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Investigating the effectiveness of compliance assessment activities

Science Report: SC040042/SR

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This report is the result of research commissioned and funded by the Environment Agency's Science Programme.

Published by:
Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, BS32 4UD
Tel: 01454 624400 Fax: 01454 624409
www.environment-agency.gov.uk

ISBN: 1844325024

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Dissemination Status: Publicly available

Keywords: compliance, assessment, modern, regulation, indicators, environmental, outcome, risk

Research Contractor:
None - internal project

Environment Agency's Project Manager:
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Collaborators:

Science Project reference:
SC040042

Product Code:
SCHO0705BJQD-E-P

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Steve Killeen
Head of Science

Executive Summary

Background

In *Delivering for the Environment* (Environment Agency, 2005), we made a clear commitment to adopt a risk-based, outcome-focused approach to modern regulation. Compliance assessment is central to this approach and provides the means to ensure operators comply with permits for regulated processes and activities. Our objective in this pilot study was to provide evidence that our approach to compliance assessment supports the principles of modern regulation. We also aimed to identify any need for further work to ensure our approach is supported by sound science. It is important that we have objective evidence to support our regulatory approach in the face of increased scrutiny by Government and other external stakeholders.

Our findings

Our review of the use of environmental indicators showed that, currently, few are directly relevant to compliance assessment. The development of suitable indicators would aid how we assess the influence of compliance assessment. We recommend further work to develop specific indicators that relate compliance assessment to environmental outcomes and environmental risk. The development of compliance assessment indicators should be part of an integrated approach to the management and use of environmental information across our organisation.

We used an influence matrix approach as a first attempt to identify a qualitative baseline for judging the influence of compliance assessment in the context of modern regulation. The approach has the potential to be developed and might be used, for example, to analyse trends or step changes in compliance assessment.

We developed a generic framework and methodology to assess the effectiveness of compliance assessment. This was tested qualitatively in case studies that covered different scales of regulatory activity – an individual landfill site, the pulp and paper sector and two examples at regime level from water resources. These provided qualitative evidence that the principles of modern regulation are being applied to compliance assessment activities in ways that improve effectiveness and efficiency.

Our case studies provided evidence of good practices in compliance assessment and permitting that support our risk-based and outcome-focused approach to regulation. This suggests that the principles of modern regulation are being embedded into our regulatory activities.

Further work is required to provide objective, and preferably quantitative, evidence on the link between risk-based compliance assessment, environmental outcomes and environmental risk. We recommend a programme of research to help ensure that sound science supports our compliance assessment activities and our modern regulation approach.

Contents

1. Introduction

1.1 Purpose and objectives

An essential element of our approach to environmental regulation is to assess an operator's compliance with the conditions set in a licence or permit. Increasingly, we are adopting risk-based approaches to compliance assessment. We implemented this project as an initial investigation into the effectiveness of risk-based compliance assessment.

Our principal objective is to:

- provide evidence that our approach to compliance assessment supports the principles of modern regulation (see text box).

Other objectives are to:

- recommend a programme of research that will ensure our compliance assessment activities are supported by sound science;
- develop a baseline and an assessment framework for our compliance assessment activities.

These objectives are consistent with our stated aim in *Making it Happen* that we will use risk-based approaches and sound science to focus on environmental outcomes (Environment Agency 2000b).

Principles of modern regulation

Any modern regulatory regime must meet the five principles set out by the Better Regulation Taskforce. It must be:

- **transparent** – we must have rules and processes which are clear to those in businesses and local communities
- **accountable** – we must explain ourselves and our performance
- **consistent** – we must apply the same approach within and between sectors and over time
- **proportionate** (or risk-based) – we must allocate resources according to the risks involved and the scale of outcomes which can be achieved
- **targeted** (or outcome-focused) – the environmental outcome must be central to our planning and in assessing our performance

Throughout this report, the term 'modern regulation' refers to these principles of good corporate governance that have been adopted by the Environment Agency in 'Delivering for the Environment' (Environment Agency 2005).

The way that we regulate is under increasing scrutiny by Government and other external stakeholders, including the:

- National Audit Office and Public Accounts Committee;
- Cabinet Office Regulatory Task Force;
- HM Treasury's Hampton review of inspection and enforcement (Hampton, 2005).

This high level of scrutiny makes it essential that we have objective evidence to support our risk-based approach to regulation. This project responds to that challenge by seeking data to evaluate the effectiveness of risk-based and outcome-focused regulatory approaches compared to traditional approaches. We also sought an understanding of how our regulatory activities influence the behaviour of the regulated community and affect environmental risk.

1.2 Regulatory cycle

The scope of this project is focused primarily on the compliance assessment part of the regulatory cycle (*Figure 1.1*). Environment Agency staff carry out about 200,000 compliance assessment inspections each year so there is potential for a modern regulation approach to bring substantial benefits. Our findings focus on compliance assessment, but may have implications for other parts of the regulatory cycle since all the activities are closely linked.

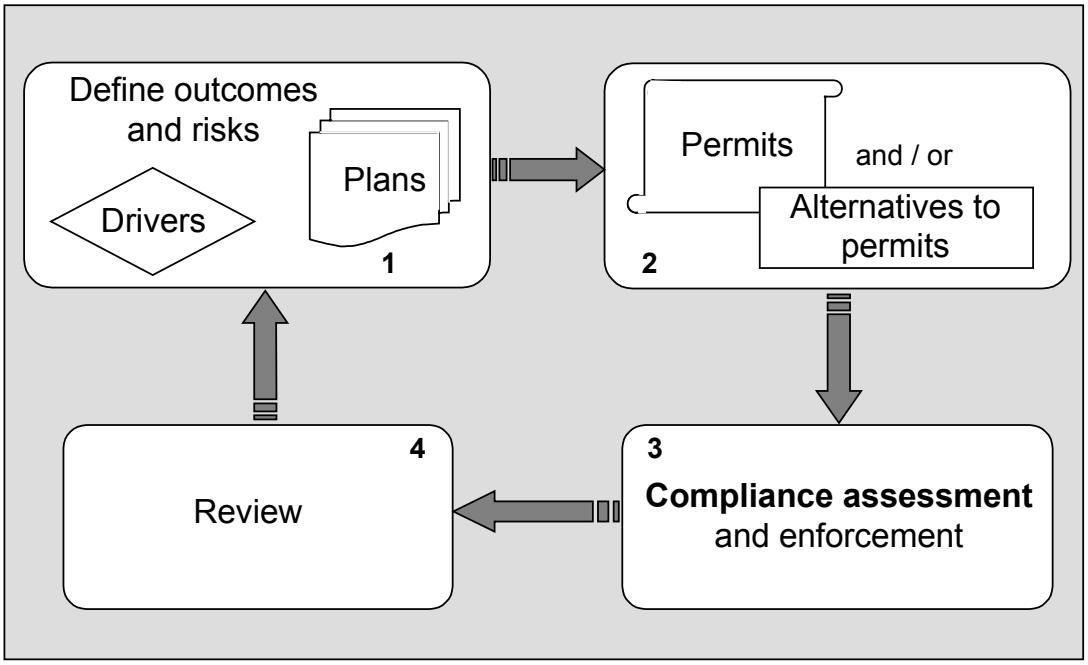


Figure 1.1 The regulatory cycle.

1.2.1 **Compliance assessment**

We aim to improve and protect the environment by specifying appropriate requirements in the permits for the processes and activities that we regulate. Compliance assessment allows us to check whether an operator is complying with these regulatory requirements

and to decide whether further action is required. Compliance assessment involves a mix of activities, as shown in *Figure 1.2*.

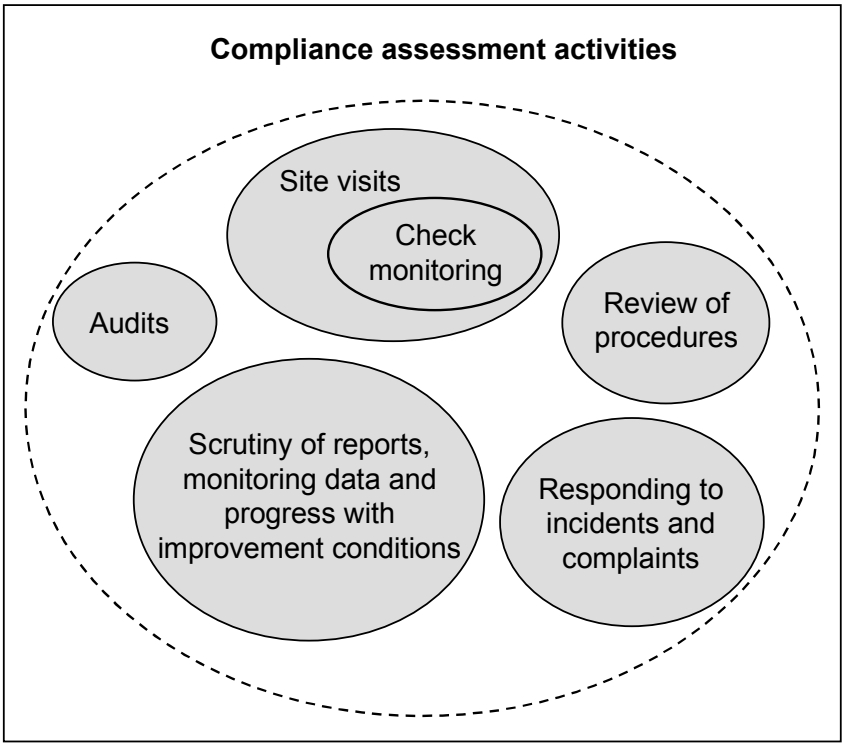


Figure 1.2 Compliance assessment activities.

Resources for compliance assessment will be allocated on the basis of risk, which includes management and operating performance, complexity of the activity, environmental impact and location. We are progressively introducing new tools to help us assess risks so we can allocate resources effectively. These include Compliance Assessment Plans (CAPs), Operator Pollution Risk Appraisal (OPRA) and the Compliance Classification Scheme (CSS). These tools are discussed in more detail in Section 3.2.2 of this report.

1.3 Report structure

The remainder of the report is structured as follows:

- Section 2 describes briefly the methods used in this project.
- Section 3 presents our results and observations and consists of four sub-sections: (a) the use of environmental indicators, (b) review and characterisation of compliance assessment, (c) development of an assessment framework and (d) the related case studies.
- Section 4 summarises the conclusions.
- Section 5 gives a prioritised list of recommendations.

2. Methods

2.1 Project structure

The project consisted of four tasks:

- reviewing the use of environmental performance indicators;
- reviewing and characterising compliance assessment;
- undertaking case studies to evaluate the influence of our compliance assessment activities;
- examining the underlying science and developing recommendations for future work.

These four tasks were completed over the 6 month duration of the project.

2.2 Environmental indicators

A brief search of the external literature and our internal documentation identified over 260 potentially relevant documents on the use of environmental performance indicators. These were examined and, based on professional judgement and the extent of citations in certain key documents, 25 documents were selected for more detailed review (see list in Annex A). The review considered the science of environmental indicators and models for conceptual frameworks based on the types, categories and uses of environmental indicators. The review sought to identify:

- good practice;
- availability of indicators relating to compliance assessment and to environmental risk;
- data that might be used to develop indicators that link compliance assessment and environmental performance, including environmental risk.

