Environment Agency

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Perceptions, attitudes and communication: their role in delivering effective environmental regulation for municipal waste incineration

Science Report – SC030184/SR1

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Steve Killeen

Head of Science

Foreword

The Environment Agency regulates many activities about which the public feel strongly. From air pollution to the disposal of radioactive substances, we recognise that public perception of health risk can impact on people's quality of life and is something we need to take into account when we make regulatory decisions. We're open to finding ways we can do this more effectively, so we asked the Department of Health to look into how the public perceive risk, using municipal waste incineration as a case study.

The findings and recommendations in this report will help us build on the work we are already doing to improve the way we work with communities on regulation. We know that listening to communities and involving them in decision-making helps reduce public anxiety and builds trust in planning and regulation. It can be challenging discussing scientific evidence and uncertainty but is an important part of open and accountable decision-making and one that we must undertake. What's more, listening to communities makes us a better regulator because we can address community concerns directly. We have been doing more of this and there are examples of both good and bad practice from which we are learning lessons.

A major challenge for us is to work closely with other organisations who are also involved in the planning and regulation processes. Although we have an important role in protecting people's health through regulation, our remit only extends to certain issues. Other organisations have important but different roles. Local authorities, for example, are responsible for planning where waste sites are located, while health professionals provide expert advice on issues like public health risk. We work together closely and it is important that we find ways to make it clear to communities who does what, so their concerns can be considered by the right people at the right time.

Steve Killeen

Head of Science

Executive summary

Waste disposal is a challenge in all countries. Municipal waste, domestic waste and hazardous wastes from specialised processes have to be handled and disposed of in such a way to prevent harmful exposure to the waste or products generated during its destruction.

Municipal waste, which includes household waste, garden waste and that generated by council recycling schemes, is growing year on year. Most of this waste is currently disposed of in landfill sites. We need alternatives to landfill such as waste treatments that help recover value from wastes and ensure effective disposal. Landfill inputs have fallen gradually since 2001–2 while the amount of waste handled by treatment facilities and incinerators has almost doubled; this trend is set to continue.

There is significant public concern about the possible effects on health of compounds released from incinerators and co-ordinated opposition to planning applications to build them. There are many reasons for this level of public concern. Some reflect a growing concern that not enough is being done to recycle waste while others are based on misapprehensions regarding the likelihood of effects on health of emissions of hazardous or toxic pollutants that have been linked to health effects such as cancers, birth defects, cardiovascular disease and respiratory conditions. This report uses the issues surrounding municipal waste incinerators as a focus for discussing some of the reasons for such opposition and suggesting means by which underlying fears may be addressed.

This report is the result of two meetings at which experts were invited to discuss the issues surrounding the public perception of the scientific issues behind the incineration of municipal waste. The task was approached by reviewing the processes involved in permitting for municipal waste incinerators in England and Wales and the processes of environmental and health impact assessments that form an important input to this process. Members then turned to an analysis of those factors that tended to concern the public, especially those living close to a proposed incinerator. The role of pressure groups, the importance of the increasing availability of scientific evidence (often via the internet) and the role of non-mainstream scientific thinking were then considered.

A key element in the discussions surrounding this problem is the assumption that the process of approval or disapproval of an application to establish a facility for waste disposal should be demonstrably open and fair, both to local people and to those making the application. By this we mean that it is generally assumed that the decisions that form part of the process should be based upon scientific evidence and upon the accepted principles of scientific thinking. This is the philosophical background against which the problems were discussed.

Three major problems were identified as being significant factors for public discontent with the processes used in determining planning applications and operating permits. Recommendations for dealing with these issues were suggested.

Firstly, local people may feel that they are not sufficiently involved in the process. It is critically important to involve local people in the discussion leading to a decision at an early stage. The responsibility for this lies with the applicant, the local authority and the Environment Agency.

Secondly, local people may express distrust for expert opinion. This may be due to an intuitive feeling that the experts are wrong or a perception that there is more than one expert opinion on the point in question, that the experts are biased, or that not all the

relevant evidence has been presented or considered. Again, involving local people in understanding and discussing the evidence presented in support of the application is essential. This recommendation places a responsibility on the Environment Agency and on the statutory consultees in the process, who should be seen as guardians of public welfare and should inform the public of their concerns. Meetings with the public may be needed and officials from the Environment Agency should regard these as more than opportunities to register local concerns. Accepting that contrary opinions may be expressed is very necessary.

Thirdly, linked to doubts about expert opinion are concerns about uncertainty. Expert opinion often includes a discussion of uncertainty, which may be expressed in a variety of ways but which is usually well understood among scientists. However, local people may view uncertainty in a very different way. Explaining that many scientific conclusions based on experimental or observational evidence are subject to uncertainty is difficult and cuts across the perception that science should provide sure answers. In some ways this is due to firm assertions made by scientists and in part to the fact that the public in general are personally familiar with only elementary science or elementary expositions when the uncertainties, which certainly exist, are not discussed. Again, engaging with local people is essential. It is important to explain that local knowledge and information has a real and important part to play in the deliberative process. We feel that an adversarial approach should be avoided as far as possible.

A final recommendation is that the Environment Agency should learn from examples of decisions that have ‘gone well’ – in the sense that participants have been satisfied by the process – and from those that have ‘gone badly’.

We also make three recommendations for specific areas of scientific research that will help the Environment Agency tackle problems of public distrust and concern.

1. Work is needed to explore why people have a distrust of conventional science when it is applied to decision-making processes, something that applies much more widely than just with the question of incineration. We think this might be approached by means of focus groups.
2. Problems are sometimes encountered where applications include much complex science, particularly in the field of modelling dispersion of pollutants and predicting their effects on health. We need to find ways of simplifying such presentations so they can be more widely understood.
3. Further work on how local people acquire and understand scientific evidence is needed. Again, work with focus groups may be a useful way forward

Many of the points we make are already familiar to the Environment Agency: we hope that putting our views together in this way may be of further help.

Preface

This report deals with the need to involve local people more fully in the decision-making which forms part of the process of determination of applications to build or modify incinerators. The editors of this report wish to thank all those who contributed in the discussion and writing stages of the work. Responsibility for the contents of the chapters lies with the named authors. The report should not be seen as reflecting either Department of Health, Health Protection Agency or Environment Agency policy: it is a contribution to debate.

The authors of individual chapters are indicated in the text. Robert Maynard and Helen Smethurst wish to thank Professor Judith Petts, Mr Fintan Hurley and Dr Vyvyan Howard for assistance with their chapters.

Helen Smethurst

Robert Maynard

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1 Introduction

R. L. Maynard and H. Smethurst

Waste disposal is a challenge in all countries. Municipal solid waste (MSW), domestic waste and hazardous wastes from specialised processes have to be handled and disposed of in such a way to prevent harmful exposure to the waste or products generated during its destruction. Municipal waste, which includes household waste, garden waste and that generated by council recycling schemes, is growing year on year. While a significant proportion of this waste is currently disposed of in landfill sites, landfill space is limited and there are challenging Government targets under the EC Landfill Directive to reduce the amount of biodegradable municipal waste sent to landfill.

A total of 29 million tonnes of municipal waste were treated or disposed of at waste management facilities permitted by the Environment Agency in England and Wales during 2006–7. While this figure is on the increase, the proportion going to landfill is decreasing. In 2006–7, 58% of MSW went to landfill compared to 78% in 2001–2. In 2006–7, 11% of MSW was incinerated and 31% was recycled or composted. We need alternatives to landfill such as waste treatments that help recover value from wastes and ensure effective disposal, for example incineration with energy recovery. It is clear that options other than landfill are being developed.

The current capacity for municipal waste incineration in the UK is 3.8 million tonnes per year. The capacity of incinerators and the number of incinerators are increasing slowly. There are currently 17 incinerators in England and one in Wales licensed to burn MSW. However, there is significant public concern about incineration and co-ordinated opposition to planning applications to build incinerators is common. Indeed, the great majority of applications to build and operate such facilities fail.

