintain sustainable levels of surface and ground waters. This is defined as abstraction of waters not being in excess of recharge. This will be an important driving force in re-assessing abstraction licences and other areas of water use. However, what implications it will have on the industrial sector specifically is uncertain.

IPPC also considers other forms of resource use. While any resources may be addressed within permit conditions, that of energy use may be particularly important. This would assist both in achieving the goal of reducing greenhouse gas emissions and in reducing resource costs to industry.

An important principle of waste management is to reduce resource use in the production process. Regulation may provide precise objectives in this regard, such as in relation to packaging waste and end-of-life vehicles (see below). However, regulation may simply establish principles of resource use reduction rather than specific targets.

Production of Pollution

Controls on Emissions to the Air

Controls of emissions to air from industrial processes have a long history in the UK. These began as far back as 1273 with a prohibition on the use of coal combustion in London. However, the first 'modern' legislation controlling emissions to air was the series of Alkali Acts in 1863, 1874 and 1906. These established as range of principles that are still found in current regulation. These included:

- controls on emissions from stacks and from fugitive emissions;
- statutory emission limits (the first being for hydrogen chloride);
- the concept of 'best practical means' for controlling emissions;
- a system of registration and inspection (Health and Safety at Work Act, 1974).

[8] Directive on integrated pollution prevention and control, 96/61/EC, OJ L257, 10.10.96.
[9] Directive establishing a framework for Community action in the field of water policy, 2000/60/EC, OJ L327, 22.12.2000.

The impact of the early legislation was limited to certain industries and did not prevent the severe London smog of 1952. As a result the 1953 Clean Air Act was passed (amended in 1968). This established smokeless zones in which coal could not be burnt in open domestic fires and required increased stack heights in many areas.

Early legislation in general required control of 'noxious' emissions from a limited number of 'scheduled processes'. Inspectorates had a duty to ensure that processes used the 'best practicable means for preventing the escape of noxious or offensive gases…and for rendering such gases where discharged harmless and inoffensive'. The Industrial Air Pollution Inspectorate was responsible for a number of installations, although many were the responsibility of local authorities. While the Clean Air Acts 1956 and 1968 and the Public Health Act 1936 gave powers to the latter to prevent emissions of dark smoke, many emissions could only be controlled under provisions of nuisance, ie action could only be take once the problem had arisen, not in anticipation of the problem.

The passage of the Environmental Protection Act 1990 provided a significant change in the duties available to the, then, Her Majesty's Inspectorate of Pollution in England and Wales and Her Majesty's Industrial Pollution Inspectorate in Scotland. These changes were in part a response to the adoption of a number of EC Directives[10], but also to debate within the UK regarding reform of the regulatory system. Certainly the system produced by the Environmental Protection Act 1990, Integrated Pollution Control (IPC), was ahead of developments at the EU level and was important in shaping the EU's own future legislation in this area (IPPC).

Under the Environmental Protection Act 1990 industrial processes were divided into two groups. Larger installations were to be regulated by HMIP under IPC, while air emissions from smaller processes in England and Wales would be regulated by local authorities under the system of local authority air pollution control (LAAPC). While HMIP produced 'chief inspectors guidance notes' detailing what was considered the Best Available Techniques Not Entailing Excessive Cost (BATNEEC) for different categories of process (including emission limits), these were not binding. Specific permit conditions could be determined on the basis of the circumstances of that installation, eg local conditions or technological developments since the publication of the guidance. This flexible approach will continue with the publication and use of BAT guidance notes under IPPC. Those processes regulated by local authorities, however, were subject to standard emission limits detailed in documents issued by the Department of the Environment. Following the passage of the Pollution, Prevention Control Act 1999 IPPC will be regulated by both the Environment Agency and local authorities (largely depending upon whether they were originally regulated under IPC or LAAPC). Small process will remain under LAAPC. In Scotland, where there are fewer installations, all of those under IPC/IPPC and LAAPC are regulated by SEPA.

EU Directives have also established statutory emission limits for a limited number of processes. Typically these have either related to those emitting large volumes of pollutants or those which may be particularly toxic. Limits have been established for:

[10] Particularly the Directive on combating of air pollution from industrial plants, 84/360/EEC, OJ L188, 16.7.84.

- Large combustion plants (mostly power stations)[11];
- Hazardous waste incinerators[12];
- Municipal waste incinerators[13];
- Emissions of volatile organic compounds from a wide range of processes[14].

Where appropriate such limits will now be applied within IPPC permits.

A third strand of EU legislation affecting emissions to air from industry is that aimed at controlling transboundary air pollution, particularly that leading to acidification, eutrophication or tropospheric ozone pollution. While many of the actions in the UK to limit total emissions have been derived from international fora, particularly the UNECE Convention on Transboundary Air Pollution, limits to total emissions are also established at the EU level. The 1988 large combustion plant Directive was particularly important in driving UK policy. As a result pollutant sources such as power stations were required to reduce emissions based on a national plan. This became stricter following the adoption of the 1994 UNECE Second Sulphur Protocol. More recently a Multi-Pollutant Protocol was signed in 1999 and this has stimulated the development of a proposed EU national emission ceilings Directive (COM(1999)125, 9.6.1999). While all of these developments mean that national issues have to be addressed alongside individual permit determinations, the basis for these agreements has changed. Other developments under this Convention include the 1998 Protocol on Persistent Organic Pollutants, which will also require action by some industries.

Firstly, the proposed Directive will apply to all pollutant sources, so will affect a wider range of industrial installations as well as other sectors such as transport, agriculture, etc. This will be important in ensuring that the most cost effective solutions are determined across all sectors in an equitable way.

Secondly, recent UNECE and EU developments have been derived from the 'effects-based' approach using assessments of critical loads and levels of pollutants. These determine the level of pollutant deposition (load) or concentration (level) below which adverse effects no long occur. By modelling techniques taking account of sources across Europe and the relative sensitivity of the different environments attempts have been made to optimise emission reductions for different countries to maximise environmental protection at minimal cost. Naturally, significant debate is still occurring over cost issues. However, this approach, which deviates from the earlier one of setting arbitrary national limits, can be viewed as taking full account of the principle of environmental carrying capacity. Given the scale of the problem, though, no proposal would yet lead to the elimination of exceedence of all critical loads and, in this regard, emissions will remain unsustainable (although significantly improved).