2.3 Reviewing and characterising compliance assessment

We gathered information about our current practice in applying indicators to compliance assessment activities by reviewing internal documents and speaking to relevant staff. This information was used to develop a baseline, using an Excel spreadsheet, that identifies the major regulatory and corporate influences that arise from, and act on, compliance assessment activities.

We also developed a wide-ranging list of indicators that might have potential to demonstrate the effectiveness of compliance assessment (see Annex B).

An assessment framework methodology was developed. A generic plan–do–check–review model was selected, on the basis of past experience, as a pragmatic way forward. The model provides a framework that allows compliance assessment activities to be analysed against the principles of modern regulation. It should also allow the question of the effectiveness of compliance assessment to be addressed by the derivation and analysis of suitable indicators against performance targets.

2.4 Case studies

Four case studies were selected to test the assessment framework across different regulatory levels or scales, regulatory regimes and functions:

- a landfill site with a waste management licence regulated by Environmental Management;
- pulp and paper sector with Pollution Prevention and Control (PPC) permits regulated by Process Industries Regulation;
- deregulation of the abstraction licensing regime regulated by Water Resources;
- Streamlining Abstraction Processes (SAP) being implemented by Water Resources.

The case studies were selected with advice from and agreement of the Project Board. Information for the case studies was obtained by either face-to-face interviews or telephone interviews with relevant Environment Agency staff.

2.5 Underlying science

We used information from the preceding tasks to provide an overall view of the science that underlies compliance assessment activities. This was analysed to determine whether there is an adequate scientific basis on which to assess the links between compliance assessment and environmental performance. We then developed recommendations for a programme of research to assess further the impact of compliance assessment to:

- provide objective evidence of the influence of compliance assessment on the environmental performance of regulated sites and on environmental risk;
- inform decisions on the priorities allocated to compliance assessment activities by targeting specific sectors or regulatory regimes.

3. Results and observations

3.1 Environmental indicators

The Environment Agency, European Environment Agency (EEA), Department for Environment, Food and Rural Affairs (Defra) and Organisation for Economic Co-operation and Development (OECD), all use large sets of environmental indicators (Environment Agency 2000a, European Environment Agency 2003, Defra 2004, OECD 2004). There is no unified indicator set in use, but there are similarities between sets. Indicator sets are generally organised by environmental themes and policy uses and they mostly provide 'state of the environment' information and address environmental states and pressures. Our literature review showed that these existing environmental indicators do not present information directly about the effectiveness of environmental regulation or compliance assessment activities. Neither do they provide much information on environmental risk.

The types of information that we currently gather and process within the Environment Agency reflect our organisation's focus and generally refer to 'state of the environment'. For example, indicators relate to waste and resources, flood risk, land and air quality and wildlife. The existing indicators provide a useful context for the baseline of this project; indicators such as those presented in the *Spotlight* (http://www.environment-agency.gov.uk/business/444255/1110581/?lang=_e) and *What's in Your Back Yard* (http://www.environment-agency.gov.uk/maps/). Reports provide indirect measures to evaluate compliance assessment.

From our examination of environmental indicator studies for Germany (Walz 2000), vehicle manufacture (Tam 2002), Sweden (Deutsch *et al*. 2003) and Canada (Environment Canada 2003), we concluded that the environmental indicators in current use are insufficiently developed to use as environmental compliance and enforcement indicators. These studies provide some valuable points about the limitations of indicators and recommend indicators that:

- monitor the dynamics of ecosystem resilience and performance;
- are functionally–related, to measure the resource deployed per functional outcome;
- integrate organisation design and decision processes;
- are aggregated into an overall pressure index for a specific problem area.

Work on environmental compliance and enforcement indicators is in the early stages of development through the joint programme of the INECE and the OECD (INECE-OECD 2003). There is not yet much readily accessible information on the proposed indicators, but this work has the potential to make a significant contribution towards demonstrating the effectiveness of compliance assessment and modern regulation. The Environment Agency already participates in INECE, which should continue so that we might influence international development of compliance assessment indicators, possibly through the work of this project and any subsequent studies.

3.1.1 **Conceptual frameworks**

Conceptual frameworks provide a structure in which to develop and use environmental indicators. Two widely recognised conceptual frameworks for environmental indicators are:

- Pressure—State–Response (PSR) model as applied by the OECD (Linster 2003);
- Driving forces, Pressures, State of the environment, Impacts and societal Responses (DPSIR) model as used by the EEA (European Environment Agency 2002).

The OECD reports useful work on selection criteria, types of indicators and good practice in the design and use of indicators. It notes the need to strengthen the use of indicators in policy evaluation and in national reviews of environmental performance. The OECD does not provide an indicator set focused on compliance assessment or modern regulation principles.

The EEA *Signals* report (EEA 2002) describes a DPSIR model that uses a socio-economic and environmental assessment framework to characterise indicators. It presents key indicators to illustrate the most important environmental trends and progress in policy domains, such as reducing the emissions of acidifying pollutants. Analysis of the EEA's DPSIR indicators used by the EEA is outside the scope of this report, but more detail can be found on the EEA's web site (http://themes.eea.eu.int/indicators/all_factsheets_box).

Our review suggests that conceptual frameworks for environmental indicators may have limited usefulness and can introduce complications, such as indicators can often be classified in more than one part of a framework.

3.1.2 **Indices of indicators**

We also reviewed indices of indicators (Goldberg 2002, Environment Agency and URS Corporation 2004) as potential models to develop suitable indices for compliance assessment or for the broader role of modern regulation.

An interesting example is provided by the German Environment Index (Deutsche Umwelt indeX (DUX)). Typical output for DUX is shown in *Table 3.1* (information source: http://www.umweltbundesamt.de/index-e.htm). DUX provides an illustration of environmental trends based on the relative achievement of environmental targets within six fields – climate, air, soil, water quality, energy and raw materials. These are not absolute indicator values, but a calculation of each indicator's relative achievement of the target for a particular year compared to a base year value. Complete achievement of a target would give a maximum score of 1000 points, with the base year value being 0. Where the situation worsens compared to the base year, a negative score results. DUX does not describe the state of the environment in Germany, but illustrates the degree to which environmental policy goals have been achieved in some critical areas.

The basis for DUX is the 'Environment Barometer for Germany', found at http://www.umweltbundesamt.de/dux-e/umweltbarometer.htm, which presents detailed annual environmental data for each of the six DUX indicators. The DUX indicator value is based on calculation of the relative change compared to the base year and the percentage achievement of the target for the particular year. The example calculation

Table 3.1 German Environment Index (DUX).

DUX for September 2002	
Indicator	*Score (max. 1000 points)*
Climate	615
Air	698
Soil	–100
Water	295
Energy	239
Raw materials	82
Total score (max. score 6000)	**1829**

provided on the web site is based on data for 1998, when emissions to air were 45.9 per cent lower than in the base year (1990). The target for air quality for 1998 was a reduction of 70 per cent compared to 1990, so the percentage achievement of the target was calculated as [(45.9/70)*100] = 65.6 per cent. This value was multiplied by a factor of 10 to give a DUX indicator score for air quality of 656. It is recognised that information is lost in calculating this score.

The DUX web site makes clear that the index is focused on policy performance and is linked to environmental pressures and targets. This might be an area for future development, since evaluating the links between policy and environmental performance could help inform future developments of the modern regulation approach.

3.1.3 **Indicator position**

We identified from the literature review that environmental indicators are used at different 'positions' within an overall hierarchy, which ranges from corporate planning information to international indicator sets. The hierarchy is illustrated in *Table 3.2*.

We can use this hierarchical classification to provide a framework in which to think about the management of indicator information relevant to compliance assessment and overall environmental outcomes. The 'position' of an indicator is defined by the:

- scale of the activity being indicated, for example, whether local area indicators, or national and international state of the environment reporting;
- scale of the dominant primary groups of producers and users of the indicator set. Within the Environment Agency, for example, local operational teams through to national corporate reporting represent different dominant groups with different uses for the information from indicator sets;
- direction of the dominant flow of indicator information tends to be linked to the scale at which the information is required – for example, collated and processed data are presented at different scales as it moves from Area reports to the national *Spotlight* report.

Table 3.2 Direction of indicator information flow.

Direction of information flow	*Type of information*
	**Corporate work planning** - information on resource allocation closely linked to corporate reporting below
	Raw information - local operational information
	Aggregated operational information - refined information, such as key performance indicators
	Corporate reporting - corporate scorecard
	Nationally reported indicator information - *Spotlight*, State of environment
	Nationally reported indicator information - Defra sustainable development indicators
	Internationally reported indicator information - OECD and EEA indicator sets

3.1.4 Discussion on use and development of environmental indicators

Our literature review did not identify any relevant published international or regulatory experience of using environmental indicators to demonstrate the effectiveness of compliance assessment or the principles of modern regulation. Continuing involvement in the INECE-OECD programme will provide a good perspective on other regulators' knowledge and experience.

Some existing environmental indicators used within the Environment Agency are suitable for demonstrating the influence of risk-based, outcome-focused modern regulation (see Annex B, *Table B.1*), but the set of existing indicators is not sufficient to show the influence of compliance assessment on environmental performance and environmental risk. There is a need to improve existing indicators and add new indicators that:

- match the five terms (resources, risk, environmental outcome, scale of achievable outcome and assessment of performance) used in the modern regulation principles;
- can be aggregated to provide indicators that match these five terms;
- are consistent and comparable across the whole organisation;
- enable the full value of the indicator information to be utilised in our regulatory tools and systems.

An extensive and illustrative list of candidate indicators has been developed (see Annex B, *Table B.2*). From this list, a small set of appropriate indicators to evaluate the effectiveness of compliance assessment could be identified and agreed, but this will require further work.

To provide information relevant to assessing the influence and effectiveness of compliance assessment and modern regulation, it is likely that indicators will need to be combined to provide 'aggregate' indicators. 'Aggregate' indicators could provide usable measurements of risks and environmental outcomes. To demonstrate the influence of modern regulation effectively, the processing of relevant indicator information should become a routine operation. If 'aggregate' indicators are difficult to design or use at an operational level, the same information may be aggregated at national level. This type of processing is already carried out at a national level using existing indicator information to produce the *Spotlight* report, corporate scorecards and the State of the Environment report.

Conceptual frameworks, such as PSR and DPSIR, may have limited usefulness. They can introduce other complications in that indicators are often classifiable in more than one part of a framework. It is also misleading to use a framework that implies causality between indicators because the indicators may be affected by many factors, including complex environmental interactions.

3.1.5 **Conclusions from literature review**

In summary, our literature review found:

- useful OECD work on conceptual frameworks for indicators;
- no relevant case study, or set of relevant environmental compliance and enforcement indicators, that meets the requirements of this project;
- a need to develop environmental compliance and enforcement indicators that can be used to assess the effectiveness of compliance assessment and to judge the influence of the Environment Agency's modern regulation;
- useful ongoing work by INECE-OECD to develop environmental compliance and enforcement indicators;
- examples of indicator indices that potentially could be applied to modern regulation to assess the links between policy performance and environmental pressures and targets.

We were unable to identify in our literature review any specific indicators that link compliance assessment to environmental outcomes and environmental risk, although we did note that some work is in progress. We recommend further work to improve existing indicators and develop new indicators that can provide:

- quantitative evidence about the influence of compliance assessment on environmental performance and environmental risk;
- objective evidence of the effectiveness of compliance assessment in achieving the desired environmental outcomes;
- information on potential improvements in effectiveness and efficiency in our regulatory systems.