There are many reasons for this level of public concern. Some reflect wider environmental issues, such as a growing concern that not enough is being done to recycle waste. However, others relate to concerns about the effect of emissions of hazardous or toxic pollutants that have been linked to health effects such as cancers, birth defects, cardiovascular disease and respiratory conditions. This is, in part, based on concerns about old incinerators that did release much larger quantities of chemicals than current facilities. However, in all cases these substances are controlled to prevent or minimise their emissions and reduce their impact on public health. Modern incinerators must now meet tighter emission standards under the Waste Incineration Directive. Although studies into the health impacts of incineration have been reassuring, concern persists and opposition continues.

The most recent independent review of evidence on the health effects of household waste treatment and disposal was published by Defra in 2004. This comprehensive review utilises the results of studies into the health of people living near waste sites and studies into the emissions from waste sites to draw conclusions on the environmental and health effects of different waste treatment and disposal options including the process of waste incineration. This review considered 23 studies of the patterns of disease around incinerators and also 4 review papers looking at health effects of incinerators.

The report concluded:

Published studies of the health of communities living in the vicinity of incinerators have failed to establish any convincing links between incinerator emissions and adverse effects on public health; specifically no impact was demonstrated on the incidence of cancer, respiratory health symptoms or reproductive outcomes.

This statement supports data on emissions and ambient air monitoring suggesting that modern, well-managed waste incinerators only make a very small contribution to background levels of air pollution.

It is clear that communicating the findings of such reports to the public is a difficult task which is sometimes unsuccessful. Indeed, communicating scientific evidence in general is an important challenge and one that is regularly faced by local authorities dealing with planning applications for new incinerators and by Environment Agency staff dealing with environmental permits. They may face a barrage of questions and complaints at public meetings and it is not uncommon to encounter distrust not only in local authority and Environment Agency officials but also in expert opinion and in scientific evidence in general.

This report uses the issues surrounding municipal waste incinerators as a focus for discussing some of the reasons for such opposition and suggesting means by which underlying fears may be addressed. This report does not set out to discuss the issues associated with municipal waste incinerators in any detail as this has been done elsewhere. The process of health impact assessment is well developed in the UK. For information, the essentials of the process are set out in Appendix 1. Information on the need to assess environmental impacts at the strategic level in plan making is given in Appendix 2, while the process of determining environmental permits for municipal waste incinerators and how the Environment Agency assesses and takes decisions based on environmental and health impacts is given in Appendix 3. Appendix 4 sets out briefly how the planning system delivers facilities to manage the waste we all produce.

We have striven to be brief and to point to problems that need further and detailed examination. This approach has led us to statements and conclusions that may be challenged. We assert, for example, that there is, currently, a reduction in the confidence of the general public in opinions put forward by experts. This point might be debated at some length: it could be argued that nobody knows how the public in general thinks about expert advice and that our perception is biased by paying undue attention to the views of pressure groups, activists and protesters. This may well be so, but it is such groups that Environment Agency staff often face. Also, these groups seek intentionally to influence public opinion. Understanding the views put forward by such groups seems important to us in the context of communicating scientific evidence effectively and reliably to the general public.

Similarly, we have discussed the role played by what is sometimes described as non-mainstream scientific opinion in influencing and forming people's views. This we see as an important area and one that is worthy of much deeper study. In our brief discussion of the area, as elsewhere in this report, we have adopted an open-minded approach and have striven not to regard the propositions put forward by some commentators as simply unscientific and thus inadmissible. We feel that such an approach is essential if we are to understand the factors that influence public opinion – sometimes very strongly indeed. We are aware that we have only touched on this area and, again, think that an in-depth study is needed.

We have tried to pull together our thoughts into a number of recommendations for how the public might be encouraged to engage more closely with the scientific evidence. Many of the points we make are already familiar to the Environment Agency: we hope

that putting our views together in this way may be of further help. Our most important conclusions, however, are those that call for further work.

2 Methodology

R. L. Maynard and H. Smethurst

The Environment Agency asked the Department of Health to undertake a short study investigating the problem of communicating scientific evidence to the public. This is an important problem and one that is regularly faced by Environment Agency staff dealing with opposition to the permitting of new waste incinerators; however, it also reflects a level of distrust, not only in Environment Agency staff but also in expert opinion and in scientific evidence in general.

The Department of Health responded to this request by holding two meetings at which experts in the field were invited to discuss the issues surrounding the public perception of science and how it causes contention around municipal waste incinerators. Those attending the meetings are listed in Appendix 4.

The task was approached by reviewing the process involved in permitting for municipal waste incinerators in England and Wales and the processes of environmental and health impact assessments that form an important input to this process (Appendices 1, 2 and 3). Members then turned to an analysis of those factors that tended to concern the public, especially those living close to a proposed incinerator. The role of pressure groups, the importance of the increasing availability of scientific evidence (often via the internet) and the role of non-mainstream scientific thinking were considered.

A small subgroup of experts was selected to compile this report. The report explores the problem, analyses reasons for distrust and makes suggestions for how this distrust might be allayed. In writing this report it has become clear that an expert group cannot probe all the reasons behind people's discontent, and suggestions for how this might be further investigated are made. These include the use of focus groups. It will be seen that we think this is an important area and that we advise that it should be taken forward.

The report and its findings are the responsibility of those who wrote it: they cannot be seen as reflecting the policy or opinion of the Department of Health or the Health Protection Agency.

3 Factors contributing to public concern and distrust

R. L. Maynard and H. Smethurst

The public are concerned about the decision-making processes which local authorities use to assess planning applications and which the Environment Agency uses to assess operating permits relating to industrial processes such as incineration. The perception that decision-making is closed and not transparent is prevalent and a climate of distrust has developed. This is unfortunate. In this short chapter some reasons for the growth of such distrust are explored.

One cause of growing distrust or doubt is the increasing lack of trust that the public has in official decision-making in general. There is a common perception that decision-makers are biased and that regulators and decision-makers are not primarily 'on the side' of the public. These perceptions are, in part, due to lack of involvement with the public in the early stages of decision-making. This is further compounded by the complexities of the system for delivering waste management infrastructure to meet waste strategies and the different factors that are considered at different stages in the planning and permitting process. This is explained in Appendix 4. Additionally, there is a declining faith in experts in general. Doubts are often entertained about the competence of experts, about their integrity and about what is 'knowable'. Media stories bring to almost daily notice examples of when 'the experts' have been wrong. Unexpected and adverse reactions to drugs, for example, and publication of any research that casts doubt on received wisdom cause some members of the public to ask just how reliable expert opinion actually is.

Public confidence in those predicting effects or lack of effects of processes or chemicals on health may have declined more than that in other areas, such as the prediction of environmental impacts. This concern about the reliability of expert opinion is not limited to questions relating to the safety of incineration facilities. On the contrary, the general climate of doubt in expert opinion is fuelled by many sources including some far removed from such local concerns. A part of this distrust is due to the growing perception that experts do not have all the answers to difficult questions. This perception has led some to seek other approaches – other, that is, than those generally regarded as scientific.

Set against this general background may be local concerns about vested interests and bias. The expression 'they would say that, wouldn't they?' is often heard when local people are confronted by evidence that purports to be reassuring. That such evidence may be put forward by applicants does not lead to an increase in confidence: on the contrary, it may lead to deepening doubts. This is clearly a difficult and complex problem and throws a great responsibility on regulators and decision-makers. It may be believed that an applicant can marshal greater resources in terms of 'scientists to speak for him' than those opposed to the application. The call for a wholly independent examination of evidence often arises: its roots being in distrust of both the applicants, seen as biased and with vested interests, and the regulators, seen also as biased in the applicant's favour. Whether these perceptions are correct or not is beside the point – the point is that they occur and need to be recognised and addressed.

One important area that leads to doubt and concern is that of scientific uncertainty. The terms 'uncertainty', 'ignorance' and 'indeterminacy' are often combined or confused, to

the detriment of discussion in this area. Ignorance is taken to mean a lack of knowledge – a condition or state that might or might not be rectified by further effort. Uncertainty is taken to imply the presence of doubt; again this might be amenable to resolution but in many areas of science 'uncertainty' accurately describes the current position. Indeterminacy implies that resolution of a question is impossible and harks back to the interdeterminacy principle or uncertainty principle formulated by Heisenberg in work on quantum mechanics (Heisenberg, 1927). It is hardly surprising that the casual use of such terms might lead to confusion.