[11] Directive on the limitation of emissions of certain pollutants into the air from large combustion plants, 88/609/EEC, OJ L336, 7.12.88.
[12] Directive on the incineration of hazardous waste, 94/67/EC, OJ L365, 31.12.94.
[13] Directive on the prevention of air pollution from new municipal waste incineration plants, 89/369/EEC, OJ L163, 14.6.89.
[14] Directive on the limitation of emissions of VOCs due to the use of organic solvents in certain activities and installations, 1999/13/EC, OJ L85, 29.3.99.

Controls on water discharge

Early controls on the pollution of water were based on common law whereby civil courts would judge claims for nuisance. The first legislation to make water pollution a criminal offence was the Rivers Pollution Prevention Act 1876 whereby it became an offence to allow 'any poisonous, noxious or polluting liquid proceeding from any factory or manufacturing process' to enter a water course. However, the Act also severely limited the circumstances where it would apply in the 'seat of manufacturing industry'.

Modern legislation begins with the Rivers (Pollution Prevention) Act 1951 which placed a duty on the River Boards to maintain or restore the wholesomeness of rivers. The Act gave the Boards powers to grant consents for discharges and to establish emission limits. The latter power was rarely used and the nature of the consents granted reflected the perceived use to which the rivers were put. The Control of Pollution Act 1974 largely consolidated previous legislation. Only with the passage of the Water Act 1989 was it possible for the Secretary of State to set statutory water quality objectives for different types of waters. The Act also created the National Rivers Authority with responsibility to monitor and control water pollution. One year later the Environmental Protection Act 1990 introduced the IPC regime, whereby a single industrial permit would also contain the discharge limits required by the NRA.

The development of the various strands of UK water legislation relating to industry owes much to EU legislation. Key items of EU legislation that were formative in developing UK policy were:

- The 1976 dangerous substances Directive[15] established requirements for emission limits and for environmental quality standards for specific lists of dangerous substances;
- The 1978 fish life Directive[16] established environmental quality criteria for rivers;
- The 1980 groundwater Directive[17] prevented or limited discharge of lists of substances into groundwater aquifers;
- The 1991 urban waste water treatment Directive[18] included limited requirements for discharge from industrial installations.
- The 1996 IPPC Directive included a requirement for emission limits to be established for a wide range of industrial installations via a determination of BAT.

This legislation is clearly far from comprehensive. However, it includes requirements for consents, statutory emission limits and statutory water quality objectives which are the basis for current UK practice.

At the end of 2000 the water framework Directive was adopted. This was specifically developed to overcome the fragmentary nature of previous EU legislation and will

[15] Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community, 76/464/EEC, OJ L129, 18.5.76.
[16] Directive on the quality of fresh waters needing protection or improvement in order to support fish life, 78/659/EEC, OJ L222, 14.8.78.
[17] Directive on the protection of groundwater against pollution caused by certain dangerous substances, 80/68/EEC, OJ L20 26.1.80.
[18] Directive concerning urban waste water treatment, 91/271/EEC, OJ L135, 30.5.91.

have significant impacts on future protection of surface waters in the UK. Key elements include:

- An integrated administrative approach to water management;
- The Directive applies to rivers, lakes, estuaries, coastal waters and ground waters;
- All waters will have environmental objectives defined according to ecology and chemistry;
- Abstraction of waters will need to be 'sustainable';
- Discharge consents will be based on the 'combined approach' of IPPC, using strict emission limits combined with a need to ensure environmental quality standards are complied with. The Directive incorporates the 1976 dangerous substances Directive. This was done in order to tackle the problem of discharges to water from industrial installations which are not regulated under the IPPC Directive.

The precise implications of this new Directive for the UK are uncertain. However, even with the improvement in river water quality in recent years, there are still significant bodies of water which, in the language of the Directive, cannot be considered as having 'good ecological status'. It is likely that the discharge consents for a number of industries will need to be reviewed, within IPPC permit determinations or other regimes where appropriate.

It is also important to note that substances are not the only form of pollution that may be produced by an industrial process. Under IPC and IPPC thermal discharges are also included in the range of the issues to be addressed. The River Trent in Nottinghamshire has a series of power stations located along it that result in stretches of elevated water temperatures maintaining fish populations typical of much warmer climates. The requirements to achieve 'good ecological status' under the water framework Directive will mean additional regulatory action to be taken as these power stations are permitted under IPPC.

The implementation of existing EU water legislation and legislation specific to the UK has improved environmental protection. However, it cannot be said to have a system capable of delivering a sustainable water environment. Powers exist which have never been used, eg that for establishing statutory special ecosystem standards. The water framework Directive should change this. Protection is afforded to all waters, not just to those that the UK government deems to designate. The objectives are based on the ecology of the water bodies – the final arbiter of whether the water is in a good condition. All pollution sources are covered that may affect the objectives of the Directive. If implemented correctly, this Directive should establish a regulatory system capable of delivering sustainable water management, including the impacts that industry has on that environment. Unless the UK seeks derogations for specific water bodies, these objectives will need to be delivered by December 2015.

Land contamination

Much of the regulation concerning contaminated land (eg Part II of the Environment Act 1995) actually concerns cleaning up existing contaminated land to prevent it creating a threat to the environment, rather than controls on the creation of contaminated land *per se*. Such controls are the province of pollution control regimes,

including IPPC and waste regulation. Land contamination is clearly a long-term sustainability issue. We experience the problems and expense of cleaning contaminated sites that we have inherited from previous generations and, therefore, there is a need to reduce our legacy for the future. The IPPC regime takes particular account of the problem. Not only does it require permits to take account of pollution to land generally, but a new installation must indicate how it will return the site on which it is located to a condition similar (or better) to that which existed prior to its operation. This assists in internalising this long-term issue within the industrial economic market.