We recommend that development of compliance assessment indicators should be part of an integrated approach to the management and use of environmental information across the organisation.

There is also a need to evaluate alternative approaches to obtain the required information by aggregating existing indicators either at the operational level or at the national level. Further work is required to develop 'aggregate' indicators that can demonstrate the influence of modern regulation. Much of the data to support the use of 'aggregate' indicators is already collected within the Environment Agency, but further work is required on information management.

In the longer term, we recommend that:

- any improved indicators should be designed to be consistent with, and add increased value, to our regulatory tools and systems;
- the potential for using higher levels of indicator information should be evaluated. This may be through an index of indicators to collate and summarise indicator information or through a conceptual framework for indicators to guide the management of indicator information. Such approaches could help in communicating complicated information to different audiences and possibly aid analysis of long-term trends in indicator data.

3.2 Review and characterise compliance assessment

3.2.1 **Background**

Compliance assessment means, within the Environment Agency, the overall approach taken to check compliance with permit conditions, including the emissions monitoring programme and, where relevant, compliance with a site's improvement programme. It does not include permitting, enforcement or prosecution. The mix of activities that comprise compliance assessment is discussed in Section 1.2.1.

Compliance assessment, as defined by the Environment Agency, is equivalent to 'environmental inspection' as defined by the European Council (Council of the European Communities 2001). This difference in terminology is interesting since, in the UK, we use the term inspections more normally to mean a site visit or audit rather than the entire mix of compliance assessment activities.

3.2.2 **Modern regulation approach to compliance assessment**

The principles of modern regulation are defined in *Delivering for the Environment* (Environment Agency 2005a). The two considered most relevant to compliance assessment are:

- **risk-based** (proportionate) – 'we must allocate resources according to the risks involved and the scale of outcomes which can be achieved';
- **outcome-focused** (targeted) – 'the environmental outcome must be central to our planning and in assessing our performance'.

These principles rely on relationships between the component terms of assessing performance, environmental outcome, risk, resources and the scale of achievable outcome, as illustrated in *Table 3.3*. One of the benefits of breaking the principles down

into their component terms in this way is that it provides a basis for developing potential indicators relevant to compliance assessment.

Table 3.3 Modern regulation principles, terms and relationships

Principle	*Definition relating terms within each principle*	*Relationship based on each principle*
Risk-based (proportionate)	Allocate resources according to the risks and scale of achievable outcomes	Resources proportionate to risk
		Resources proportionate to scale of achievable outcomes
Outcome-focused (targeted)	Environmental outcome must be central to planning and assessing performance	Resources proportionate to scale of achievable outcomes
		Assessment of performance is proportionate to environmental outcome

The two principles provide the principal elements of our modern regulatory approach and are already embedded in our compliance assessment and reporting systems. For example, in:

- Environmental Protection's OPRA (EP OPRA) – a multi-attribute risk assessment tool to assess the environmental hazards associated with a site and how well they are being managed. OPRA allows the regulatory effort to be targeted. It supports the polluter pays principle and through a cost-recovery charging framework can provide a financial incentive to operators to improve their environmental risk management performance.
- Compliance Classification System (CCS) classifies an operator's non-compliance with permit conditions according to the potential impact on the environment. It provides a consistent means to escalate action if an operator repeatedly breaches permit requirements and it can be used to help direct resources where we identify risks.
- public reporting of compliance performance in the annual *Spotlight* report.
- operator self-monitoring and Operator Monitoring Assessment (OMA).

Examples of compliance assessment systems at the development stage and designed to improve modern regulation approaches include:

- Generic Compliance Assessment Methodology that sets out the overarching framework for compliance assessment for all regimes.
- Compliance Assessment Plans (CAPs), which will be used to ensure that, within a defined period, compliance is checked against all requirements of the permit and other relevant regulatory requirements. They also identify the types of compliance assessment activity required and the level of resources that we will assign to these tasks. A CAP can be developed at the site or sector level and will identify the level of resources to be assigned to the various compliance assessment activities.
- Integrated Site Database (ISD), part of the Integrated Regulation of Agriculture Project. This is being designed to collate information from multiple regulatory regimes for individual farms so that officers can assess compliance with a range of legislation.

It is planned that the ISD will generate a schedule of farm visits prioritised based on an assessment of risk.

To characterise compliance assessment against each principle, indicators must be used that match the terms and relationships relied on by that principle. Few existing indicators can provide information on the influence of compliance assessment and modern regulation. We identified an extensive list of indicators that might have potential as measures of the effectiveness of compliance, listed in Annex B. We recognise that it would be impractical to use large numbers of indicators in attempting to relate compliance assessment to environmental outcomes. We recommend that any future work should:

- design and use environmental indicators for compliance assessment that more fully take account of the principles of modern regulation;
- analyse the current regulatory practices, regulatory tools and indicator systems, with reference to *The Regulatory Book* (Environment Agency 2005b), to identify opportunities for improved use of currently available information for compliance assessment;
- develop a small, agreed set of environmental indicators specific to compliance assessment.

3.2.3 **Baseline for compliance assessment**

We considered how to develop a baseline to allow the influence of modern regulation on our current compliance assessment activities to be judged. This proved more difficult than anticipated because regulatory regimes tend to evolve over time, usually without step changes that could provide 'before and after' information. There are also complex inter-relationships between compliance assessment and other regulatory activities, such as permitting, enforcement and environmental reporting, and their related systems for indicators and information. We decided that an influence matrix approach would be suitable to present information on these complex inter-relationships and provide a qualitative, broad-brush, baseline for our current compliance assessment activities.

The influence matrix approach is described in Annex C. The baseline matrix provides a qualitative indication, based on expert judgement, of where compliance assessment currently influences, or is influenced by, existing activities and systems. A considerable amount of information about compliance assessment is summarised in the baseline matrix. This was a first attempt at defining a baseline for compliance assessment and, with further development, the influence matrix approach could provide useful, though qualitative, information for policy and process decisions. For example, potential uses for influence matrices are to:

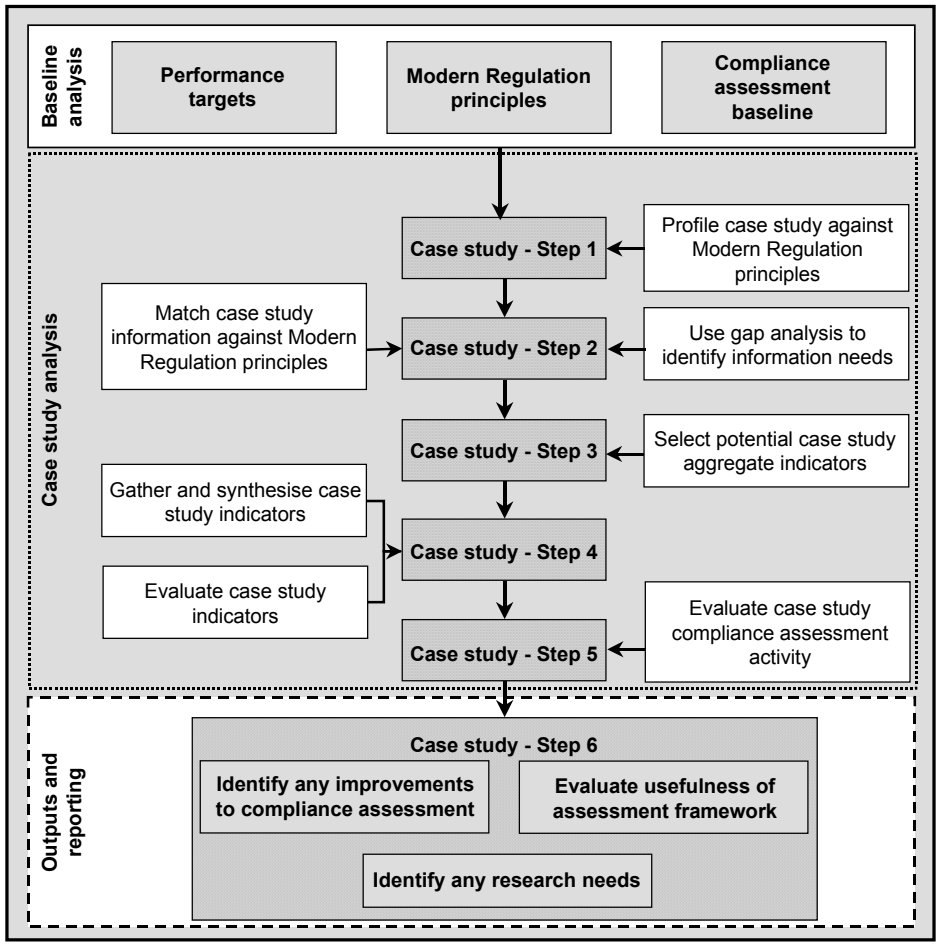
- analyse trends or step changes in compliance assessment performance;
- plan improvements to regulation by comparing the existing baseline with the desired future baseline;
- compare between compliance assessment in different regimes or alternative scenarios.

The matrix developed in the pilot study was necessarily qualitative and broad-brush, but the approach might be developed further at more detailed levels to examine specific sectors or regimes.

3.2.4 **Development of an assessment framework**

We developed a framework to provide a method to assess the effectiveness of compliance assessment in the context of modern regulation. The assessment framework, shown in *Figure 3.1*, consists of three main elements:

Figure 3.1 Outline of the assessment framework.



- **Baseline analysis** – examine the relationships between the principles of modern regulation (see Section 3.2.2), identify or set performance targets that are consistent with the risk-based, outcome-focused approach of modern regulation and assess the current baseline for compliance assessment activities.
- **Case study analysis** – We start the assessment process with a detailed review of the case study information against the relationships that define modern regulation to assess, in particular, whether the compliance assessment activity is risk-based and outcome-focused (see *Table 3.1*) – Step 1. We proceed to identify available information sources and any additional information needs – Step 2. Our next activity is to select compliance assessment indicators for the case study, including any aggregate indicators that may use existing data sources – Step 3. We continue by gathering and synthesising data for the case study indicators and evaluating these indicators against the performance targets – Step 4. We use the case study indicator

information to evaluate the effectiveness of the compliance assessment activity in terms of, for example, resources applied, environmental outcomes achieved and affects on environmental risk. We also analyse the indicator information to seek objective evidence about the influence of risk-based, outcome-focused compliance assessment in achieving the desired environmental outcomes – Step 5.

- **Outputs and reporting** – Finally, we identify any potential improvements to the case study compliance activity, evaluate the usefulness of the assessment framework and identify any further research needs – Step 6.

Inclusion in Step 6 of an evaluation of the usefulness of the assessment framework was a necessary part of this pilot project because there would be little point in further developing the framework if it did not deliver the required outputs. A more detailed description of the assessment framework is given in Annex D.

The assessment framework was designed to use primarily the existing indicator information available within the Environment Agency. It was recognised there might be a need to specify other potential indicators to evaluate the effects of modern regulation and compliance assessment. These could include aggregate indicators that bring together different types of raw data to provide a measure of a particular activity or effect. An extensive list of potential indicators is given in Annex B (*Table B.2*), but we recognise that use of a large number of indicators is impractical. A small set of appropriate indicators would need to be selected based on suitability and relevance to modern regulation.

3.3 Case studies

The case studies provide qualitative information that gives useful insights into the impact of compliance assessment. Only a summary of the main findings from the case studies is presented here, but more details are given in Annex E. The four case studies were:

- a landfill site with a waste management licence regulated by Environmental Management;
- pulp and paper sector with PPC permits regulated by Process Industries Regulation;
- deregulation of the abstraction licensing regime regulated by Water Resources;
- Streamlining Abstraction Processes (SAP) being implemented by Water Resources.