In simple terms we take uncertainty and indeterminacy as similar in their immediate implications – both imply doubt – but only the latter implies that this doubt cannot be resolved. Scientists and experts are sometimes not as clear as might be wished about whether their doubts stem from ignorance, uncertainty or the indeterminacy of the problems they face. This has practical implications. Uncertainty can be, and is, managed daily: the Precautionary Principle[1] has been developed to aid this, but dealing with ignorance and indeterminacy is much more difficult.

In toxicological terms we may know that exposure to a *high* concentration of compound **c** can cause effect **d** but we may be uncertain whether exposure to a *specific* concentration of **c** can cause effect **d**. This is uncertainty and is dealt with daily by regulatory toxicologists. This, however, seems quite different from a position of ignorance (we simply do not know whether exposure to compound **c** causes effect **d**), or of indeterminacy (we cannot know whether exposure to compound **c** causes effect **d**).

Some toxicologists would argue that while ignorance is common, indeterminacy is likely to be rare: perhaps non-existent given sufficient research. It is certainly true that as toxicological research advances areas of ignorance are resolved and yet we remain faced with apparently irresolvable questions. For example, theoretical considerations predict that for some carcinogenic compounds there is no completely safe level of exposure. Taken to the extreme this means that a single exposure to one molecule of the given carcinogen should be associated with some risk of cancer. That this risk is likely to be low seems reasonable given common experience with carcinogens, but calculating the exact risk is regarded by many as impossible. Thus, the exact risk at the lower limit of exposure is both uncertain and indeterminate. The risk at low levels of exposure can, however, be estimated though not all toxicologists accept the validity of the methods available to make such estimates. Much depends on the level of accuracy required of the estimate.

Risk assessment plays an important part in many decision-making processes. One aspect of risk assessment that has often been advocated as a means of dealing with indeterminacy is the 'worst case analysis' approach. Such an approach needs discussion.

If we assume that any process carries some level of risk to local populations then we might agree that our first task is to predict that risk as accurately as possible. The outcome of such a predictive process will be dependent on the assumptions made as part of the analysis. For example, it might be assumed that an incinerator is functioning normally – i.e. within the limits defined for normal operation. Emissions of a certain compound might be expected to vary between t and t' kg per month. An analysis of the process should yield a distribution of probability of the emissions exceeding or being

[1] The Precautionary Principle states; where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation (report of the United Nations conference on environment and development, Rio de Janeiro, 3–14 June 1992).

less than that specified by the range t and t' kg per month. One would expect the likelihood of great exceedances to be small – increasingly small as the level of exceedance increases.

An analysis of impacts based upon such a predictive distribution forms the basis of a sensitivity analysis. In essence we ask how the local population is likely to be affected by exceedances of the expected level of emission. For example, we might ask for a prediction of effects should the emission rate increase to 2t or 5t kg per month. An upper limit of emissions could be defined as that which might occur if all safety devices failed. Let us assume that this equalled 100t kg per month. Looking at the likely effects of 2t or 5t kg per month might be described as a sensitivity analysis: how sensitive are the predicted effects to variation in emissions? However, looking at the predicted effects of emission of 100t kg per month is a 'worst case analysis'. To a scientist it might appear that the likelihood of emissions reaching 100t kg per month is so small that an analysis of consequences is unhelpful; to a local population, mindful of disasters such as occurred at Bhopal (Kamat et al. 1985), such an analysis might seem essential.

It is sometimes argued that worst case analysis can be used to deal with indeterminacy. This seems to be a flawed perception. It is true that while the effects of emissions of 100t kg per month may be predictable (determinable) this fact says nothing about the determinacy of the effects of emissions of t kg per month – unless of course assumptions regarding exposure–response relationships are introduced into the analysis. This is an important point – the possible effects of the normal (likely) level of emissions may be unknown though the effects of much greater levels of emissions may be predicted with some accuracy. Furthermore, prediction of effects at normal levels of emissions from those likely to occur at much increased levels introduces a further level of uncertainty into the process.

Much of the above discussion may seem theoretical and, perhaps, far divorced from practice. All analyses include assumptions and a clear explanation of why certain assumptions were made may be more important than simply explaining how those assumptions were used in an analytical model. There are at least two audiences for such explanations: the technical audience and the non-technical (i.e. the general public). This leads to more work for the analyst and can induce a feeling of exasperation summed by the view 'I cannot be expected to teach the public toxicology, physics, engineering, probability theory and all the other disciplines necessary for a full grasp of the analysis!' While such a view can well be understood, it misses the point. Often the public might be satisfied to know that the analyst did understand all these disciplines and that he could explain – in lay terms – his processes. That this is not easy is obvious, that it is needed is equally obvious.

An aspect of the analysis, or perhaps of the assumptions lying behind the analysis, that often concerns the public is the unsupported assertion that the process considered is 'necessary'. It may rightly be asserted that waste management, including disposal, is necessary. But that begs the question, 'why here?' This is a difficult issue and needs more discussion than can be provided here and we think that it needs to be separated from health impact assessment. Equally, concerns regarding amenity and house prices (to simplify terms) may be raised and these too should not be seen as a part of health impact assessment, but they are important. It is sometimes asserted, and may be sometimes true, that local groups who express concern about the possible damage to health from emissions from an incinerator may, in fact, be more concerned about the impact of the incinerator on local amenity. Such a charge often leads to vehement denial or a counter question to the regulator 'well, would you want an incinerator at the end of your road?' The honest answer may be, 'No, I would not'. Dismissing such feelings as unscientific is a wholly inadequate response; a much more useful response

is to call for an integrated impact assessment. This should include health impact assessment but should go much further and look at amenity effects and effects on house prices. Indeed this is a role for the development planning process.

Decision-making in such an area goes beyond the remit of this report and takes us into ground that is not wholly accessible to science. Valuing the absence of an incinerator is a difficult concept and yet if the very presence of an incinerator (not any emissions from it) is what is objected to, this seems to be required. The conflicting accusations: ‘I have a right to conduct a legal business where I like’, and ‘I have a right not to live near certain businesses’, cannot be resolved by health impact assessment nor, indeed, by any form of scientific analysis. Only full engagement with local people and their concerns can lead to resolution, though it must be admitted that while consensus is possible, perhaps remarkably often, unanimity may be elusive.

4 Public acceptability of incineration – the role of pressure groups

T. Brown

As an anti-pollution campaign group, the National Society for Clean Air (NSCA) often gets contacted by members of the public who are concerned about the potential impact of new industrial developments. Incinerators are the most controversial, often provoking intense campaigning at local level, partly through the usual concerns associated with any new development, but also because incineration facilities are perceived to be particularly risky from a health perspective. Many NSCA members are local authorities who bear the brunt of these concerns and have to make planning decisions about a new facility. More generally, they are faced with the need to develop waste strategies which deliver national policy objectives for recycling and landfill diversion, but which make social, economic and environmental sense.

In 2000 NSCA commissioned a study on the public acceptability of incineration, or Energy from Waste (EfW), which aimed to address key factors affecting the public response to proposals for new incineration facilities, including fears about possible health effects. The study, published in 2001, suggested that the potential for health impacts from modern EfW facilities is now so low as to be negligible. However the study concluded that there remained some legitimate concerns, both about other impacts of incinerators on the local environment, and their place in the national waste hierarchy.

The research, overseen by an independent panel of academics, concluded that Waste Local Plans should identify optimum levels of recycling, composting and disposal options. Where there is an accepted need for incineration facilities, they should be sized to deal with local waste requirements, in order to reduce transport and reduce public resistance to waste ‘imports’. Public consultation processes should be conducted first at strategic level to encourage ownership of waste policies and improve the public’s understanding of the issues.

The study also suggested that no waste management option is totally safe. EfW facilities still produce pollution, although their total contribution to local emissions is likely to be small in relation to other sources. In particular, emissions of dioxins, which provoke most concern, are orders of magnitude lower than those from older EfW facilities now phased out thanks to tighter environmental regulations. On the other hand, the alternative disposal routes – landfill, re-use or recycling – each have associated environmental impacts. The research concluded that if (and that is an important ‘if’) EfW facilities comply with the new emissions standards to which they are designed, they are unlikely to pose a threat to local health. Such conclusions were not popular with other environmental groups. Their reaction could be divided into two responses.