Waste Regulation

Waste regulation has always addressed issues in a wider context than industrial regulation alone. This is particularly so when considering non-hazardous waste. Where a process does produce hazardous waste, then the particular management strategies adopted for its disposal may be viewed more clearly within the context of industrial regulation.

The Control of Pollution Act 1974 introduced a system of waste management based on waste disposal plans and licences, in particular making it an offence to dispose of waste (including industrial) to land unless that land was licensed by the waste disposal authority. These requirements were expanded under the Environmental Protection Act 1990 and the Environment Act 1995, whereby waste disposal control was to be undertaken by the Environment Agency.

Early regulation of the generators of solid waste by industrial installations was very limited. Only with the introduction of IPC in 1991 and, more comprehensively, with IPPC in 1999 has waste production been incorporated into a more holistic framework. Even now, however, much of the regulatory pressure on waste produced by industry is indirect, acting via constraints on waste disposal facilities more generally, such as via the UK landfill tax.

The principles of waste management may be viewed in terms of the waste hierarchy: reduction, reuse, recovery and disposal. These principles apply equally to industrial waste. However, many waste management decisions for particular regions will take an integrated approach to all waste arisings.

The most recent policy statement for waste management in England and Wales was the government's Waste Strategy in 2000[19]. A National Waste Strategy: Scotland was published in December 1999. Some of the aims relate to waste from industry, eg for England and Wales:

- to consider the scope for economic instruments to tackle hazardous waste and the use of hazardous substances;
- to achieve a target to reduce landfilling of industrial and commercial waste to 85% of the 1998 level by 2005.

[19] Waste Strategy 2000 for England and Wales, DETR. 2000.

UK policy builds upon EU legislation, particular the waste framework[20] and landfill[21] Directives. However, these establish principles concerning pre-treatment, restrictions on disposal options for different types of waste, etc, which have to be interpreted in individual cases for their effects on industry. Clearly, where disposal routes for waste from an industrial installation are no longer available or more difficult to comply with, then this exerts pressure on industry to seek alternatives, including changes to the production process.

An important recent development for industry in the area of waste management has been that of legislation concerning producer responsibility, ie that the manufacturers of products should retain responsibility for their environmental impacts after they have left the factory gate. Most notable has been the packaging waste Directive[22]. This limits the amount of packaging waste going to final disposal through re-use and recovery. In 2000 an EU Directive on end-of-life vehicles was adopted[23]. This sets quantified targets for the reuse/recovery of end of life vehicles, with responsibility for the collection and management being with the vehicle manufacturers. A proposal for a Directive on waste electrical and electronic equipment (COM(2000)347, 13.6.2000) would establish targets for collection of waste and require producers to take responsibility for certain phases of the waste management of their products, thus promoting waste minimisation.

Accidents

Damage to the environment may not occur through the normal operation of an installation, but take place when that operation goes wrong, ie through accidents. Regulation of installations in relation to accidents is largely undertaken through implementation of the EU 1996 COMAH Directive[24] (which replaced similar Directives dating from 1982 and later). This requires an operator to notify the regulator of installations where dangerous substances are present, to prepare a safety report and an internal emergency plan. This will identify potential hazards and the responses to be taken for different potential emergencies. A local authority also prepares an external emergency plan. Given that the regulations protect both workers and the environment, the competent authorities to regulate industry include both the Health and Safety Executive and the Environment Agency (or SEPA). Under the IPPC Directive the operator also has to consider the effects of potential accidents in seeking a permit. Given that the COMAH Directive only applies to those installations with specified 'dangerous substances', the effect of the implementation of IPPC may be to extend contingency planning to a wider number of industrial installations.

Noise

Prior to the Noise Abatement Act 1960, noise could only be controlled by the courts following a common law action for nuisance. General noise regulation is now undertaken through Part III of the Environmental Protection Act 1990. However, the

[20] Directive on waste 75/442/EC, OJ L194, 25.7.75, amended 91/156/EEC, OJ L78, 26.3.91.
[21] Directive on the landfill of waste 1999/31/EC, OJ L183, 16.7.99.
[22] Directive on packaging and packaging waste, 94/62/EC, OJ L365, 31.12.94.
[23] Directive on end-of-life vehicles, 2000/53/EC, OJ L269, 21.10.2000.
[24] Directive on the control of major accident hazards involving dangerous substances, 96/82/EC, OJ L10, 14.1.97.

IPPC Directive also introduced noise as one issue to be addressed in permit determinations for those installations regulated by the Directive. Other EU noise legislation concerns various types of transportation and construction plant. These are not usually relevant for general industrial operation. Under IPPC local authorities have the responsibility to determine appropriate noise limits, which are, where necessary, included in permits issued by the Environment Agency or SEPA.

In 2000 the European Commission published a proposal for a framework Directive on ambient noise (COM(2000)468, 26.7.00). This would include noise generated by transport and industry and Member States would need to establish common methods to assess and map noise levels. Within six years of coming into force the Commission could make additional proposals for noise reduction goals and for protection of 'quiet' areas in open country. Such legislation would provide a broad noise strategy lacking currently in the UK.

Environmental Quality Constraints

The previous sections have surveyed industrial regulation regimes in terms of emissions controls. In seeking to identify what controls to require on discharges it is possible to adopt one of two approaches:

- to set discharge limits as strict as possible, given the constraints of current technology and some determination of what costs are acceptable. This approach assumes that pollution should simply be minimised and might be viewed as precautionary, at least in part;

- to determine what levels of pollution are acceptable in the environment (eg what concentrations of pollutants result in no adverse impacts) and determine what level of discharge is consistent with this environmental objective. This approach builds on the concept of the environment's carrying capacity.

In practice regulators are now required to use both methods in setting discharge limits. This 'combined approach' is required both by the 1996 EU IPPC Directive and the 2000 EU water framework Directive. In effect the combined approach requires pollutant emissions to be minimised, while at the same time confirming that this also ensures adverse impacts to the environment do not occur.