Both Water Resources case studies are related to changes instigated by the Water Act 2003.

3.3.1 **Landfill site, Environment Management**

This case study shows that more efficient and effective use of resources for managing risks can be achieved by applying a risk-based approach. This reflects the principles of modern regulation in practice.

The case study considered a contentious landfill site with a nearby off-site methane gas ‘bubble’ that may or may not be related to the landfill site’s operations. We have no remit to regulate the underground off-site gas directly, but it represents an environmental risk and, if an accident happened, a high business risk in terms of loss of reputation and trust. A risk-based, outcome-focused approach has been adopted to separate landfill issues from the off-site gas problem. This has led to improvements in landfill operations

being achieved through regulation, while the off-site gas problem is being managed through influencing and working in partnership with the landfill operator and the local authority. Overall, the case study shows that compliance assessment needs to take account of both environmental risk and business risk.

Following a change in compliance assessment resource or activity level, there could be a change in risk, compliance, performance or outcome, which should result in changes in the values of compliance assessment indicators. The landfill case study suggests that changes in indicator values may not necessarily be a true reflection of a change in compliance or performance. Indicator values may be affected by other interactions associated with the change in compliance assessment resource or activity, such as changes in perceptions and behaviours of complainants, operators and regulators.

3.3.2 **Pulp and paper sector, Pollution Prevention and Control**

The Environment Agency has regulated the pulp and paper sector under the PPC Regulations since 2001 (and previously under Integrated Pollution Control (IPC)). The main issues from the case study are about the effects of EP OPRA, use of a 'club' approach to regulation and the reporting 'calendar'.

The case study provided anecdotal evidence that the automatic fee increase for non-compliance in EP OPRA since 2003 has focused pulp and paper operators on achieving good compliance. This suggests the focus on risk and outcome in EP OPRA is a good example of modern regulation in action. Unfortunately, we did not obtain suitable data to relate operator performance and compliance to changes in EP OPRA risk-based subsistence fees.

We found anecdotal evidence that the use of risk-based charging under EP OPRA may have driven improved compliance and reductions in emission limit values (ELVs), although we were unable to obtain suitable data to demonstrate these effects. If suitable data were available, this would be a good example of an outcome-focused and risk-based approach driving improved environmental performance.

The pulp and paper sector, through its trade association, often adopts a club or group approach to developing solutions to common regulatory issues such as effluent testing. The Environment Agency has supported this method of working. It represents an example of a modern regulation approach that has improved the effectiveness of permitting and compliance assessment.

This case study also identified a potential need to improve compliance assessment practices, such as synchronising the calendar of PPC permit reporting requirements across the sector. Synchronising the reporting calendar for the sector could improve of operator efficiency and compliance. It could improve the efficiency of our permitting and compliance assessment activities, facilitate compliance assessment co-ordination and, possibly, reduce the need for enforcement activity.

3.3.3 **Water Resources**

We considered risk-based deregulation of abstraction licences under the Water Act 2003 as a possible case study, but our investigations showed it was not relevant to the needs of the project. In the longer term, it could provide evidence about the effect on the environment of a step change in compliance assessment.

A more relevant case study was the SAP project. This is a business change project to manage the allocation of permitting resources for issuing extra abstraction licenses required as a result of the Water Act 2003. It is adopting a risk-based approach and will introduce improved risk-based compliance assessment by Water Resources. The underlying risk assessment includes consideration of business risks, such as contentiousness, along with impact, likelihood and consequence (outcome). Decision-making is risk-based with a set of 'business rules' being applied to each Water Resources application. Very low risk applications can be treated as 'simple' and receive standard licence conditions, whereas other higher risk applications will be handled as 'complex' and require specific licence conditions.

This case study shows that the principles of modern regulation and, in particular, risk-based compliance assessment can be applied across a complete regulatory regime. It also shows that modern regulation can respond to changes in legislation and provide an effective basis for implementing new duties, such as the extra abstraction licences required under the Water Act 2003. In common with the deregulation case study, SAP should be subject to any future study since it represents significant change in permitting and compliance assessment.

3.3.4 **Conclusions from the case studies**

The case studies show that the principles of modern regulation are being applied within the Environment Agency at different regulatory levels (individual site, sector and regime). They provide qualitative evidence that the principles of modern regulation are being applied to compliance assessment activities in ways that improve effectiveness and efficiency.

It was intended that the case studies would be a test of the full assessment framework. This could not be done because there was insufficient project time to identify and gather relevant data to test the framework's more quantitative elements. A quantitative demonstration was also hindered by a lack of available indicators to assess the link between compliance assessment and environmental performance.

We found in the case studies that quantitative information already held as compliance assessment indicators (e.g., data provided by EP OPRA, CCS and key performance indicators (KPIs)) is an under-developed information resource. There is potential to improve the available compliance assessment indicators and the information systems that process compliance assessment indicators, to realise the full value of the information.

The Water Resources case studies show that the principles of modern regulation are being followed and will impact initially on permitting activities. The impact of the modern regulation approach within Water Resources and possibly projects such as Core Regulation for waste management licensing are potential case studies for future work. Such case studies could be useful to:

- study indicators that will become available for the risks and outcomes of permitting and compliance assessment activities;
- identify modern regulation policy issues;
- derive modern regulation best practice.

From our experience in undertaking the case studies, we recommend that future work should:

- refine and apply the assessment framework on case studies of a number of regulatory practices to identify and define the information requirements for indicators of compliance assessment;
- undertake further case studies to provide more quantitative information on the influence and effectiveness of compliance assessment;
- analyse the results of the case studies to provide objective evidence of the influence of modern regulation on environmental performance and environmental risk to:
  - inform decisions on the prioritisation of compliance assessment activities by targeting specific sectors or regulatory regimes;
  - inform review of regulatory practices.

3.4 Underlying science

We have shown in the case studies that risk-based approaches are being used effectively to support modern regulation. There was insufficient time to explore fully the scientific basis for such approaches. For example, it was not possible to investigate in detail the link between compliance and environmental performance. We found anecdotal evidence, from the pulp and paper sector, that EP OPRA is having a beneficial effect in reducing overall discharges to the environment. To strengthen the scientific basis for the modern regulation approach, we recommend that any future studies examine more closely the influence of compliance assessment on environmental performance and environmental risk.

Our brief literature review showed that considerable scientific effort is going into the development and use of environmental indicators, although few, if any, indicators address compliance assessment directly. The OECD's work on environmental indicators is a valuable resource to aid development of suitable indicators for compliance assessment. A similar resource is the work by INECE-OECD that aims to provide sound indicators for compliance assessment activities. Such indicators have the potential to link compliance assessment effort with environmental performance, although difficulties are acknowledged in establishing and evaluating the strength of such links. Modern Regulation staff are already involved in this work and we recommend that the Environment Agency should continue to participate because it could provide a widely accepted set of compliance assessment indicators. Through continued participation we could influence international developments using the knowledge gained from this project and any future work on compliance assessment indicators.

Our literature review has also shown that significant scientific effort underlies the conceptual frameworks for indicators of environmental performance. A conceptual framework for a broader set of environmental indicators might help guide the management of indicator information. We recognise that the use of conceptual frameworks requires some caution because they can mask complicated environmental interactions. Conceptual frameworks, such as those adopted by OECD and EEA, can help to map the required linkages, analyse the difficulties and possibly identify effective potential solutions. It may be possible to use an index of compliance assessment indicators to collate and summarise indicator information or to link to the corporate scorecard.

Our work indicates that our understanding of the links between compliance assessment, environmental outcomes and environmental risk is not well developed. This represents a gap in our scientific understanding of modern regulation and further research is required to:

- provide objective and, preferably, quantitative evidence of the influence of modern regulation on environmental performance;
- identify scientifically sound and practical indicators that link compliance assessment with environmental performance and environmental risk.

Filling these gaps in our knowledge would better inform decisions on prioritisation of compliance assessment activities and enable more efficient and effective targeting of specific sectors or regulatory regimes.

4. Conclusions

Our work shows that suitable environmental indicators could contribute to demonstrating the influence of risk-based, outcome-focused modern regulation. We identified a need to further develop specific indicators that relate compliance assessment to environmental outcomes and environmental risk.

An influence matrix was developed to identify a qualitative baseline to judge the influence of compliance assessment in the context of modern regulation. The influence matrix could be applied to regulatory activity at any scale from individual site to regulatory regime. Influence matrices have potential to be used to:

- analyse trends or step changes in compliance assessment performance;
- plan improvements to regulation by comparing the existing baseline with the desired future baseline;
- compare between compliance assessment in different regimes or alternative scenarios.

An assessment framework and methodology was developed that can be used to assess the effectiveness of compliance assessment. The assessment framework was tested qualitatively on case studies, and the results suggest it could be applied to other regulatory activities. We could not test the more quantitative parts of the framework because suitable data were not available. To obtain further value from using the framework, more effort is required to obtain and process quantitative information on compliance assessment indicators. Also, there was insufficient time to explore, in any detail, the scientific basis for compliance assessment and modern regulation – this should be included in any future work.

Case studies provided qualitative evidence of good practices in compliance assessment and permitting that support the risk-based and outcome-focused principles of modern regulation. This suggests that the principles are being embedded into our regulatory activities.

Further work is required to provide objective evidence on the link between risk-based compliance assessment, environmental outcomes and environmental risk. We recommend a programme of research (see Section 5) that will help to ensure that sound science supports our compliance assessment activities and our modern regulation approach.

This project and any future work have the potential to affect the whole regulatory cycle, not just compliance assessment. The value of further work is high because of the broad scope of activities that may be affected and the high values of potential savings and efficiencies. This work on compliance assessment has potential implications for corporate governance because there may be possible improvements to the coherence of information management across the organisation. We suggest that, in the future, indicators may be required that can be used to measure and manage resources, performance, risks, regulatory activity and environmental outcomes. Advances in the science of indicators and information management will benefit risk-based regulation and, in the longer term, may influence the development of legislation.

Overall, our project met its objectives to review literature on the use of environmental indicators and identify a baseline. We also developed a framework to assess compliance

assessment, obtained evidence of the influence of modern regulation and developed recommendations for research.

5. Recommendations

We recommend that the Environment Agency should carry out further studies to gain a better understanding of the principles and practices of modern regulation. Such work should provide objective evidence of the influence of risk-based compliance assessment and improve the science that underlies the use of environmental risk and performance indicators.

A prioritised list of recommendations is presented below.

5.1 Recommendations for early implementation

The following recommendations are considered as highest priority, and we suggest early implementation, as part of a research programme, over the next 18-24 months:

Section 3.1.5: Improve existing indicators and develop new indicators that can provide quantitative information to:

- demonstrate the influence of compliance assessment on environmental performance and environmental risk;
- provide objective evidence of the effectiveness of compliance assessment;
- identify potential improvements in effectiveness and efficiency in our regulatory systems.

Development of compliance assessment indicators should be part of an integrated approach to the management and use of environmental information across the organisation.

Section 3.1.5: Evaluate alternative approaches to obtaining the required information by aggregation of indicators, either at the operational level or at the national level.

Section 3.2.2: Design and use environmental performance indicators for compliance assessment that more fully take account of the principles of modern regulation.