One concern was that, even with tighter emission standards, incinerators are still polluting and represent a direct threat to health. Although the national emissions data shows EfW facilities to be negligible contributors overall, they might still be locally significant sources of dioxins. Plus, since the compliance regime for individual facilities

does not include continuous monitoring for dioxins (something that is difficult to do), there is no guarantee that occasional ‘spikes’ of dioxin, caused by transient conditions in the combustion system, might not be escaping. Indeed, NSCA’s own research quoted data which suggests that local levels of dioxins around EfW facilities could be much higher than the stack monitoring might imply.

Other groups were less worried about health impacts. Their main concern was that the building of more EfW facilities would reduce the impetus to recycle and create a continuing need to feed incinerators with waste. They suggested that incineration is contrary to more sustainable waste management strategies. However, they did allude to health concerns when briefing local opposition groups. While accepting privately that the health risk was low, they were often content to allow exaggerated fears about health impacts, on tactical grounds.

NSCA‘s own view was that, on the health question, the main route for human exposure to dioxins is through food and drink, rather than direct inhalation. If pressure groups were truly concerned about exposure to dioxin, there are a number of more significant sources which should be tackled. But some scientists working for pressure groups do seem genuinely concerned about local dioxin emissions. Our conclusion is that it is really up to the regulatory bodies who issue authorisations for EfW facilities (the Environment Agency, Scottish Environment Protection Agency or Environment and Heritage Service Northern Ireland) to reassure the local population that they will actually meet their designed emission standards. Appendix 3 explains how the Environment Agency assesses the environmental impacts of waste incinerators and how decisions are reached on whether a permit is granted. Communicating this to the public is a major challenge.

On the role of EfW within waste strategies, we agreed that large numbers of EfW facilities might start to suck in waste which would be better recycled, although many other European countries manage to combine high levels of incineration with high levels of recycling. In addition, there comes a point at which it becomes environmentally damaging to recycle some materials. What is needed is an analysis of the best environmental option for dealing with different wastes – working out what makes environmental sense. This would mean recycling and composting some elements and perhaps recovering energy from others, either through incineration or other techniques such as pyrolysis or digestion. All routes will have some environmental impact, but a lifecycle approach will indicate which impacts are lower.

Our conclusions should be broadly reassuring to people worried by the possible health effects of a new incinerator. But they also point to the need for local and national government, regulators, pressure groups and the waste industry to work harder to agree waste management policies that deliver a balance of environmental, social and economic goals. In particular, we need pressure groups firstly to work more closely with regulators to build confidence in understanding the likely emissions and their health impacts, and secondly to be more candid about the reasons for opposition to EfW facilities. It is certainly unfair to worry local people unnecessarily over health concerns when the real campaigning objective is broader policy change.

5 Public and scientific information sources

R. L. Maynard and H. Smethurst

We live in an age that is uniquely rich in publicly available sources of information. Material that just a decade or so ago could only be found in specialist libraries and collections is now freely available via the internet, so the interested person can rapidly acquire access to nearly all the information available to professional scientists, engineers and regulators. The impact of this explosion of access, which is not necessarily the same as an explosion of knowledge, cannot be overestimated. When combined with enhanced legislative requirements for public access to information, this requires a major shift in how professionals interface with the public.

An enthusiast, or person concerned with a single issue, can easily build up an immense fund of data and can grasp the significance of a great deal of this. The task is aided by websites set up specifically to help: sites focusing on individual diseases, toxic chemicals and processes are now common, hosted by a multitude of different sources and inevitably of varying quality in terms of the scientific basis of the materials. Dealing with the consequences of this 'information overload' is a challenge.

Professionals without experience of dealing with the interested public may be surprised by how rapidly the uncertainties of science are grasped. The interested public have a great advantage: they do not seek to rival the professional in all his or her areas of knowledge. They seek only to challenge the professional's certainty or confidence at some points. This is often an easy route to tackle because of the inherent uncertainty but also because of personal experience and knowledge which can enhance an individual's interest and ability to engage with scientific material. In medicine the concept of the 'expert patient' is well known and this can readily be extended into toxicology and environmental science. Here the concept of the 'lay expert' is often used. The greatest mistake a toxicologist writing a report on the possible effects on health of emissions from an incinerator could make would be to assume that his/her public audience is uninformed. They should in fact assume that the public are well informed. Indeed it is self-evident that not only lay experts but professional experts may exist in any community. The solution is obvious: the Environment Agency must regard the public as partners in exploring the evidence and thus as partners in the decision-making process.

A common complaint made by the public is that professionals retreat behind a smokescreen of jargon, especially when under pressure. This is all too often true. The public may readily recognise when a professional is falling back on complex theoretical concepts, which are not easily expressed in plain words. This may lead to a loss of confidence and sometimes disbelief. Mathematical jargon is particularly likely to lead to this. For example, an aerosol scientist may be asked to predict the concentration of a pollutant at a specified distance from a source. This requires the application of dispersion models, the theoretical basis of which may be undisputed among aerosol scientists. A commercially available model might be used to expedite the calculations. The public asks for an explanation of the model and for a discussion of its inherent uncertainties. The scientist may not have thought about the basis of the model for many years, may well know the likelihood of uncertainty in its predictions but in explaining these may give the impression that the model is more uncertain than it really

is. Of course, the scientist might not know the likelihood of uncertainties and is then ill-placed to explain them. Under pressure there is the temptation to fall back on assertions about the 'generally accepted' validity of a particular approach, while the questioner may be armed with a printout from a website suggesting the use of different models might lead to different conclusions. The scientist may simply have used a standard approach that other professional colleagues would not dispute. In some circumstances there is dispute among professionals and this may be readily identified by the interested lay person. All this leads us to think, again, that an approach based on partnership is needed: partnership with the public and honest, informed and clear explanations of areas of ignorance and uncertainty.

The interested public's desire for information often leads to multiple sources of information being used. Some of these may not be familiar to the professional. Some may focus specifically on areas of disagreement and contention. A desire to have the output from these sources discussed follows and this leads to the public weighing the evidence from multiple sources. This again presents a challenge to the Environment Agency and its expert advisers.

Since the interested public has access to many sources of information, they may wish to use these sources to assess assertions made in impact assessments. Consequently, time needs to be made available for investigation and discussion during the 'digestive and assimilative' processes. Decision processes that combine analysis with discussion or deliberation, sometimes called 'analytic–deliberative' decision processes, are currently the subject of much discussion and have official support. Not only do these ensure that the process of impact assessment is open to public challenge, but also that the key questions and issues that form the basis of the assessment are debated and agreed before the assessment commences. This is termed 'framing'. For example, discussion with a local community before a health impact assessment begins might identify particular concerns about local health problems that might be exacerbated by a new emission source. Such work could identify the importance of local data on the background prevalence of diseases and lead to these data being used in the assessment.

The last point introduces the concept of 'experiential knowledge', or knowledge that is acquired by direct personal experience. It may be valid or false in scientific terms but it is very important in supporting public concerns and in generating questions put to professionals and experts and therefore does need to be recognised. Importantly, within communities the role of social networks (families, friends and neighbours) is known to be very important in informing and enhancing experiential knowledge and in cascading information. Of course, local knowledge of circumstances and conditions may not be accessible to the independent scientist or regulator and can readily undermine the robustness of assessments. For example, a traffic assessment relating to a planned incinerator that was undertaken with poor understanding of local circumstances was immediately and readily criticised by a local community when they noted that cyclists had not been included in the traffic surveys. These represented a significant and potentially vulnerable group of local road users because of the proximity of a school to the proposed incinerator site. Such knowledge cannot be utilised without involvement of local people in the assessment process. Weighting the importance of experiential knowledge in comparison with more standard scientific assessments is a difficult problem.

This discussion of public access to scientific information has important implications for presenting the process of health impact assessment to the public. While there is a need for proactive discussion with people, it is important that written information (including that on websites) should compare favourably with the private and commercial information sources and websites to which the public has access. The level

of detail, presentation of uncertainties and accessibility (e.g. use of jargon) should all be considered. In presenting evidence, particularly for contentious issues such as the possible effects on health of dioxins, more than the ‘standard scientific line’ or received wisdom, is needed. It should be recognised that other opinions are possible – these should be discussed and reasons for adopting the chosen approach should be provided. Abrupt dismissal of alternative views engenders confidence in neither the chosen approach nor the conclusions.