The setting of environmental objectives is usually achieved by establishing standards[25], eg for pollutants, in different media. There is, however, some misunderstanding about the nature of environmental standards by many stakeholders. In practice standards may be set a three levels:

- at the threshold for impact, also known as a 'no effect level'. If this is accurately determined, concentrations of a pollutant below this level should not result in any adverse impacts;

- at the threshold for impact, plus a safety factor. This safety factor may be of one or more orders of magnitude. Such standards are often established for toxic

[25] RCEP (1998). Setting Environmental Standards. 21st Report. HMSO, London.

substances such as pesticides. A safety factor is required because the no effect level may be determined on a limited number of organisms and a precautionary approach is needed to ensure that all potentially sensitive organisms (especially humans) are protected;

- above the threshold for impact. This can occur because no safe level of a pollutant can be determined (eg for radioactive contamination) or, alternatively, because the costs of meeting such threshold levels are prohibitive.

Clearly the implications for industrial regulation and the environment vary depending on the type of standard adopted. Where industrial emissions do not cause a standard set at the threshold for effect (or with a safety factor) to be exceeded, there is no obvious benefit to be gained from further emission reductions. However, if the standard is set above the threshold for impact, additional emission reductions may lead to benefits, even though the standard is met. For example, the first daughter Directive of the EU air framework Directive[26] provides a standard for sulphur dioxide for vegetation (a threshold for impact) and for PM_{10} for health (where no safe level is known). Both are standards, but mean different things. Two standards established in regulation might have the same legal (and hence regulatory) meaning, but have different contexts in terms of environmental sustainability.

It is also important to note that statutory standards have now moved well beyond the simple statement of a particular concentration of a substance in the environment. Standards are also established for ecological systems. Two examples illustrate this:

- the 1992 EU habitats Directive[27] requires that the favourable conservation status is determined for sites designated under the Directive. This could relate to abundance or distribution of particular species or a complex functioning of whole habitats. However, this favourable conservation status acts as a statutory 'standard' in implementing other legislation such as IPPC. Thus the Environment Agency is, for example, currently reviewing all discharge consents that might result in an effect on the favourable conservation status of sites;

- the 2000 EU water framework Directive requires that 'good ecological quality' of all rivers, lakes, estuaries and coastal waters is determined. This is a complex assessment of a range of biological characteristics. However, the result will act as a statutory obligation on Member States to ensure that this quality does not deteriorate, eg through industrial discharges to water.

From these developments it can been seen that an understanding of the environmental constraints to be interpreted through industrial regulation is becoming increasingly complicated.

Statutory environmental objectives or standards have not historically been a feature of UK law. While standards have been identified, the UK has traditionally allowed the Regulator some flexibility in determining whether meeting such standards is an absolute priority in permit determinations. EU legislation has changed this. A range of

[26] Directive on ambient air quality assessment and management, 96/62/EC, OJ L296, 21.11.96.
[27] Directive on the conservation of natural habitats and of wild fauna and flora. 92/43/EEC. OJ L206, 22.7.92.

EU Directives has introduced an increasing number of obligatory environmental standards, especially for air and water, over the past thirty years.

This difference in approach between the UK and EU is reflected in the UK Government's guidance on the use of air quality standards in setting permit conditions under IPPC. The IPPC Directive requires that such conditions must not result in emissions which lead to a breach of an environmental quality standard set out in other EU legislation. The UK follows this requirement. However, the UK has also established its own standards, eg for air quality, which do not have an EU counterpart as yet. The Government guidance does not require that IPPC permit conditions meet these standards, although there is pressure to do so. These UK standards have been 'decoupled'. Assuming both EU and UK environmental standards are similarly related in scientific terms to the achievement of environmental sustainability, the regulation framework means that, in practice, their actual relationship to this objective may be different.

Product Controls

A wide variety of controls exist on products. Many of these relate to consumer protection, but an increasing number take account of the wider environment. This is important, in that there is little point in undertaking a strict control of emissions from a process, if dangerous substances are 'emitted' in the form of products. Similarly, responsibility for products may alter company performance throughout their manufacturing life cycle.

Standards for individual products may be established in different ways. For example, the European Commission is currently proposing a Directive (COM(2000)347, 13.6.2000) on the use of hazardous substances in electrical and electronic equipment. The purpose of the proposal is to facilitate recycling and disposal, by requiring the phase out of substances such as lead, mercury, cadmium, etc, from a range of electrical products.

Chemicals

One particular range of products which has seen extensive regulation is that for chemicals. EU chemicals policy, in particular, has had two main objectives:

- To ensure protection of workers, consumers and the general environment;
- To ensure the operation of the single market.

These two strands are often difficult to disentangle, although it is the former which is of interest in this paper. Thus EU legislation concerning the labelling of chemicals has obvious environmental objectives, eg ensuring safe use, but also facilitates the operation of the free market for those products in all Member States. It was for this latter reason that much EU chemicals policy was developed before many other areas of environmental legislation. In most cases this predated the development of coherent chemicals policies in the Member States. Thus EU chemicals policy dominates national policy more completely than other EU environmental policy areas.

EU chemicals policy has a number of different strands, the following of which are most relevant to this paper:

New Chemicals

Legislation in this area began in 1967, but has since been amended many times. The manufacturer of a new chemical is subject to a prior notification system whereby they must submit the results of tests to evaluate possible harmful effects to a competent authority in a Member State. If no objections are raised within a given period, the manufacturer then has assured access to the entire market of the EU. This legislation takes a precautionary approach, requiring a demonstration of safety before approval, but it also serves the needs of the common market.

Existing Chemicals

Legislation introduced in 1993 requires manufacturers and importers of existing chemicals (before 18/9/1981) above certain quantities (10 tonnes per year) to provide information on risk assessments of these substances. This information will then be used to determine whether they pose a risk to health or the environment. The European Commission develops a list of priority substances, taking special account of substances that may be carcinogenic or that may have other chronic effects. Each substance on the priority list is then allocated to a Member State, which designates a rapporteur to carry out the assessment. The majority of chemicals that are manufactured are 'existing' and, given the difficulties in undertaking the assessment process, there is limited control on many environmental consequences of their production.