Section 3.2.2: Analyse the current regulatory practices, regulatory tools and indicator systems, with reference to *The Regulatory Book* (Environment Agency 2005b), to identify opportunities for improved use of currently available information for compliance assessment.

Section 3.2.2: Develop a small, agreed set of environmental indicators specific to compliance assessment.

Section 3.3.4: Refine and apply the assessment framework on case studies of a number of regulatory practices to identify and define the information requirements for indicators for compliance assessment.

Section 3.3.4: Undertake additional case studies to provide more quantitative information on the influence and effectiveness of compliance assessment.

Section 3.3.4: Analyse the results of the case studies to provide objective evidence of the influence of modern regulation on environmental performance and environmental risk to:

- inform decisions on the prioritisation of compliance assessment activities by targeting specific sectors or regulatory regimes;
- inform review of regulatory practices.

Section 3.4: To strengthen the scientific basis for our modern regulation approach, any future studies should examine more closely the influence of compliance assessment on environmental performance and environmental risk.

Section 3.4: Continue Environment Agency participation in the INECE and OECD work on the development of environmental compliance and enforcement indicators.

Section 3.4: Our understanding of the links between compliance assessment, environmental outcomes and environmental risk is not well developed and further research is required to:

- provide objective and, preferably, quantitative evidence of the influence of modern regulation on environmental performance;
- identify scientifically sound and practical indicators that link compliance assessment with environmental performance and environmental risk.

5.2 Recommendations for later implementation

These recommendations are suggested for later implementation, say in 2-3 years, partly because some of them are dependent on the outcome of the higher priority recommendations above:

Section 3.1.4: Any improved indicators should be designed to be consistent with and add increased value to our regulatory tools and systems.

Section 3.1.4: Evaluate the potential for using higher levels of indicator information. This may be through the use of an index of indicators to collate and summarise indicator information or a conceptual framework for indicators to guide the management of indicator information. Such approaches could help in communicating complicated information to different audiences and possibly aid the analysis of long-term trends in indicator data.

We also identified some general recommendations for longer-term implementation that may need to be considered as the science and understanding of environmental indicators develops. We recommend:

- Adopting a co-ordinated approach to the design of an organisation-wide system of modern regulation indicators. This should aim to provide a set of environmental and business indicators that can be used coherently across the whole regulatory cycle and throughout the organisation.
- Any proposals for changes that arise out of this project or any future work should be subject to an impact assessment and require a business case to be consistent with

good practice and corporate standards. Some issues that should be considered include:

- scope of potential changes in information management required to demonstrate the influence of modern regulation across the whole regulatory cycle;
- impact on all activities in the regulatory cycle, not just compliance assessment;
- values of potential savings and efficiencies;
- any implications for corporate governance from the potential improvements to information management across the organisation.

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7. Glossary of terms

Audit means the objective evaluation of the ability of the operator or management system to achieve full compliance.

Compliance assessment means the overall approach taken to check compliance with all the conditions of a permit or other regulatory instrument. It does not include enforcement or prosecution. Compliance assessment, as defined by the Environment Agency, is equivalent to 'environmental inspection' as defined by the European Council. In the UK, we would use the term inspections more normally to mean a site visit or audit.

Compliance Classification System (CCS) classifies an operator's non-compliance with permit conditions according to the potential impact on the environment. It provides a consistent means of escalating action if an operator repeatedly breaches permit requirements and it can be used to help direct resources where we identify risks.

EP OPRA means Environmental Protection's Operator Pollution Risk – a multi-attribute risk-assessment tool to assess the environmental hazards associated with a site and how well they are being managed. OPRA allows the regulatory effort to be targeted. It supports the polluter pays principle and, through a cost-recovery charging framework, can provide a financial incentive to operators to improve their environmental risk management performance.

Operator Monitoring Assessment is a regulatory tool to assess an operator's self-monitoring processes to identify areas for improvement and aid targeting and prioritisation of the Environment Agency's check monitoring programme.

Site visit can cover a whole range of activities from a simple inspection of permit conditions through check monitoring to a major audit.

8. List of abbreviations

CAMS	Catchment Abstraction Management Strategy
CAPs	Compliance Assessment Plans regulatory tool
CCS	Compliance Classification System regulatory tool
CICS	Common Incident Classification Scheme regulatory tool
CPI	Confederation of Paper Industry trade association
Defra	Department for Environment, Food, and Rural Affairs
DPSIR	Driver–Pressure–State–Impact–Response framework for indicators
DTA	Direct Toxicity Assessment technique
EEA	European Environment Agency
ELV	Emission Limit Value
EMS	Environmental Management System
EP OPRA	Environmental Protection's Operator Pollution Risk Appraisal
INECE	International Network for Environmental Compliance and Enforcement
ISID	Integrated Site Information Database project
IRAP	Integrated Regulation of Agriculture Project
KPI	Key Performance Indicators
NIRS	National Incident Recording System
OECD	Organisation for Economic Co-operation and Development
OMA	Operator Monitoring Assessment regulatory tool
PPC	Pollution Prevention & Control Regulations 1999
PSR	Pressure–State–Response framework for indicators
SAP	Streamlined Abstraction Processes project

Annex A: Summary of key documents

Summary of selected references

Author	*Topic*	*Value to project*
Bockstaller *et al*. 2003	Indicators for agriculture	Validation of indicators
Council of European Community 2001	EU inspection criteria	Relevant
Dalhstrom *et al*. 2002	EMS	Useful context
Defra 2004	Environment in your pocket	Indicators – not linked to compliance assessment
Deutsch *et al*. 2003	Sweden, indicators, resilience	Very good
Environment Agency 2000a	Set of Environment Agency environmental indicators	Relevant
Environment Agency 2000b	Making it happen, Risk-based	Relevant
Environment Agency 2005a	Delivering for the Environment	Very relevant
Environment Agency 2005b	The Regulatory Book (draft)	Very relevant
Environment Agency and URS 2004	Corporate environmental reporting	Useful context
Environment Canada 2003	Indicators, Canada	Good reporting structure
European Environment Agency 2002	Framework for indicators	Useful context
European Environment Agency 2003	Core set of indicators	Not linked to compliance assessment
Goldberg 2002	Aggregated environmental Indices, OECD	Very good on DUX (Germany) and NEPP (Netherlands)
Hampton 2005	Hampton Report, UK	Very relevant
Hopkinson *et al*. 2000	Water industry indicators, UK	Relevant indicators
INECE-OECD, 2003	Environmental compliance and enforcement indicators	Common problems in developing indicators
Kyritsis *et al*. 2001	Indicators, Greece	Fair
Levy *et al*. 2000	Indicators, multi-attribute value theory, Canada	Fair
Linster 2003	OECD indicators – development, measurement and use	Very good on frameworks
Nicholson *et al*. 2002	Indicators	Case studies, more references
OECD 2004	OECD Key Environmental Indicators	Very good
Tam 2002	Indicators	Good
Volokh *et al*. 1996	Proportionate, USEPA	Modern regulation, enforcement
Walz 2000	Indicators, Germany	Good
Wasserman *et al*. 1996	Framework, USEPA	History UNEP, modern regulation

Note: The full citations can be found in Section 6.

Annex B: Existing and potential indicators

Table B.1 Existing indicators

Relevance to principles of modern regulation	Examples of existing indicators (cost, scores, number or percentage)
Terms used in both risk-based and outcome-focused modern regulation	
Resource	No. Grade 5, 4 and 3 regulatory officers No. permits by regime and sector (e.g., Permit Administration System) No. policy advisors and/or no. process advisors No. key performance indicator (KPI) inspections No. hours (e.g., for Control of Major Accident Hazards (COMAH) work) No. guideline hours per inspection service level (e.g., KPIs)
Scale of achievable outcomes	River Quality Objectives Best Available Technique guidance values e.g. for emissions linked to performance of abatement technology
Terms and relationships used in risk-based modern regulation	
Risk	No. breaches listed on the Compliance Classification System (CCS) No. compliances No. prosecutions – £ fines, £ costs No. enforcement actions; *Spotlight* prosecution tables; Operator Pollution Risk Appraisal (OPRA) and Operator Monitoring Assessment (OMA) scores
Resource proportionate to risk and scale of achievable outcomes	OPRA and OMA scores
Resource proportionate to risk	
Resource proportionate to scale of achievable outcomes	
Terms and relationships used in outcome-focused modern regulation	
Environmental outcome	*Spotlight* league tables Pollution Inventory assessment Reductions in emission monitoring returns (Kg per year); No. cat 1, 2, 3 and 4 incidents e.g. using National Incident Recording System and Common Incident Classification Scheme data River General Quality assessments
Assessment of performance	% compliance with Citizen's Charter Standards Nine corporate frameworks for performance management and reporting (e.g., Director's Brief, corporate balanced scorecard, KPI Dashboard)
Resource proportionate to scale of achievable outcome	Air Quality Objectives (AQO) River Quality Objectives (RQO)
Assessment of performance proportionate to environmental outcome and scale of achievable outcome	National Environmental Technology Centre (NETCEN) air quality assessments compared to AQOs River General Quality assessments compared to RQOs Emissions (*Spotlight* league tables, pollution inventory assessment and monitoring returns show trends, outliers and identify scale of improvements desired)

Table B.2 Potential indicators

Relevance to principles of modern regulation	Examples of potential indicators (cost, scores, number or percentage)
Terms used in both risk-based and outcome-focused modern regulation	
Resource	No. compliance assessment actions (e.g. no. warning letters, no. formal cautions) No. compliance assessment actions per compliance assessment activity type No. compliance assessment actions per inspection No. inspections per permit No. compliance assessment actions per permit and by sector No. compliance assessment actions per permit condition by type or by sector
Scale of achievable outcomes	No. high scale of achievable outcomes permits No. low scale of achievable outcomes permits (data from Permit Administration System (PAS) and Strategic Permitting Group (SPG))
Terms and relationships used in risk-based modern regulation	
Risk	No. high- and low-risk permits (data from PAS and SPG) No. high- and low-risk breaches (data from Compliance Classification Scheme(CCS)) % or no. High- and low-risk breaches per inspection % or no. High-risk breaches per high-risk permit No. improvement conditions by regime and sector Risk assessment for setting inspection frequencies: • regime (e.g., CCS, Pollution Prevention and Control Compliance Assessment Plan (CAP)) • sector (e.g. sector CAP, CCS) • permit (e.g., CAP, Pollution Hazard Appraisal, OPRA, NIRS, CCS) • a condition (e.g., improvement condition classes) • a compliance assessment activity (e.g., OPRA, OMA)
Resource proportionate to risk and scale of achievable outcomes	OPRA scores, OMA scores % or no. High and low scale of achievable outcomes improvements per high-risk permit
Resource proportionate to risk	No. Grade 5 inspections per high-risk permit No. Grade 3 inspections per permit (high risk and low risk)
Resource proportionate to scale of achievable outcomes	No. Grade 5 inspections per permit (high and low scale of achievable outcomes)
Terms and relationships used in outcome-focused modern regulation	
Environmental outcome (EO)	No. incidents (high and low) EO (e.g., NIRS, CICS) % or no. prosecutions per breach (high EO and low EO) £ improvements No. EO improvements (high and low £ value) £ per high EO improvement per permit (high and low risk) % improvement conditions compliance by regime or sector (e.g.,

Table B.2 Potential indicators

Relevance to principles of modern regulation	**Examples of potential indicators** (cost, scores, number or percentage)
	CCS
Assessment of performance	% prosecutions per serious offences
Relationship used in outcome-focused modern regulation	
Resource proportionate to scale of achievable outcomes	Improvement conditions state desired scale of achievable outcomes
Assessment of performance proportionate to environmental outcome per scale of achievable outcomes	% EO per permit (high and low scale of achievable outcomes) % or no. high and low EOs per high scale of achievable outcomes improvements Outputs from audits of compliance assessment performance
Resource proportionate to scale of achievable outcomes *and* assessment of performance proportionate to environmental outcome per scale of achievable outcomes	CAP score

Annex C: Baseline for compliance assessment

Compliance assessment is only one part of the regulatory cycle and should not generally be considered in isolation, but for this project we wanted to establish a baseline for our current compliance assessment activities. Establishing a baseline is not straightforward because compliance assessment has evolved, and will continue to evolve, in response to changes in legislation, pressure on resources and the modern regulation agenda. This usually occurs without step changes that could provide 'before and after' information that would help identify a current baseline. There are also complex inter-relationships between compliance assessment and other regulatory activities such as permitting, enforcement and environmental reporting.