Where applications are successful the involvement of the public should not be limited to the decision-making period: long-term involvement via websites, visitor centres and local liaison groups is helpful. These are examples of good practice that improve engagement and understanding in local communities and are adopted by the more responsible waste management companies.

6 The role of alternative science

R. L. Maynard and H. Smethurst

Our perception that there is currently a reduction of confidence in conventional science was mentioned above. This change seems to have developed during the past half century during which the early to mid 20th century confidence that science could and would solve many of mankind's problems has declined. There may be many reasons for this, including the disappointments associated with failure to find a cure for diseases such as cancer and the application of science to warfare. Concerns about the effects of accidental exposure to chemicals have also played a part and public opinion has moved from a position of generally believing what scientists said about some chemicals and processes being ‘safe’ towards a belief that no chemicals or processes are safe. Changes or perceived changes in government positions have weakened the status of scientific advice: the bovine spongiform encephalitis (BSE) episode in the UK may have added to this.

At the same time as some people have turned away from conventional science and its predictions, alternative sources of advice and opinion have grown. Of particular concern as regards health impact assessment has been the growth of what is sometimes called ‘alternative science’. This is a poorly defined term and embraces a range of opinions and viewpoints. In this chapter only a brief exploration of the area will be undertaken.

It is important to realise that ‘conventional science’ does not imply agreement as to what are often regarded as ‘facts’. On the contrary, conventional science is better defined by agreement as regards methods, especially methods of thinking. The processes of inductive reasoning (from the particular to the general), of hypothesis development and testing and of deductive reasoning (from the general to the particular) all play their part in conventional science. But not all scientists and scientific philosophers agree as to the reliability of different approaches. Karl Popper, for example, explored the long-standing Baconian approach based on inductive reasoning and argued with force that only the hypothetico-deductive approach could provide truly reliable knowledge (Popper, 1980). Others disagreed. However, the established process of observation, hypothesis development, experimental testing of hypotheses, repeatability, generalisability, publication and peer review have been widely accepted as the hallmarks of conventional science. Most practising scientists would recognise this description and many would broadly agree with it, but there is by no means such general agreement regarding the products of this process.

To take a simple example, experts in the field of carcinogenicity practising in the USA (for example in the US Environmental Protection Agency) support the general use of mathematical quantitative risk assessment for predicting the risks associated with exposure to low concentrations of carcinogens (US Environmental Protection Agency, 1986). However, experts in the UK (Department of Health Advisory Committee on the Carcinogenicity of Chemicals in Food, Consumer Products and the Environment) disagree, regarding the approach as unpredictably unreliable and do not recommend it as a general approach. These experts are familiar with the same body of evidence and neither group has unique access to some other source of wisdom. They simply disagree. The layperson might deduce that one of the two groups must be wrong: it

would be fairer to say that neither group is likely to be wholly right. As scientific work in the carcinogenicity area progresses each group is likely to ease its position and to draw closer to the other.

If we accept that scientists may themselves differ in how to interpret evidence, it is perhaps not surprising that people interested in demonstrating the acceptability or safety of a process will be able to adopt a view that accords with their beliefs, or may put more weight on one scientific view than another. Such an approach is not even-handed but is based on the adversarial method used in many judicial systems. This approach involves identification of 'sides' (e.g. prosecution and defence) with each making its case as strongly as possible. In the judicial setting the evidence is then summarised and inspected by an impartial judge and the decision taken by a lay jury.

Finding views that deviate somewhat from standard interpretations of scientific evidence is not difficult; indeed there are a number of professional scientists whose views are characterised by the extent to which they differ from those of the majority of their professional colleagues. Such scientists are sometimes described as mavericks or under other circumstances as 'hired guns': hired, that is, to advance a particular scientific, often pro-industrial, viewpoint. Such scientists prove troublesome to their colleagues, though this in itself is by no means evidence that they are wrong. There has always been a place for unconventional views in science and important discoveries and paradigm shifts in thinking often depend upon such views. Within the scientific community such views do little harm and may do much good. The public, however, might be expected to have more difficulty in interpreting such views.

Case study A

Professor A has long asserted that exposure to carbon monoxide causes osteoporosis (we know of no evidence, in reality, to support this) and has, for years perhaps, been putting this theory forward at scientific meetings. His views have not prevailed – his colleagues have seen his evidence, have been unimpressed by it and have come to regard his views as eccentric. Now a proposal to build an incinerator is put forward and it is agreed that some carbon monoxide will be released to the air. Public concern rises and Professor A appears with his theory. The public, not knowing anything of Professor A and not having looked in detail at his evidence, latch onto his theory and a scare begins. Scientists with conventional views are consulted and state, rather cautiously, that they know of 'no evidence to support' Professor A's views. On further questioning they admit that they cannot prove that carbon monoxide does not cause osteoporosis because the appropriate experiments have not been done and, in any case, 'proving a negative' may be impossible: Professor A's evidence is described as unconvincing. The stage is now set for conflict: Professor A is seen as battling alone on behalf of the local people against entrenched scientific opinion and may be treated sympathetically by the media. Concern mounts. Has Professor A's intervention been helpful? It is likely that conventional scientists would say 'no', and local campaign groups would say 'yes'. As the conflict proceeds, opinion is likely to become polarised: neither side seeing anything useful or good in the other's position.

The problem may be made worse by Professor A quoting unpublished work, or work published in journals outside the mainstream of science, as these are likely to be disregarded by conventional scientists. Conventional scientists place considerable reliance in the quality control of published work provided by the process of peer review. Scientists not in the mainstream may regard peer review as a conspiracy designed to maintain conventional views and inhibit the development of novel views. In recent years a tendency to establish new journals specifically to publish non-mainstream views has arisen. These are viewed by mainstream scientists as being outside the peer review process. In principle, peer review should be undertaken by disinterested and

well-informed critics, with the work being judged solely on its merits. But ‘merits’ is a ‘loaded term’ and in mainstream science implies demonstrated acceptance of conventional scientific practice and logic. Non-mainstream scientists may not accept such constraints and the process fails. This raises an interesting but difficult point regarding the definition of science and scientists: to some the acceptance of shared methods is an essential part of the definition.

A second and different example of non-mainstream science might be provided by the following example.

Case study B

Professor B has been impressed by some early results from an unimpeachable mainstream source: perhaps, but not necessarily, his own laboratory. If confirmed, these results suggest greater risks on exposure to some compound c than suggested by current mainstream assessments. However, assessing such early findings is always difficult. In mainstream science the need for scepticism and for caution are generally encouraged: evidence is not accepted until vigorously tested and found to be sound. But Professor B, arguing that it is better to be safe than sorry, buttresses his views with the Precautionary Principle and releases his results to the local media in an area where an application to build an industrial facility known to release compound c to the air is being considered. Again, the stage is set for conflict.

Professor B feels he has been impelled to act by the highest motives: a desire to protect health. The local campaign groups are concerned and ask for Professor B’s views to be considered. Mainstream scientists are cautious and unwilling to discuss Professor B’s claims which are admitted to be ‘worrying – if true’. Confusion follows. The safe conclusion appears rapidly – more research is needed. However, the applicant urges that a decision should be made in accordance with the normal rules of procedure. This places regulators in a difficult position and waiting for the results of research (if such could be funded) to explore Professor B’s assertion may not be a realistic option.

There is no suggestion that the motives of either Professor A or Professor B result from anything other than a desire to protect public health. Dealing with their interventions is, however, difficult.

A third type of intervention might also be considered. This is by those who decline to accept the conventional scientific paradigm outlined above and who refer to alternative philosophies. A well-known example is provided by homeopathy. Another is where a belief in ley lines may be used to argue that an industrial facility may interfere with some force field that is not recognised by conventional physicists. Such views do not, in general, have a great impact upon the processes of health impact assessment and do not receive much support from local people. Such views will not be discussed here.