The UK is developing a chemicals strategy which is aimed at influencing the development of an EU chemicals strategy. Both will address the need to take a broader view of existing chemicals. In order to support the UK strategy a Stakeholder Forum has been established, which includes manufacturers. This Forum will advise Ministers on criteria for priority substances.

For both new and existing chemicals the assessment of risk distinguishes clearly between 'hazard' and 'risk'. Hazard is a property intrinsic to the substance, such as its toxicity. 'Risk' concerns the likelihood of harm to health or the environment and thus depends upon exposure. Reducing risk can be achieved either by reducing the hazard (eg using alternative chemicals) or reducing exposure (eg preventing release of the chemical into a particular environment).

Restrictions on Marketing and Use

Following a risk assessment undertaken for chemicals, marketing and use of a substance may be restricted, or even banned. Legislation for this was first introduced in 1976 and amended many times. Other measures may also ban specific products. This has included the phasing out of the production and use of chlorofluorcarbons, implementing the 1990 Montreal Protocol. This is a good example of regulation

taking a long term and global sustainability perspective as CFCs have no local or regional impacts.

Packaging and Labelling

Important for both environmental protection and operation of the market is that substances are appropriately packaged and labelled. Since 1967 the EC has adopted a range of Directives to ensure this is undertaken.

Exports

Controls on substances within the EU do not necessarily apply outside the Union. Of particular concern has been the potential for the export of dangerous substances to third countries, especially the developing world. Since 1988 legislation has developed which requires that such countries must give ‘prior informed consent’ before they are allowed to be exported from the EU. This is important in supporting the principle of intragenerational equity.

Chemicals legislation in the UK has not been developed in a unified or strategic way. The elements of EU legislation outlined above have been progressively introduced in primary and secondary legislation, most notably the Health and Safety at Work etc Act 1974, the Consumer Protection Act 1987 and the Environmental Protection Act 1990.

Ecolabel

The promotion of good environmental performance by industry may be achieved through the use of 'ecolabels', whereby the consumer is informed that the product on sale has been produced in a way that meets certain environmental performance standards above those required by direct regulation. Various labels are found in the UK, although that relating to manufacturing industry is the EU's own ecolabel. This is a voluntary scheme covering specific product types, for which the Commission has published environmental performance criteria. However, development has been slow and by early 2000 only 41 ecolabels had been awarded to 31 manufacturers covering 216 products across the EU. The UK is disappointed in progress and views the potential development of an integrated product policy as a means to stimulate ecolabeling.

Integrated product policy

Integrated product policy (IPP) is seen as a tool to internalise the environmental costs of products throughout their life cycle through the use of market mechanisms. This builds on developments such as life cycle analyses. However, where these may be used to make regulatory decisions (eg on resource use, emissions, etc), IPP focuses on the context in which the products are sold. In 1998 the DETR issued a consultation paper on IPP, which supported the principle. At the end of 2000 the European Commission also produced a Green Paper on IPP which examined a range of options to reduced the environmental impacts on manufactured products. Potential methods to achieve this include:

- extension of the scope for and role of eco-labels and energy labels;
- differentiated tax rates according to their environmental performance, e.g. reduced VAT on products awarded the eco-label;
- development of criteria on environmental performance for product groups enabling differentiation between the green and less green products e.g. strategies for benchmarking, performance indicators and self-declarations;
- encouragement of eco-design of products through elaboration, dissemination and application of guidelines;
- producer responsibility for goods at the end of their life cycle e.g. further Directives relating to take back of end-of-life products and deposit refund systems.

Many of these issues are developments of existing measures. However, it would provide a more coherent framework in which to promote improved environmental performance of products.

Additional Mechanisms to Improve the Environmental Performance of Industry

These mechanisms include various forms of economic instruments and flexible measures such as negotiated agreements or tradable permits. In this context they are only described as 'additional' in that they are outside the traditional command and control approach to establishing precise requirements on industrial operators through permits. Such mechanisms can be successful in linking industrial performance with the requirements of sustainable development.

Economic instruments

An economic instrument imposes a financial incentive (eg a tax or tradable permit) incrementally related to the level of 'undesirable activity' (eg quantities of pollutant emitted or resource used). There is considerable support for such instruments from those seeking to integrate sustainable development principles into industrial policy[28]. Examples include possible energy or carbon taxes, the UK climate change levy and the landfill tax. Economic instruments may also be simpler in scope, such as the differential levels of tax imposed on leaded and unleaded petrol in the UK. Economic instruments such as these integrate well with the polluter pays principle, providing an advantage to any industrial process that results in less burden on the environment. However, for reasons of political acceptability, such taxes cannot be excessive and, therefore, there may be a limit to the range of activities which they might affect. For example, research by the DETR has suggested that a tax on water abstraction would need to be very large before it would result in significant reductions in water use[29]. This is not considered to be desirable.

Tradable permits

Tradable permits provide a system whereby overall restrictions, eg total pollutant emissions, are placed upon an industrial sector, for example, but the individual

[28] See for example the Conclusions of the Council of the EU, May 14-15, 2001 on a strategy for integration of sustainable development into the enterprise policy of the European Union.
[29] See Economic instruments in relation to water abstraction: a consultation paper, DETR, 2000.

companies within that sector are free to trade the content of those permits between themselves. This allows companies to invest in cleaner technology and recoup some of those costs through sale of the 'saved' emissions to others. Such trading may take place at three levels:

- movement of emissions between installations owned by a single company, eg sulphur emissions within company bubbles for the UK power generators;
- trading between companies, eg sulphur emissions between US power generators;
- trading between countries, eg on carbon dioxide emissions.

There has, in fact, been limited use of this tool in the UK and even within the EU, where the single market and largely common regulatory regime might facilitate it. This system cannot be used where permit conditions are necessary to protect the local environment, unless the trading takes place between a group of companies in one locality (as might be the case with water abstraction). However, in achieving global and long term sustainable solutions, tradable permits may assist in reducing costs to industry and stimulate investment in cleaner technology.