We decided that an influence matrix approach would be suitable to present qualitative information on the complex inter-relationships relating to compliance assessment. A matrix, such as shown in *Figure C.1*, can be constructed to show how different activities or processes influence each other.

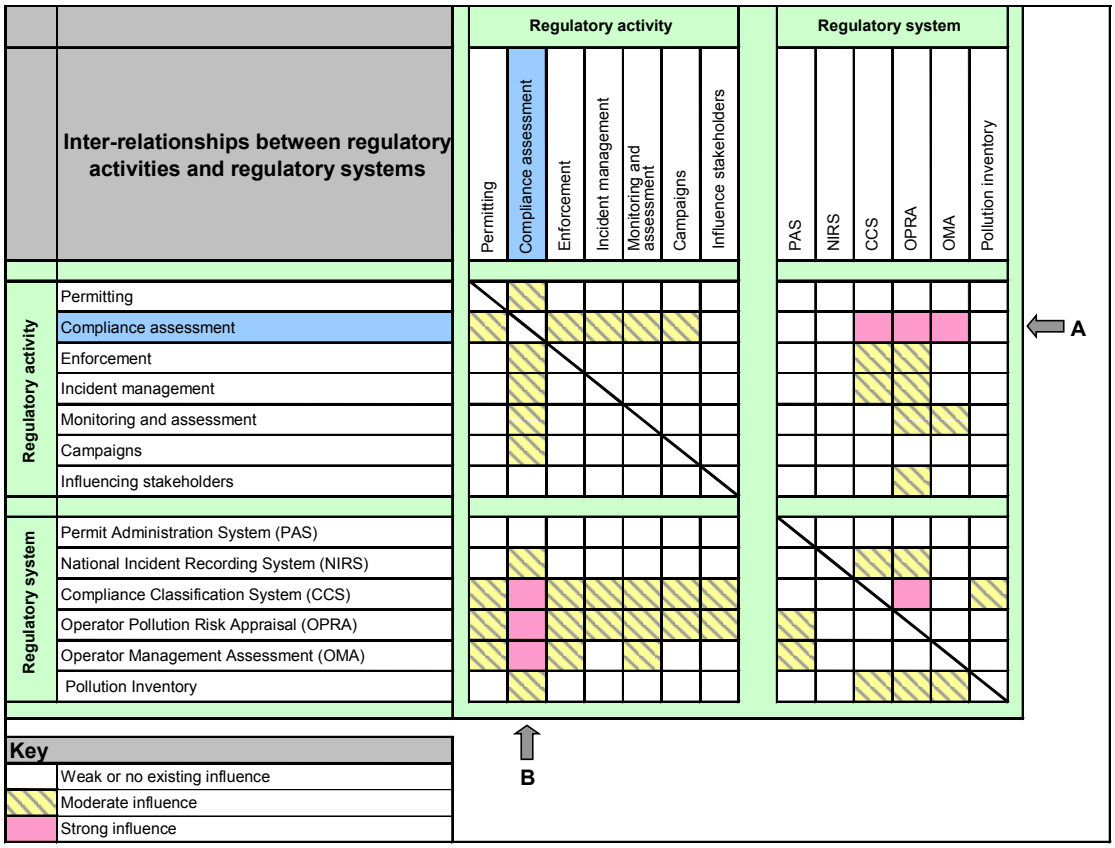


Figure C.1 Example of an influence matrix.

Figure C.1 shows how some of our regulatory activities and regulatory systems are inter-related, for example:

(a) If we look across the row marked 'A', we can see an indication of the influence of compliance assessment on the processes and activities identified in each of the columns. For example, we can see that compliance assessment strongly influences three regulatory systems, the CCS, OPRA and OMA. This is because these tools

support compliance assessment activities and are also used to inform decisions on resources for such activities. We can also see that compliance assessment has only a weak influence on the National Incident Recording System (NIRS) and Pollution Inventory, which derive information and data from other sources.

(b) If we now look down the columns, we can see the influence of the various processes and systems on compliance assessment. In the column marked 'B', we can see that CCS, OPRA and OMA strongly influence compliance assessment. It can also be seen that NIRS and the Pollution Inventory exert a moderate influence because these systems provide information that can help guide decisions on the resources required for compliance assessment.

The matrix provides a 'snapshot in time' of the inter-relationships between various compliance assessment processes and systems. We recognise that it is subjective and qualitative, but we considered the influence matrix approach suitable for further development to provide a much broader baseline picture for compliance assessment. Other approaches might be equally valid, but we were not able to investigate alternatives within the pilot project timescale.

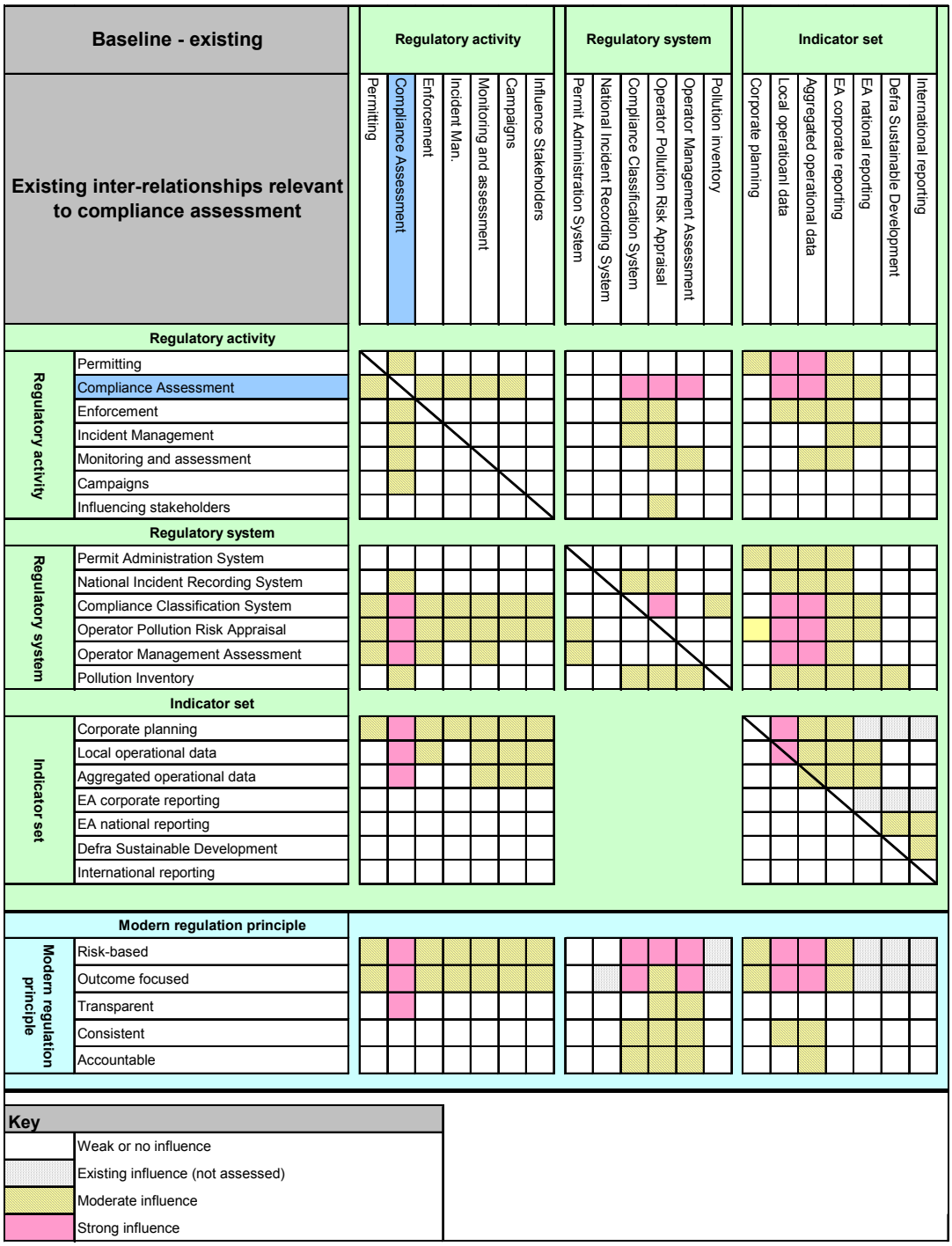
We extended the influence matrix, using expert judgement, to develop a broad description of where we are now in terms of judging the factors that influence compliance assessment in the context of modern regulation. We brought into the matrix consideration of the relationship with various sets of environmental indicators and with the terms that define the modern regulation approach. This extended influence matrix, shown in *Figure C.2*, may be used to identify:

- relevant indicators, activities and systems;
- their inter-relationships;
- the influence of modern regulation;
- interactions and indicators relevant to compliance assessment.

The information presented in the baseline matrix provides a qualitative indication of where compliance assessment currently influences, or is influenced by, existing activities and systems. For example, compliance assessment moderately influences enforcement, but only weakly affects 'influencing stakeholders', which arises because existing compliance assessment activities are focused on the operator's performance in relation to permit or licence conditions. The matrix in *Figure C.2* also shows that in the context of modern regulation, compliance assessment is strongly influenced by the risk-based and outcome-focused principles, but more weakly by the principles of consistency, transparency and accountability. The influence of these latter principles is likely to increase as new systems, such as Compliance Assessment Plans, come into operation.

The baseline matrix for our compliance assessment activities provides a fairly broad indication of the strength of the different inter-relationships, but this was sufficient to inform development of the assessment framework and its application in the case studies.

Figure C.2 Existing baseline matrix.