How, then, should the views of the fictional Professors A and B be dealt with in the context of a health impact assessment? Dismissing their views out of hand would be a major error. Labelling Professors A and B as mavericks or ‘wild-cat scientists’ and their views as ‘off the wall’ is unhelpful and may be counterproductive. In our view, the correct approach is to engage with their views and to meet them in argument. But this may be exceedingly difficult. It may be that Professors A and B decline to engage in debate and simply assert that they have stated their opinions as clearly as they can and that it is up to the regulators to take them into account. Alternatively, Professor B, perhaps, may be all too willing to engage in debate and may prove a well-informed and formidable protagonist. Long experience may well have sharpened his wits and with missionary zeal he may be prepared to confront conventional opinion. Such a public

debate between Professor B and a cautious and conventional scientist may be unevenly balanced. Professor B is an acknowledged authority in his field, has published distinguished work and argues for a precautionary approach; the cautious mainstream scientist may well feel outweighted and also that he is being asked to speak against a precautionary approach and thus, perhaps, against the public interest. Finding scientists prepared to engage with Professor B may be difficult and this may, itself, lead to Professor B's views being regarded as sound by local people.

The solution lies in the early engagement of so-called alternative or 'non-mainstream' scientific views in the health impact assessment process. Those conducting such an assessment should identify leading figures in the 'alternative science' field and invite their participation. Detailed evidence rather than prognostications of doom should be sought and proper analysis of these views should be undertaken. Tracking the development of the arguments put forward is important. It is certainly not sufficient or satisfactory to assert that Professor A has long been regarded as maverick and that his views will thus be disregarded. It should be recalled that Professor B, and perhaps Professor A, could be right. Exploring the various scientific viewpoints, conventional and alternative, with the public is important; this might best be done in small groups with preliminary material provided to orientate the discussion. Involvement is the key – involvement of the public, of alternative scientific views and mainstream scientific views in the process of health impact assessment. It is recognised that this will be costly and demanding both in terms of time and the resources of scientists and regulators.

It is recognised that even when the public has been fully involved in the determination process and a decision has been made, some will remain unsatisfied and unhappy with the result – and possibly with the process by which it has been reached. It is impossible to design a consultative process combined with a decision taken by a regulatory body that inevitably generates complete satisfaction. However, 'getting the process right' will satisfy many and will lead to those opposing the final decision being asked to maintain their position by detailed argument rather than by assertion alone. It is unlikely that a process which is demonstrably fair and inclusive will limit the number of people opposed to an application 'on principle' but the majority are unlikely to hold such views. This belief is supported by experience. In Southampton a notably inclusive process was used with reference to an application to build an incinerator (Judith Petts, personal communication 2005).

It is accepted that even the best run process is unlikely to lead to Professor A accepting the finding, though it is slightly more likely that Professor B might be persuaded. Clearly no regulatory authority can allow discussion and explanation of the issues to continue indefinitely. The Environment Agency is required to follow a timetable in determining applications: organising a fully inclusive deliberative process within this timetable will place a heavy workload on Environment Agency staff. Responsibility for drawing the process to a close lies with the Environment Agency.

7 How the Environment Agency is working to improve the science–public interface

P. Orr

The Environment Agency wants to be recognised as a progressive organisation that uses its scientific knowledge to benefit the environment. Therefore making informed regulatory decisions is a key task. While the Environment Agency strives to use the 'best' science, public values must be taken into account to manage the areas of uncertainty, ignorance and indeterminacy referred to in earlier chapters. As a public body, the Environment Agency needs to ensure that its decision-making reflects the values and concerns of the different sectors of society who have an interest in or are affected by those decisions. This is reflected in our Science Strategy, which states: 'We also recognise the importance of engaging with public audiences about our science and its implications' (Environment Agency, 2004a).

As the number of proposals to use incineration as a means of managing waste increases, the Environment Agency has had to look at how it talks to people about incinerators and their regulation. This review of the approach to incineration is happening against a background of efforts to improve relations with local communities in all areas of the Environment Agency's work, which has been badged as 'Building trust with communities' (Environment Agency, 2006).

Like other public bodies, the Environment Agency has recognised that issues become contentious for a number of reasons, which are not necessarily related to the level of environmental hazard. High-profile conflicts over the potential health hazards from the spreading of fly ash from the incinerator at Byker in Newcastle, the proposed incinerator for Guildford and the licensing and operation of the waste management facility at Crymlyn Burrows in Swansea have contributed to the view that waste incinerators pose significant risks to public health and safety.

What is more important than the actual hazard represented by the site is what the public believes or their perception of the risk. Communities tend to become concerned when they hear contradictory statements about a site or activity, especially when made by people responsible for their control. Equally troubling are statements that give the impression that the activity and its impacts are not well understood by science.

7.1 Recognising the value of improving the public–science interface on incinerators

There are often statutory requirements for public bodies to engage with or consult those likely to be affected by their decisions. However, if this is seen simply as a chore required to comply with regulations, staff will concentrate on communicating the information that they see as important and give scant consideration to what interests or concerns the community. Long technical reports are produced and circulated, but there

may be no meaningful discussion of topics that local people see as important, if they are not on the agenda of the public body involved.

Local authorities and the Environment Agency have different roles in permitting and controlling incinerators, which will influence the relationship with members of the public. The roles played by the Environment Agency are given in Table 7.1. Where the Environment Agency is the decision-maker, it has the main responsibility for engaging the community. We have developed a simple guide to help staff think about how they approach engagement, which is based on some key principles (Box 7.1). Where the Environment Agency is not the decision-maker, it works with local authorities and others to promote open, transparent and inclusive discussion of waste planning through public debate on draft strategies, plans and development proposals. The earlier the public can be involved, the more likely it is that these objectives can be achieved.

Hampshire County Council is one local authority that has made an effort to get local people involved in discussions about waste management options, including incinerators. Its experience demonstrates that discussing the issues associated with incineration has helped to:

- identify potential problems and deal with concerns at an early stage, before they escalate;
- respond to demands to be involved;
- gather ideas that may have been overlooked;
- pool and share information;
- improve proposals and decision-making;
- promote a wider sense of ownership and acceptance of proposals;
- demonstrate accountability and responsiveness.

Table 7.1 Roles played by the Environment Agency in permitting and controlling incinerators

Activity	**Environment Agency role**
Development of regional spatial strategy and local development framework	Stakeholder
Planning applications	Consultee
Permit applications	Decision-maker
Incidents and breaches	Decision-maker
Development of science	Commissioning body

Box 7.1 Key principles to guide staff when working with communities

How we work with local communities and others is just as important as **what** we do. Use the following principles to guide all the work you are involved in:

- **Clear boundaries** – make sure people know what the Environment Agency can and cannot consider or do and what can or cannot be changed as a result.
- **Providing information** – give as much information as possible and explain if information is missing, uncertain or not known.
- **Showing respect** – show that people's views really do count and will be acted on wherever possible.
- **Feeding back** – let people know about progress and decisions as soon as possible so that they know what is happening when and why.
- **Taking action** – make people feel it is worth their while taking part by showing how they can affect change.
- **Learning** – communities bring valuable knowledge and insights. You have as much to learn from them as they do from you.
- **Being independent** – try to keep personal views, preferences and personalities out of the process.
- **Targeted approach** – different groups have different needs that you need to consider when working with them.
- **Focused on common results** – look for results that make sense to local people not just those that meet our needs.
- **Making the most of resources** – always make the best use of resources, especially time. The amount of time you spend should depend on how important the issue is. Time spent early on will often save time and effort later.
- **Part of the bigger picture** – our aim is to improve the environment. Be clear from the start how any work with communities and others can help this.

From Environment Agency (2006)

7.2 Recognising the audience

The siting and operation of a waste incinerator is seen as affecting not just the people living immediately outside the perimeter fence, but potentially the wider local area and its development. Local concern about the proposal for a waste facility at Crymlyn Burrows in Swansea focused on the health risks of the incinerator and the impact of incineration on a community already impacted by other environmental 'bads' (a major road development and industrial sites). The Environment Agency's role in permitting the site brings a responsibility towards the community, to understand its concerns and

share its thinking. The public should be able to understand the science that informs decisions.