Negotiated agreements

Negotiated agreements occur when an industrial sector, for example, undertakes to deliver a specific objective voluntarily. The regulator does not specify how it is to be delivered (eg emission limits on individual installations), but allows the sector to determine the least cost route overall to achieving the goal. This has obvious advantages in reducing compliance costs and administrative burdens. Such agreements can be reached at a national level or at an EU level. A recent example of the latter was an agreement with the detergent manufacturing industry, which has proved patchy in its implementation. It is important to note that negotiated agreements have a limited role in implementing EU legislation. This is because Member States are required to transpose EU legislation into national law, thus imposing specific requirements on industry. Thus the option of flexibility afforded by a negotiated agreement is not possible (even if all parties are confident of implementation and costs would be reduced).

Currently in the UK discussions are being held between different industry sectors and the DETR on negotiated agreements to improve energy efficiency. This process is linked to the climate change levy, whereby those sectors that successfully conclude an agreement will receive a reduction in the levy imposed upon them. This is an interesting example of integrated these two types of 'novel' regulatory mechanisms.

It is interesting to note that just at the time when such mechanisms are being explored in more detail, recent legislative developments may have restricted their potential use. In particular, the IPPC Directive requires that installations are permitted and that these permits contain emission limits. There is considerable debate about how flexible this system will be for forms of control which do not establish such limits. In contrast, the water framework Directive identifies such mechanisms as appropriate within an overall programme of measures to improve water quality.

Liability

A further measure that can be adopted to take action against damage to the environment (including from industry) is to establish a liability regime. Such a regime exists in the UK, through a number of different Acts. In particular polluters are generally liable for the costs of removal of the pollution that they have caused. In 2000 the European Commission published a White Paper on environmental liability (COM(2000)66, 09.02.2000) which considers proposals that would extend significantly the liability regime currently in place in the UK. Key proposals included:

- coverage of both "traditional" damage (harm to persons and property) and "environmental" damage (contaminated sites and damage to natural resources or "biodiversity");
- strict liability (no need to prove fault);
- no retroactivity (applying only to damage occurring after the regime comes into force, leaving Member States to decide how to deal with the backlog from the past);
- liability channelled to the operator in control of the offending activity;
- restriction to activities classified as dangerous under other EC legislation, except for biodiversity damage, where other activities would be drawn in on a fault basis;
- biodiversity damage confined to sites designated under the EC's Natura 2000 network;
- "commonly accepted" defences, some alleviation of the plaintiff's burden of proof, but also some equitable relief for defendants where pollutants were released within the terms of statutory permits.

Environmental management

Environmental management schemes are voluntary measures whereby an operator seeks certification for an installation based on a range of criteria aimed at improving the environmental performance of the enterprise. These criteria include a need to monitor and review environmental performance, resulting in continuous improvement and the adoption of management systems within the company to achieve this. Independent verification procedures are established to ensure quality control. Two schemes are open to UK industry. ISO 14001 is an international standard agreed in 1996. The EU also has its own Regulation adopted in 1993[30], which was revised in 2001[31]. The revision extends the scope of EMAS to cover more organisations, promotes integration with international standards, promotes the involvement of employees and strengthens the role of the environmental statement. ISO 14001 has proved more popular in the UK as, unlike the EU EMAS Regulation, ISO 14001 does not require the production of a validated environmental statement and only requires continuous improvement in the company's environmental management system, not environmental performance.

Although the schemes are voluntary, they have been important in raising awareness of environmental issues across the entire operation of industrial installations and in communicating these issues to many staff. When undertaken properly they should

[30] Regulation allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme, 1836/93, OJ L168, 10.7.93.
[31] Regulation allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), 761/2001, OJ L114, 24.4.2001.

assist in promoting more sustainable industrial activity. Traditionally there has been a separation of environmental management approaches from specific regulation. However, under IPPC consideration is being given to options of easing the regulatory burden of IPPC to those companies fully in compliance with environmental management schemes.

Integrated Regulation

Over the last twenty-five years there has been increasing pressure to integrate the environmental regulation of industry. This pressure has been driven by environmental considerations (ensuring that measures to control pollution to one medium do not lead to adverse effects in another medium) and from industry (seeking a 'one stop shop' to the administrative burden of regulation). For UK industry the key milestones in integrated regulation are:

- The introduction of the concept of 'Best Practicable Environmental Option' (BPEO) by the Royal Commission on Environmental Pollution (RCEP) in 1976.

- The promotion of an integrated approach to pollution control in the UK by the RCEP in 1988.

- The introduction of integrated pollution control (IPC) in Britain by the Environmental Protection Act (1990), implemented in England and Wales in 1991 and in Scotland in 1992.

- The creation of the Environment Agency and Scottish Environment Protection Agency in 1996 with a specific objective of integrating their regulatory functions.

- The adoption of the EU Directive on Integrated Pollution Prevention and Control (IPPC) in 1996, to be implemented between 1999 and 2007.

The previous survey of air, water or waste regulation has shown that early regulations were often highly specific in their objectives, focusing on particular substances or processes and establishing discharge requirements limited to these problems. The growth of the integrated approach has seen a progressive inclusion of controls within one medium, an integration of approaches across media and finally an attempt to include environmental concerns beyond those caused by pollutant discharges. Accompanying these developments has been an integration of administrative arrangements for regulation.

Integrating environmental concerns into a single decision-making process means that some judgement is made as to the relative merits of different process options in terms of their overall environmental impact, rather than separate decisions being made for individual issues, such as air and water pollution. This need for an integrated assessment underlies the concept of the 'Best Practicable Environmental Option' (BPEO). The RCEP introduced the concept of the BPEO in 1976[32], largely addressing

[32] RCEP (1976). Air Pollution: An Integrated Approach. 5th Report. HMSO, London.

the need to minimise the overall environmental damage from the effects of pollutants. The term was more clearly elaborated in the RCEP's 1985 report[33], which stated that:

'The aim [of the BPEO] is to find the optimum combination of available methods of disposal so as to limit damage to the environment to the greatest extent achievable for a reasonable and acceptable total combined cost to industry and the public purse.'

and

'In selecting a BPEO for a given case one must take into consideration all the relevant factors: those operating at a distance as well as those close at hand, in the longer term as well as in the present, and loss of amenity as well as actual damage.'