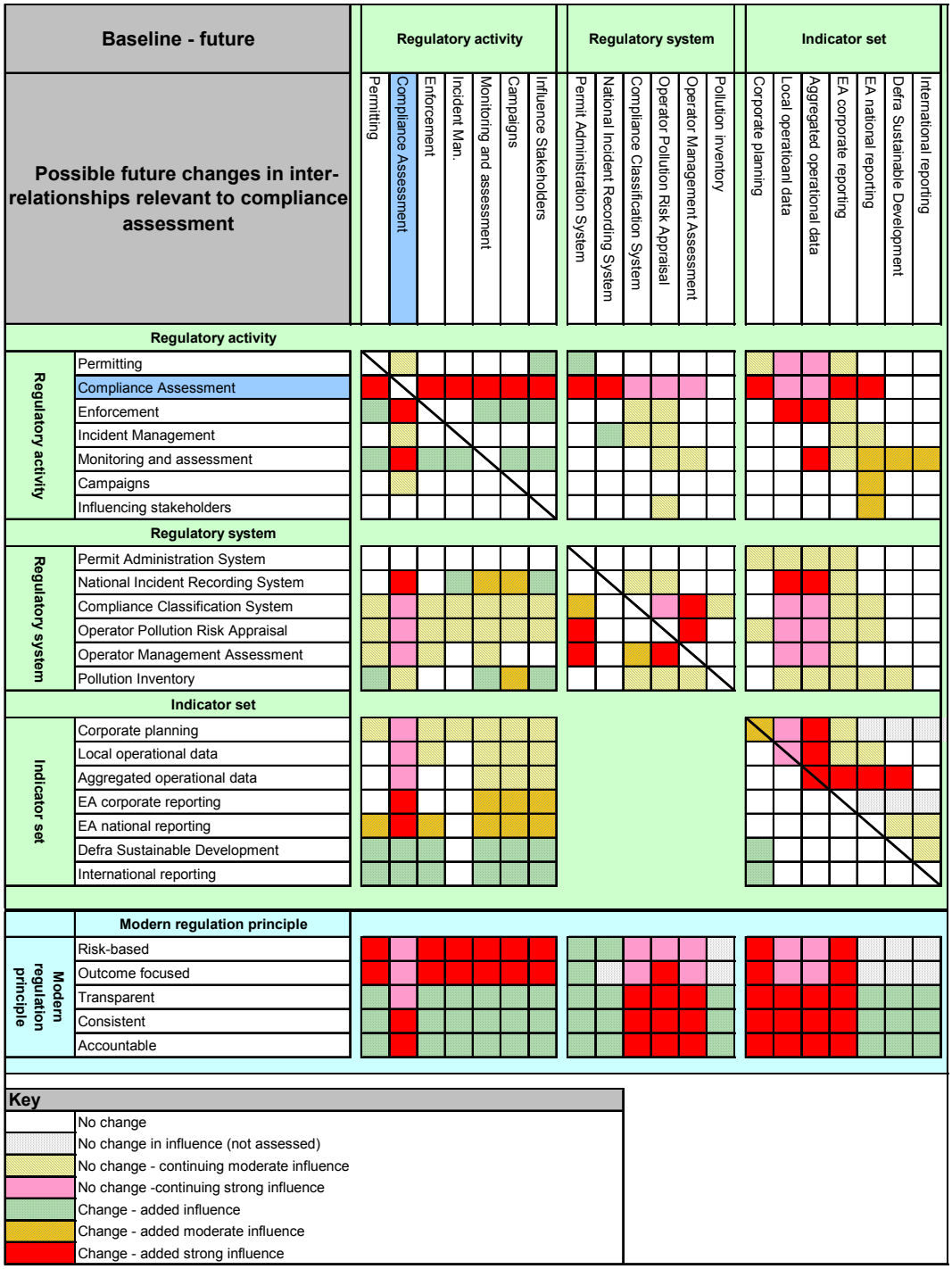
The baseline matrix in *Figure C.2* provides one example of how the influence matrix can be used; further matrices could be developed to provide more detailed insights into specific inter-relationships if required. Companion matrices could be used to:

- analyse trends or step changes in compliance assessment performance;
- compare between compliance assessment in different regimes or alternative scenarios;

- plan improvements to regulation by comparing the existing baseline with the desired future baseline.

We developed such a matrix to illustrate a possible 'future baseline' for compliance assessment, presented in *Figure C.3*. The 'future baseline' suggests which inter-relationships might be changed in the future to better meet the principles of modern regulation.

Figure C.3 'Future baseline'.



The ‘future baseline’ does not specify any particular course of action for the Environment Agency, but rather it is intended to illustrate, in a qualitative way, how compliance assessment might develop. For example, the ‘future baseline’ indicates possible inter-relationships that we might wish to strengthen in the future to obtain wider benefits from our compliance assessment approach in the context of our modern regulation.

The ‘future baseline’ matrix proved useful to the pilot project because it helped focus our assessment framework on relevant interactions that might improve our approach to compliance assessment.

Our use of influence matrices to develop a compliance assessment baseline shows how one approach might be used to gain qualitative information about the complicated inter-relationships within our regulatory and environmental reporting activities. It has helped frame the questions that we needed to consider when developing an assessment framework for compliance assessment, which is discussed in Section 3.2.4 and given in more detail Annex D.

Annex D: Assessment framework

D.1 Introduction

One of the objectives of the pilot project was to develop a framework to assess the effectiveness of compliance assessment activities. The assessment framework was intended to assist in:

- identifying performance targets for compliance assessment;
- synthesising any required aggregate indicators for compliance assessment;
- analysis of indicator information in terms of environmental outcomes and environmental risk;
- evaluating the effectiveness of compliance assessment against selected performance targets;
- identifying future research needs.

A further project objective was to use case studies based on current compliance assessment activities to test and refine the assessment framework.

D.2 Description of the assessment framework

We developed an assessment framework that comprises three main stages – baseline analysis, case study analysis and outputs and reporting. An outline of the assessment framework is shown in *Figure D.1*.

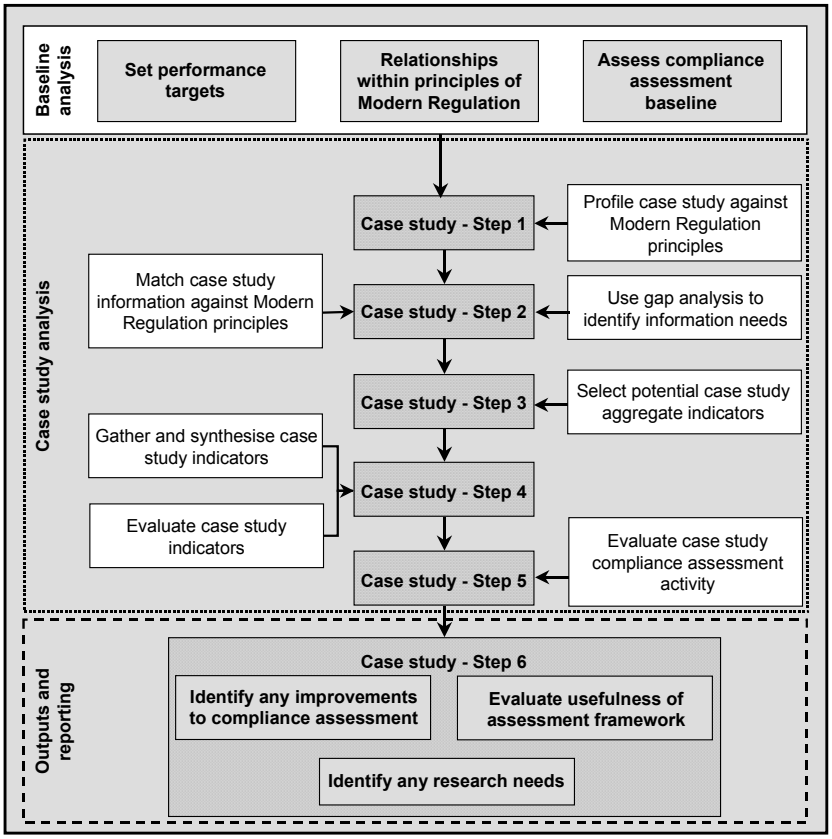


Figure D.1 Outline of the assessment framework.

Stage 1: Baseline analysis. Baseline analysis is intended to identify the component terms and relationships within the principles of modern regulation. This was an important part of the pilot project (see Section 3.2 and Annex C) and the knowledge gained can be re-used in any future application of the assessment framework. Understanding of the component terms and relationships can be applied to develop a baseline for compliance assessment. The baseline provides a qualitative assessment of the current inter-relationships between the compliance assessment proces's and other regulatory activities, systems and indicator sets. A 'future baseline' can be developed to illustrate where changes in the influence of compliance assessment might develop over time.

Information from the current and 'future' baseline analysis should allow the development of performance indicators relevant to the assessment of the effectiveness of compliance assessment. A small set of performance indicators that relate compliance assessment to the principles of modern regulation should be identified and agreed. This will allow performance targets to be set for the compliance assessment activity being evaluated in the case study.

Stage 2: Case study analysis. This is the core of the assessment framework and is designed to provide a detailed understanding of compliance assessment activities in the context of modern regulation and to provide an evaluation of their effectiveness in achieving the desired environmental outcomes and in influencing environmental risk. The process has five steps:

Step 1: Profile case study activity against the principles of modern regulation. This is an examination of the case study activity against the component terms and relationships considered in the baseline analysis. The purpose is to identify the relevance of the component terms and relationships to the particular activity. For example, is it risk-based and outcome focused? Are resources proportionate to risk? This step also aims to identify any specific compliance assessment indicators available for the activity. The information will be combined in a baseline matrix for the activity, which maps out its inter-relationships with other regulatory activities and regulatory systems, and also relates any specific indicators to other relevant indicators sets. Finally, a decision will be made on what type of evaluation is possible using the available information and data, for example, whether it possible to undertake a:

- 'snapshot in time' evaluation based on limited information;
- 'before and after' study, for which information is available linked to a step change in the nature of the activity;
- 'trend' analysis, for which sufficient long-term information and data are available to identify possible trends in environmental performance and outcomes.

Step 2: Match available information with modern regulation principles. Available case study information, including any indicators, will be matched against the component terms and relationships of the principles of modern regulation. For example, does the indicator information relate to risk, scale of achievable outcome or resources? A gap analysis will be undertaken using the current and 'future' baseline matrices. The information will be used to map possible future changes in the influence of the case study activity relative to other regulatory activities and systems. The gap analysis will also help identify potential performance indicators and any related information needs or possible changes in data requirements.

Step 3: Select case study performance indicators. A set of possible performance indicators will need to be selected using information gathered in Step 2. Performance indicators may need to be based on aggregated data. The aim should be to select a small set of possible indicators that reflect each of the governing terms and relationships within modern regulation. The selected set of possible indicators should support the evaluation of existing compliance assessment activity and any desired future changes, such as changes to regulatory activities and/or systems, related indicators and environmental outcomes. Information on available indicators should be gathered. If no suitable indicators are found, information and data should be gathered in a form suitable for developing aggregated indicators. Aggregate indicators combine data in new ways to provide a performance measure.

Step 4: Gather and synthesise case study indicators. Information and data will need to be gathered and synthesised to compile the selected performance indicator set, including any aggregated indicators. Indicator information may be available as local or aggregated operational data, or corporate planning or reporting data. It might also come from external sources, such as Defra's Sustainable Development indicator set. Considerable care will be required in designing aggregated performance indicators. It is essential that such indicators present meaningful information and reflect the component terms and relationships within modern regulation.

Step 5: Evaluate case study activity. The information provided by the available performance indicators and the aggregate indicators should be used to evaluate the effectiveness of the compliance assessment activity being studied. This should include consideration of, for example, the resources applied, environmental outcomes achieved and affects on environmental risk. Analysis of the indicators should provide information about the extent that the case study activities fulfil the principles of modern regulation. The analysis should also provide objective evidence about the influence of compliance assessment on an operator's environmental performance and, more broadly, on environmental risk.