This is not a bilateral relationship, but one that is mediated by others such as the media, professional organisations and non-governmental organisations. Since it is virtually impossible to communicate with everyone in the area, large organisations working at some distance from the grassroots often face the problem of finding valid representatives of local communities with whom they can engage. As society becomes more diverse, it is harder to find people or groups who are representative. Community organisations may represent local views on broad issues such as housing or public services, but even quite small special interest groups can mobilise significant forces behind particular campaigns. The range of groups involved in the campaign against the Guildford incinerator (from the vicar and the local paper to parents' groups) has been mirrored in other incinerator campaigns. This shows that public bodies like the Environment Agency need to be prepared to engage with different public groups and to develop skills in understanding and responding to concerns that may be expressed in very different ways.

The Environment Agency encourages staff to think about the different people they work with. They may group people according to their characteristics (are they professionals, local groups or individuals interested in environmental issues?), or the kind of knowledge or interest they have in the issues (are they primarily concerned about technical aspects, local issues or the way decisions are made?). These are not exhaustive categories, but thinking about the audience encourages staff to be responsive to different concerns. The Environment Agency's advice also highlights a typical blind spot of technical organisations: 'Be careful you do not just work with those people who are easy to work with, such as professional people, local groups and people you already talk to. You could end up excluding people who should also be involved' (Environment Agency, 2006).

7.3 Improving practice

The Environment Agency has developed a guide for staff called 'Working with others – building trust with communities' (Environment Agency, 2006) This short step-by-step guide helps staff decide the best way of working with communities and others (Figure 7.1). This guide is part of a larger package of support for staff, which includes training, learning networks and practical information.

Figure 7.1 The Building trust with communities approach. From Environment Agency (2006)

8 Summary, discussion and recommendations

R. L. Maynard and H. Smethurst

Appendix 1 to this report sets out the principles of health impact assessment and the main body of the report has focused on the means by which local people might be better involved in this process. It is our firm belief that better involvement will lead to greater trust in the process.

The process of health impact assessment is well developed in the UK. The essentials of the process are set out in Appendix 1, while Appendices 2, 3 and 4 explain how it is integrated into the process of planning approval for municipal waste incinerators and how environmental impact assessments are carried out. We have used municipal waste incinerators as an example only; this report does not set out to discuss the problems associated with municipal waste incinerators in any detail as this has been done elsewhere. We chose municipal waste incinerators as an example because planning applications associated with facilities tend to generate local opposition, and thus they provide a useful background against which to discuss reasons for such opposition and means by which underlying fears may be addressed.

A key element in the discussions surrounding this problem is the assumption that the process of approval or refusal of an application to establish a facility for waste disposal should be demonstrably open and fair, both to local people and to those making the application. We have not discussed the principle of ‘fairness’ at any length but we assume that it is widely accepted and based upon concepts of natural justice. Closely associated with the concept of fairness is the principle that the process should be scientific. By this we mean that it is generally assumed that the decisions that form part of the process should be based upon scientific evidence and upon the accepted principles of scientific thinking. These include disinterestedness in outcomes and an absence of bias. Linked with this is our acceptance that democratic processes should apply and that decision-making should be open and transparent. Again, we do not discuss why this should be the case nor whether decisions could be made in other ways – we simply accept that this is the prevailing view in the UK today.

In essence, our view is that ‘fairness’ can only be defined in terms of the prevailing societal philosophy of the time. In the UK today this calls for an even-handed weighing of scientific evidence, for involvement of the public in general, particularly those likely to be affected by any decision taken (the stakeholders), and that the process leading to the decision should be open to examination and transparent. We further accept, without discussion, that the Precautionary Principle will be used as a tool by those involved in risk management. This is the philosophical background against which we have discussed the problem before us.

In considering the reasons for public discontent with the processes used in determining planning applications we have identified three major problems.

1. Local people may feel that they are not sufficiently involved in the process. They may feel that they are disempowered and that only cursory attention is paid to their views. If this is the case, their opposition to approval of applications is almost inevitable.

2. Local people may express distrust for expert opinion. This is a complex point, but we feel that it can be broken down into four main causes or reasons:

    - The intuitive feeling that the experts are wrong. This may be based on the perception that expert opinion is often wrong or simply on the intuitive feeling that it is wrong in the specific case being considered.
    - Where there is more than one expert opinion on the point in question. This may lead to a feeling that if the experts cannot agree among themselves there must be room for doubt about all their opinions.
    - The perception that the experts are biased, particularly those called to speak in support of the case put forward by the applicants. This links with the perception that the applicant can call upon and pay for expert opinion in support of his or her case but that those opposed to the case lack access to such expert support.
    - The perception that not all the relevant evidence has been considered. Access to scientific evidence has expanded greatly in recent years due in large part to the development of the internet. This allows people to search for and often to find data not quoted by the experts commenting on the application or included within the application, and the feeling that an incomplete assessment has been made develops. This is especially the case if it is perceived that work outside what is sometimes described as mainstream science has not been considered. The voluntary involvement of experts with unconventional views may also lead to concern being increased.

3. Linked to doubts about expert opinion are concerns about uncertainty. Expert opinion is often given in a way that includes a measure of uncertainty. This may be expressed in a variety of ways and is usually well understood among scientists. Local people may, however, view uncertainty in a very different way from practising scientists. Explaining that many, if not all, scientific conclusions based on experimental or observational evidence are subject to uncertainty is difficult and cuts across the perception that science should provide sure answers. In some ways this is due to firm assertions made by scientists and in part to the fact that the public in general are personally familiar with only elementary science or elementary expositions when the uncertainties which certainly exist are not discussed.

    This difficulty is compounded by misinterpretations of the Precautionary Principle, which is interpreted by some as an instruction not to proceed in the face of doubt. Such an interpretation is quite wrong. All discussion of the Precautionary Principle should include discussion of the caveats dealing with proportionality and of the need to consider costs and benefits. But such caveats may be seen as deliberate attempts to weaken the principle and local groups may call for a more rigorous and less modified application of what they see as a clear instruction not to proceed in the face of doubt.

If these are some of the reasons for disquiet and discontent about the process of decision-making based on health impact assessment, what can be done to address them? We make a number of suggestions in the following paragraphs. In making these we have made a number of assumptions that we feel are reasonable. Indeed, we feel that without these assumptions it will be very difficult or impossible to make progress in this area. These assumptions are listed below.

1. That all those involved in the process will wish that the decision be taken fairly and in accordance with widely accepted principles of natural justice. This implies fairness towards the local population and towards the applicant. It also implies a willingness to be persuaded by evidence.

2. That views put forward by all involved reflect honestly held concerns. For example, an assertion of concern about the possibility of emissions from some process causing cancer is honest and not merely a cover for concerns about loss of amenity.
3. That a scientific approach will be taken when selecting evidence for consideration and in weighing that evidence. We think this is important, though we accept that not all might agree with it.
4. That concerns about amenity – which may not be susceptible to scientific analysis – are handled appropriately. We have not investigated approaches in this area but the principles of cost-benefit analysis may be applicable.
5. That there is general acceptance of the principle that openness and transparency should be features of all public decision-making of this type.

8.1 Recommendations

It is critically important to involve local people in the discussion leading to a decision at an early stage. The responsibility for this lies with the applicant and the local authority for planning applications and with the Environment Agency for pollution control permits. We do not believe it is satisfactory for applicants not to inform local people about their intentions to make an application: on the contrary, before any formal application is made the applicant should have been engaging in detailed discussion with local people. Responsibility to do this clearly lies with the applicant; however, local authorities and the Environment Agency should encourage applicants to discharge this responsibility.

Providing opportunities for involving local people in understanding and discussing the evidence presented in support of the application is essential. This evidence must be presented in an even-handed way and evidence that bears against the case in favour of the application must not be suppressed. This places a heavy responsibility on the applicant: they are asked to find points both for and against their case and this might be regarded as unfair to them. However, we do not think this is the case. The applicants have access to evidence that is unlikely to be available to local people and will probably have sought expert opinion. This expert opinion should be demonstrably unbiased. All the evidence and advice obtained by the applicant should be made available to the public.

The recommendation also places a responsibility on the Environment Agency and on the statutory consultees in the process. They should be seen as guardians of public welfare and should inform the public of their concerns. Meetings with the public may be needed and officials from the Environment Agency should regard these as more than opportunities to register local concerns. Explaining the evidence put forward by the applicant is important, discussing how that evidence has been acquired and its validity is important, and showing how the evidence can be tested is critical. Guidelines on how evidence should be presented and explained should be developed.