Clearly, the RCEP envisaged a holistic approach with a long-term view - a framework consistent with the objectives of sustainable development. Indeed issues of environmental equality, through a consideration of public values, were also considered by the RCEP in this context in 1988[34]:

'The advice of experts may be sufficient to ensure that best results for the environment are secured. However, where the trade-offs are difficult or controversial, the selection of a BPEO cannot be left to scientists, industrialists and regulatory experts alone. Public involvement is needed so that the public values underlying the choice of a BPEO are identified and clearly understood.'

In UK pollution regulation the use of the BPEO concept has two important strands - its use within IPC and as a principle of waste management.

The Environmental Protection Act (1990, section 7) requires that the Best Available Techniques not Entailing Excessive Cost (BATNEEC) are used to determine industrial permits but that these have *'regard to the Best Practicable Environmental Option (BPEO) available as respects the substances which may be released'*.

The Environment Agency published guidance on how BPEO assessments should be undertaken within IPC determinations[35]. This provided a detailed assessment framework requiring an industrial applicant to determine an 'integrated environmental index' of the discharges from a process. This index was a combination of comparisons of discharges to environmental standards in different media. The procedure was complex and the combination of disparate data in different media open to debate. In practice few permit conditions were altered as the result of such analyses.

The IPPC Directive was transposed into UK through the Pollution Prevention Control Act 1999 (and subsequent Regulations). The Act no longer uses the term 'BPEO', largely because the DETR sought to distance the holistic integrated environmental assessment required by IPPC from what is saw as 'spurious numerical methods' developed for IPC. However, the integrated environmental assessments required by

[33] RCEP (1985). Managing Waste: The Duty of Care. 11th Report. HMSO, London.
[34] RCEP (1988). Best Practicable Environmental Option. 12th Report. HMSO, London.
[35] Environment Agency (1997). Best Practicable Environmental Option for Integrated Pollution Control. Technical Guidance Note E1. HMSO, London.

IPPC are, in fact, closer to the BPEO assessments envisaged by the RCEP than those introduced into UK law for IPC.

Overall an integrated environmental assessment of an installation under IPPC should address:

- emissions of pollutants to all media;
- prevention, reduction, recovery and disposal of waste;
- efficient use of energy;
- use of raw materials;
- prevention of accidents;
- remediation of sites after cessation of activities (eg soil contamination).

The Directive (and subsequent UK legislation) does not tell the regulator or operator how to undertake such an assessment. It is expected that more reliance will be given to 'expert judgement' rather than a fixed procedure. The Environment Agency will consult on a draft of the proposed methodology during 2001.

The BPEO concept is also important in UK waste management. However, in this context, the concept is not established in statute, but as a principle within policy documents. In the Waste White Paper BPEO determinations explicitly require an assessment of the environmental impacts of different waste management options together with an assessment of the costs of those options. Some guidance is given as to what the BPEO might be in individual circumstances (generally following the principles of the waste hierarchy), although these will vary depending upon the geographical location. This type of analysis would apply to management options surrounding significant quantities of industrial waste.

Clearly, the issues raised in the debate over industrial regulation and BPEO mirror that regarding sustainability concerns. Each requires an operator to take account of a range of different environmental concerns over different time periods. While operators can seek to reduce their impacts in all of these areas, difficulties arise where trade-offs have to take place. How are comparisons to be made?

A further issue to be considered in determining integrated environmental assessments for IPPC for the BPEO for waste management is who should be the final arbiter in that determination. As stated above the RCEP saw an important role for the inclusion of public values into the assessment and this was further elaborated by the RCEP in its 1998 report on environmental standards. The Environment Agency has a 'selected licence application procedure' which enables particularly contentious applications to be determined with extensive consultation. However, current concern by residents over waste incineration is linked to assessments of the BPEO for waste management. The communication of the complexity of such assessments to the public is difficult and presents a challenge to the operator and regulator.

Public Information

Over the years that industrial regulation and general environmental protection measures have been developed, it has become increasingly apparent that an important element involves the provision of information to the public. This is now seen as

particularly important in the context of sustainable development. It is not possible to improve environmental equality (intra-generational equity) without individuals and communities having access to information. Similarly, the development of the Local Agenda 21 process has stimulated an increasingly participatory process in understanding the local environment and planning for its maintenance and improvement.

Information is often seen as a two-edged sword by some operators, in that the information may be open to misinterpretation, especially where the public has to confront the concept of risk. However, it is generally accepted that information should be as freely available as possible and that it is up to industry, regulators and others to argue for their interpretation of that information.

Most legislation regulating industry contains requirements that information concerning the operation of the installation, particularly in relation to releases or other risks to the environment should be made public. Often such information is in the form of public registers, eg for permit applications and monitoring results under IPC and IPPC. The 1990 EU Directive on freedom of access to environmental information[36] establishes a duty on public authorities to supply information, with certain exemptions such as issues of confidentiality. Thus information relating to the regulation of installations may also be made public through this route. The 1998 Aarhus Convention on access to information requires an extension to the rights of access under current legislation and the European Commission has proposed an amendment to the IPPC Directive as a result (COM(2000) 839, 18.01.2001). In particular, the amendment would require that NGOs are included within the definition of 'the public' and that the reasons for individual permit decisions are made publicly available.

Sustainable Development Principles

It is difficult to envisage what a sustainable society would consist of, or even how this would be reflected in the industrial sector. However, in many instances it is possible to identify trends, policies, etc, which are either moving towards or away from this opaque goal. Industrial environmental regulation can be judged in this (imprecise) context.

If one defines environmental protection as including maintenance and enhancement of the natural environment, improvement of human health and enhancing amenity, then environmental regulation of industry has, to greater or lesser degrees, contributed towards sustainable development.

This paper has only addressed one of the three 'pillars' of sustainable development (environmental, social and economic development). Early industrial development in the UK was driven by economic objectives and environmental and social protection and development measures were slowly imposed upon this goal. The integration of these three strands is difficult to achieve. Typically UK environmental legislation has left much of this decision making up to individuals, such as those issuing environmental permits. Obligatory environmental quality standards, for example,

[36] Directive on the freedom of access to information on the environment, 90/313/EEC, OJ L158, 23.6.90.

were introduced from EU legislation. These constrain the options open to the regulator.