Stage 3: Outputs and reporting. This is essentially Step 6 of the overall assessment framework, but it is identified as a separate stage because of its importance. There are three main components to this stage:

- Identify any improvements to compliance assessment – these may be improvements specific to the case study activity, such as increasing the emphasis on outcome-focused actions. Improvements might also be more general changes that might affect a spectrum of compliance assessment activities.
- Evaluate the effectiveness of the assessment framework – this is mainly an action during the development phase of the assessment framework. If the assessment framework were accepted for wider use, continued evaluation would ensure that the approach develops further, using experience from different case studies.
- Identify any research needs – case studies might identify gaps in our knowledge and recommend further research to improve the scientific basis of our modern regulation approach.

The overall action within this stage is to draw together all the relevant information to provide a clear and succinct report on the case study. The report should provide objective evidence about the effectiveness of particular compliance assessment activity in the context of our modern regulation approach. It should clearly set out justified

arguments for any actions to improve compliance assessment and for any recommendations for further work.

D.3 Application in the pilot study

We were only able to test the assessment framework to a limited extent in this pilot study because suitable data for setting performance targets were not readily available. In the case studies, we adopted a qualitative approach to determining how well compliance assessment activities met the principles of modern regulation. Lack of available data meant that it was possible to assess the effectiveness of compliance assessment qualitatively, but not quantitatively, in this study.

Annex E: Case studies

The case studies are based on qualitative information that provides useful insights into the impact of compliance assessment. The full assessment framework could not be applied because there was insufficient time to identify and gather relevant data to test its more quantitative elements.

The four case studies were:

- a landfill site with a waste licence regulated by Environmental Management;
- pulp and paper sector with PPC permits regulated by Process Industries Regulation;
- deregulation of the abstraction licensing regime regulated by Water Resources;
- Streamlining Abstraction Processes (SAP) being implemented by Water Resources.

Both Water Resources case studies are related to changes instigated by the Water Act 2003.

E.1 Landfill site, Environment Management

In this case study, we considered the regulation of a contentious landfill site with a nearby off-site methane gas release that might not be related directly to the landfill site's operations. The Environment Agency does not directly regulate the off-site gas release. This is an example in which the off-site gas presents both an environmental risk and, if an accident happened, a high business risk in terms of reputation and loss of trust.

The Environment Agency officer responsible for the landfill used a risk-based, outcome-focused approach to separate landfill issues from the off-site gas problem, which led to different approaches to risk management.

A risk-based compliance assessment planning approach is being applied to the landfill, and compliance assessment indicators show improvements in performance. There have been reductions in:

- OPRA scores for landfill operator performance, partly because the off-site gas issue was removed from the operator's score and partly because of better performance;
- incidents reported by the public;
- inspection frequency on a risk basis;
- necessity for enforcement action.

The off-site gas problem is being managed and reduced by the Environment Agency working in partnership with the landfill operator and the local authority.

By applying a risk-based approach, improvements in landfill operations are being achieved through regulation while the off-site gas problem is being managed through influencing and partnership. Resources are still required to manage this risk, but these are being applied more efficiently and effectively, which reflects the principles of modern regulation in practice.

E.1.1 Issues arising from landfill case study – business risk

A clear issue that emerged from this case study was the need for compliance assessment to take account of both environmental risk and business risk. Business risk is now seen as an important omission from the baseline for compliance assessment and

the assessment framework. Changes in business risk can affect compliance assessment. For example, one possible indicator of business risk is the number and type of complaints received and recorded on the NIRS. Changes in the number or type of recorded complaints can affect the compliance assessment resources applied to an operator's activities.

The case study identified that following a change in compliance assessment resource or activity level; there may be a change in risk, compliance, performance or outcome. Such changes should cause proportionate changes in the values of compliance assessment indicators. Changes might be seen in, for example, an OPRA score or number of non-compliances recorded using the CCS. Some caution is required because the change in the indicator value is not necessarily a true reflection of the change in compliance or performance. The indicator value may have been affected by other interactions associated with the change in compliance assessment resource or activity, such as changes in perceptions and behaviours of complainants, operators and regulators , which can affect:

- Incident reporting behaviour – there may be under-reporting or over-reporting of incidents by the public, the operator and possibly staff in logging NIRS reports.
- Perception of environmental risk by complainants and business risk by operators and regulators. Risk perception can be affected by past regulatory practice, periodic regulatory reviews and changes to risk management approach. An incident or a non-compliance may be given different levels of response depending on the known sensitivity to risk and business risk.
- Non-compliance detection rates – changes in compliance assessment resources or activities in rates that differ between sites, occasions, officers, offices, sectors and regimes.
- Non-compliance reporting rates – inaccurate, incomplete or complicated CCS records need careful analysis if they are used as compliance assessment indicators. Incidents are categorised on the CCS for severity, but may be reported disproportionately to episode duration or incident severity; for example, some non-compliances may be severe but short-lived and have few CCS reports, but other minor non-compliances that persist over many inspections may have multiple reports.
- Source of complaints – more resources might be applied if complaints from elected representatives increase.

There may also be significant time lags between carrying out the compliance assessment activity and reporting and using the compliance assessment output information, such as updating waste OPRA scores after each inspection and using waste OPRA scores in risk-based regulation. It was also noted that there is a need to harmonise the CCS and waste OPRA scoring systems; at present the CCS scoring system of zero to four (zero as most serious) runs counter to the waste OPRA scoring of one to four.

E.1.2 Conclusion from landfill case study

This case study illustrates that compliance assessment indicators need to be treated with some care; a good understanding of the problem is required before taking action. There is a need to have good data management to avoid unnecessary time lags, and to have

quality assurance of indicator information. Careful interpretation is also required to avoid the information being wrongly used to set disproportionate changes of compliance assessment resources and activities.

E.2 PPC pulp and paper

This case study is based on the regulation of specified pulp and paper activities directly regulated by the Environment Agency with authorisations under IPC and since 2001 by permits under the PPC Regulations.

This is an interesting case study because most of the permitting activity predated the formal launch of the modern regulation principles in 2003. Before 2003, a risk-based approach to regulation was set out in *'The Vision for our Environment: Making it Happen*' (Environment Agency 2000b) and applied to PPC permitting and subsequent compliance assessment.

The main issues from the case study are about the effects of the EP OPRA use of a 'club' approach to regulation and the reporting 'calendar'.

E.2.1 Effects of EP OPRA

Non-compliance did not automatically increase IPC or PPC fees until EP OPRA set risk-based PPC subsistence fees in 2003. The interviewee reported that the automatic fee increase in EP OPRA for non-compliance has secured good performance on compliance and focused pulp and paper operators on compliance. Unfortunately, no data were immediately available to demonstrate performance on compliance or changes to EP OPRA risk-based subsistence fees. The anecdotal evidence provided by the interviewee on the pulp and paper sector suggests the focus on risk and outcome is a good example of modern regulation in action.

The EP OPRA risk-based charging scheme uses an ELV for authorised discharges to the environment as part of the data used to set fees. The interviewee reported anecdotal evidence to suggest this drives operators to reduce ELVs to the point at which the benefit of a lower ELV is countered by an increased frequency of breaches of that limit. The interviewee reported that the effect of this is resulting in lower overall releases to the environment. This is an example of modern regulation's outcome-focused and risk-based approach driving operators to reduce releases and improve compliance to remain within the lower emission limits. Again, data to support the anecdotal evidence of reduction of ELVs were not readily available, but a further study might be able to identify suitable data sets.

E.2.2 'Club' approach to regulation

Through the trade association, the Confederation of Paper Industries (CPI), the sector has adopted a group or club approach to regulation on issues common across its members. For example, the sector co-ordinated its own effort on effluent tests in response to requirements in permits. The Environment Agency has supported this approach, which is an example of a modern regulation approach that has improved the effectiveness of permitting and compliance assessment. The club approach provides a useful model that might be adopted by other regulated sectors.

E.2.3 Synchronising the reporting 'calendar'

Discussion of this case study identified a potential need to improve compliance assessment practices, such as synchronising the calendar of PPC permit reporting requirements. The permits set reporting requirements that are not fully synchronised across the sector. Operators and the Environment Agency could gain benefits from adopting a club approach to synchronise the reporting calendar that would:

- improve operator efficiency and compliance;
- improve efficiency of our permitting and compliance assessment;
- reduce the need for enforcement activity;
- facilitate compliance assessment co-ordination within the Environment Agency.

Discussion of this case study also identified other changes that could be considered to improve the efficiency and effectiveness of compliance assessment:

- review compliance assessment activities and reduce regulatory effort when justified;
- audit the CCS to ensure it is being used correctly (e.g., to record compliance with each improvement condition);
- collate CCS data to compare compliance performance between sectors;
- promote wider use of Direct Toxicity Assessment (DTA) to provide a potentially useful indicator of ecological quality that could be used to relate compliance assessment and environmental performance;
- improve the Permit Administration System by adding fields for risk indicators, such as DTA.

E.3 Water Resources deregulation

The Environment Agency is deregulating, on a risk basis, some 23,000 abstraction licences (46 per cent of the total Water Resources licences) that are of low impact, at < 20 m^3/day, as set by risk-based legislation in the Water Act 2003. In these cases, compliance assessment activities will cease. This case study was not relevant to the needs of the project, but could, in the longer term, provide evidence about the effect of a step change in compliance assessment on the environment.

E.4 Streamlining Abstraction Processes

Streamlining Abstraction Processes (SAP) is a business change project to manage the allocation of permitting resources for issuing extra abstraction licenses required as a result of the Water Act 2003. It adopts a risk-based permitting approach and will introduce improved risk-based compliance assessment by Water Resources. The underlying risk assessment includes consideration of business risk, such as contentiousness, along with impact, likelihood and consequence (outcome). Decision-making is risk-based with a set of 'business rules' being applied to each Water Resources application. Very low risk applications can be treated as 'simple' and receive standard licence conditions, whereas other higher risk applications will be handled as 'complex' and require specific licence conditions. Decision-making will include the evaluation of many years of useful indicator information from aquifer balances data and Catchment Abstraction Management Strategy (CAMS) information on pressures on water availability.

SAP is unifying the approach to site visits and compliance assessment by working in partnership with other projects, such as the Integrated Site Database (ISD) project and the Integrated Regulation of Agriculture Project (IRAP). Water Resources already carry out risk-based compliance assessment and this will continue to be carried out on the remaining 54 per cent of Water Resources licences after deregulation and on the newly issued licences under the Water Act 2003. Licences currently are graded by criticality and inspected according to a compliance assessment matrix, where for example:

- Highly critical – generally the most important and potentially damaging licences, such as a licence that requires positive action by the licence holder (could be large Water Company licences), can be inspected more than once a year depending on the season, etc. There is no fixed limit on the number of visits. There can be spray irrigation licences in this group, but most are in the next level down.
- Critical – such as spray irrigation where water is abstracted in the summer when flows are lower and also there is a need for good measurement as 50 per cent of the annual charges could be payable on the volume abstracted. They are visited once a year.
- Less critical – all the rest are visited once every 5 years, on average.

The compliance assessment approach retains flexibility to switch resources in response to weather episodes.

This case study shows that the principles of modern regulation and, in particular, risk-based compliance assessment can be applied across a complete regulatory regime. It also shows that modern regulation can respond to changes in legislation and provide an effective basis for implementing new duties, such as the extra abstraction licences required under the Water Act 2003.

In common with the deregulation case study, SAP should be subject to future study since it represents significant change in permitting and compliance assessment. Further investigation of risk-based compliance assessment with Water Resources is likely to yield data evidence of effectiveness that supports the approach.

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