Early legislation also focused on abating severe nuisance issues. Long-term problems of environmental contamination were rarely addressed. Recent legislation to take account of these inter-generational issues has, in part, resulted from our having to deal with our inheritance of these problems from previous generations.

A major element of pollution legislation today is derived from an understanding of carrying capacity. Introducing pollutants into the environment above its capacity to cope with them is undesirable. However, even then other constraints may require acceptance of this. For example, the EU's Fifth Environmental Action Plan stated that the long-term objective of the EU should be that critical loads are not to be exceeded across Europe. This statement was made ten years ago, yet the current negotiating positions of all EU institutions on a proposed national emissions ceilings Directive would not meet this objective. Clearly other concerns relating to economic development and employment are influencing these positions.

The role of the precautionary principle is more problematic to interpret. A precautionary approach has, in retrospect, been evident in much environmental regulation. These range from the use of safety factors in setting environmental quality standards for toxic substances to the construction of containment infrastructure to manage potential industrial accidents. There are many causes of uncertainty and there will always be debate about how this should be managed and taken account of in regulatory instruments. A particular difficulty occurs where the issue of uncertainty is of concern to the public, which may not accept reassurances provided by industry or the regulator. This is currently a critical issue under much discussion, which also relates to much which is central to the debate over sustainable development.

Conclusions

This paper provides only a brief overview of the regulatory framework affecting the environmental performance of industry. It does not address other objectives relating to sustainable development (eg social), although it clearly shows that there has been a continuing improvement in that performance, thus contributing to environmental sustainability.

Industrial regulation has evolved from the establishment of specific and precise legal requirements to a framework which is integrated and requiring interpretation on a case by case basis. This trend can lead to some uncertainty to the industrial operator, but it is essential in order to incorporate the objectives of sustainable development. A holistic approach to environmental protection requires that principles be established which can only be interpreted as permits are determined. Assessing relative impacts in different media and weighing up the consequences for short and long-term contamination require complex analyses. Incorporating wider sustainability issues, such as economic costs and social impacts, only adds to the complexity.

Industrial regulation is taking an increasingly long term perspective. Early legislation concentrated on local nuisance concerns, but allowed the continued contamination of air, land and water. However, controls on the phase-out of certain products, eg CFCs,

and measures based on concepts of cumulative carrying capacity (whether of a river or the global environment) now establish a framework closer to that required to achieve sustainable development. Within this system there is uncertainty and debate on the equitable distribution of measures between individual industries and between industrial and other sectors. It has also opened the debate between short or medium term social and economic objectives and longer term environmental objectives.

Increasing complexity is also one driver in the development of alternative measures of industrial regulation. Eco-taxation or voluntary agreements, for example, indicate that a goal is recognised by government and industry, but leaves the specific means to achieve that goal to be developed by industry in the most cost-effective way. Indeed it can be argued that measures that ensure least cost solutions are those most likely to ensure that industry remains competitive and secures employment and economic growth for the future. This would, therefore, contribute to all three 'pillars' of sustainable development.

Having said this, the regulatory framework has never been as complex and comprehensive as it is today. The challenge is to ensure that such regulation does not lead to decisions which are less sustainable than those which could be made under alternative instruments. It is welcome, therefore, that measures such as IPPC do include some flexibility of approach in determining individual permits.

This analysis has not been able to identify any specific instrument which hinders the achievement of sustainable development for the industrial sector, although there is some debate concerning waste management issues more generally. This is not to say that an instrument might constrain decision making for sustainable development in an individual circumstance.

In conclusion the following principles of industrial regulation enhance the ability of operators and regulators to make decisions more consistent with the objectives of sustainable development:

- a holistic approach to the operation of a process and its products - from 'cradle to grave';
- a long term perspective is essential, whether this concerns persistent local contamination or global environmental change;
- an integrated approach to the operation of a process taking account of all environmental media;
- measures that integrate environmental performance with market mechanisms thereby allowing least-cost routes to attaining these goals;
- measures and individual decisions increasingly based on the carrying capacity of the environment rather than fixed or arbitrary objectives, thus involving reductions or bans on the levels of emissions, etc.

This paper has, where appropriate, also indicated some proposals for future developments in industrial regulation, particularly from the EU. Some of these build upon existing frameworks (eg additional air quality standards), but others may assist in achieving more sustainable industrial performance (eg integrated product policy).

As stated at the outset, sustainable development is not a defined 'destination'. Thus it is not possible to be clear at this point about the implications of all current and proposed instruments on whether they significantly contribute towards sustainable industrial development. However, although we cannot see the destination, we are also neither at the start of the journey. We are building on much that has gone before and the suit of instruments available should address most issues of relevance to the industrial sector. At all times, however, re-examination and review are necessary as our understanding of the complex relationship between industry and the environment improves.

Glossary of Abbreviations

BAT	Best Available Techniques
BATNEEC	Best Available Techniques Not Entailing Excessive Cost
BPEO	Best Practicable Environmental Option
CFC	Chlorofluorocarbon
COMAH	Control of Major Accident Hazards
DETR	Department of the Environment, Transport and the Regions
EC	European Community
EIA	Environmental Impact Assessment
EMAS	Eco-management and audit scheme
EU	European Union
HMIP	Her Majesty's Inspectorate of Pollution
IPC	Integrated Pollution Control
IPP	Integrated Product Policy
IPPC	Integrated Pollution Prevention and Control
ISO	International Standards Organisation
LAAPC	Local authority air pollution control
LCA	Life Cycle Analysis
NRA	National Rivers Authority
OJ	Official Journal (of the European Community)
PPG	Planning Policy Guidance
RCEP	Royal Commission on Environmental Pollution
SEPA	Scottish Environment Protection Agency
UNECE	United Nations Economic Commission for Europe
VAT	Value Added Tax
VOC	Volatile Organic Compound

Figure 1. The Regulatory Framework for Industry relating to Environmental Protection