Accepting that contrary opinions may be put forward is very necessary. This means that officials will need to engage with assertions made by recognised experts and by any others who wish to express a view. We accept that this will be both difficult and time consuming. In many cases it will not be needed, but when high-profile issues such as incineration are discussed it is likely to be essential. Discarding views as uninformed or unscientific is likely to be unhelpful. All views should be considered carefully, though officials should not be asked to depart from currently accepted views on the need for evidence to stand up to the tests of peer review and scientific logic. We think that

explaining these requirements will do much to assure local people that all points of view are being considered fairly and equally.

It is important that an adversarial approach should be avoided as far as possible. The applicant and the local people are often seen as being on opposite sides with the Environment Agency 'holding the ring' or acting as a judge. Although the Environment Agency clearly has a responsibility to decide on applications (this is its major task) and procedures for appealing against decision are in place, it is far preferable that the Environment Agency, the applicant and the local people work together to develop a satisfactory decision. This may be seen as idealistic and infeasible but we think it represents a much more satisfactory approach than an adversarial contest. However, it places a responsibility on all parties to engage constructively.

It is important to explain that local knowledge and information has a real and important part to play in the deliberative process. The perception that the decision will be taken without regard for local conditions must be dispelled. Providing a channel by which such local knowledge can be fed into the decision-making process is important and a challenge. Discussion with small groups of local people offers a way forward.

The above recommendations have focused on the Environment Agency, the local people and the applicant. One further group needs to be considered: the pressure group. In some ways such groups pose the most difficult problem. For example, a pressure group devoted to advocating greater recycling of waste and less waste production, might choose to campaign against every application to build or expand an incineration facility 'on principle'. They may argue that every incinerator that is built takes pressure off the need for waste reduction and recycling and that if no incinerators were built these processes would flourish. We cannot discuss here the validity of this position. However, it is clear that the UK and European partners have adopted the approach in the context of the waste hierarchy that some waste – probably an increasing amount of waste – will need to be incinerated. Explaining this to local people is essential: it seems to us that the utopian positions – no incinerators or even no more incinerators – are unhelpful in taking decisions about specific applications. Many pressure groups do not take such an extreme view and can play an important part in local debate.

A final and rather obvious recommendation is that the Environment Agency should learn from examples of decisions that have 'gone well' – in the sense that participants have been satisfied by the process – and from those that have 'gone badly'.

8.2 Research recommendations

We are aware that the above recommendations, if accepted, place burdens on the participants in the decision-making process. We are aware that it is easier to say what should be done than how it should be done. As a response to the latter point we have put forward a number of research recommendations.

1. Work is needed to explore people's distrust of conventional science as applied to decision-making processes. This applies much more widely than on the question of incineration. We think this might be approached by means of focus groups.

2. Difficulty is sometimes encountered as a result of applications including much difficult science, particularly in the field of modelling dispersion of pollutants and predicting their effects on health. Means of simplifying such presentations need to be found.

3. Further work on how local people acquire and understand scientific evidence is needed. Again, work with focus groups may be a useful way forward.

Appendix 1: Health risk assessment and health impact assessment

F. Hurley and J. Kemm

Health impact assessment

Health impact assessment, in the context in which we use the term, is a systematic attempt to predict the consequences for health of following different policy options, which assists decision-makers in choosing between options and in optimising the chosen option. Ideally health impact assessment would consider all impacts on health and quantify the magnitude of each impact, although in practice this is never achieved. It would also describe the distribution of impacts within the population so that those who stand to gain or lose under each option could be identified, helping decision-makers to act to decrease health inequalities. Such impacts might cover physical health (including mortality and morbidity from different diseases), psychological health and social health.

Analysis of causal pathways: the impact pathway approach

Impacts on health are considered by analysing the causal paths by which impacts might occur. For each policy option being evaluated, this involves:

- identifying the many ways in which that option leads to changes in the physical, social and economic environment;
- following the causal pathways linking those changes to changes in human health;
- describing the population affected by those changes;
- where practicable, quantifying the associated health impacts on the population-at-risk and how those changes will be distributed in that population.

The kinds of issues which need to be considered include the effects on health of:

- exposure to physico-chemical factors (such as air and other types of pollution and noise);
- changes in other environmental factors (such as traffic, the quality of housing and the built environment and amenity of the natural environment);
- changes in social factors (such as community cohesion, local pride and fear of crime);.
- changes in economic factors (such as employment opportunities and income);
- changes in psychological factors (such as fears and anxieties about proposals).

While some of the impact pathways can be precisely defined and measured, others are much more difficult to define and measure. This reflects differences in the knowledge we have of how various risk factors can be linked with changes in human health. These

differences in turn reflect differences in the complexity of the issues to be investigated and also in the maturity of various areas of public health research.

Different approaches to health impact assessment

There are two main approaches to health impact assessment. The first involves using epidemiological toxicological methods and tends to be expert-driven and not necessarily accessible to stakeholders. The second, using sociological methods, allows strong stakeholder involvement.

Ideally, health impact assessment methods will use the best of both approaches. Although this is challenging, there is evidence that practitioners of both approaches recognise the need for this.

Epidemiological toxicological approach

The epidemiological toxicological approach is based on the following concepts:

- burdens, emissions or other hazards to health associated with various policy options;
- changes in how a population-at-risk is exposed to these risk factors;
- exposure–response (or dose–response or concentration–response) curves linking changes in exposure (or dose or concentration) with the risks of adverse health effects.

Implementation of the approach involves linking these various elements together quantitatively to give estimates of health impacts in different timescales. In complex analyses, this involves the use of Geographical Information System (GIS) methods. The epidemiological toxicological approach is best suited to situations where there is substantial existing research knowledge and relatively simple causal pathways.

There are many difficulties and uncertainties associated with estimating health impacts, which therefore make it hard to implement this methodology. For example, in practice it may be difficult to estimate incremental exposure (using plume modelling etc). Often the dose–response curves for the ranges of exposure expected are uncertain, perhaps requiring extrapolation to new populations. There may be uncertainties about many other aspects such as ‘safe levels’ of pollutants, complex routes of exposure, effects of mixtures, time lags between exposure and impact or how impacts are distributed across a population, particularly among groups of susceptible individuals.

However, these are well-known problems and a good quantitative health impact assessment goes a long way towards addressing them. This will include evaluation of uncertainties, for example by carrying out sensitivity analyses of key assumptions. Note that it is neither practicable nor necessary to eliminate uncertainty. In particular, many uncertainties are sufficiently small that they will not affect what policy options are chosen.

The main advantages of the approach are that:

- it is transparent (though expert knowledge may be needed to evaluate its reliability);
- it is rooted in exposure-related and bio-medical scientific evidence;
- it pushes all involved to recognising the complexity of the assessment;
- it allows checking of what matters, and so assists in focusing on what makes a real difference to choosing between policy options.

A major unsolved problem is how best to integrate information over pathways that can be quantified and others that cannot. It is important to safeguard against a danger of basing policy only on what is quantified.

Comparative Risk Assessment seeks to combine the different impacts in a single metric. One such metric is monetary valuation. Others are 'Potential years of life lost', 'Quality adjusted life years' and 'Disability adjusted life years'. There is a growing branch of environmental economics which aims to provide empirical evidence for monetary values on health impacts, ecological impacts, amenity impacts and so on. The attraction of a single metric is obvious – if this could be adequately done, choosing between options would reduce to scoring the combined health impact and selecting the one that was most favourable. Monetary values are used increasingly in policy assessment, for example in comparing costs and benefits of a particular policy (cost benefit analysis). However, this remains a controversial approach. There are many theoretical, practical and ethical problems in combining different impacts into a single metric. Some commentators think that these are so great that it should not be attempted. For the foreseeable future judgement and trade-offs between different impacts will remain an essential part of policy decision-making.

Sociological approaches

Sociological approaches place considerable emphasis on the views of stakeholders, that is those who might be affected by the decision. This approach provides insight into many causal paths that are difficult to handle under the epidemiological toxicological approach. Communities do not passively await impacts but react in complex ways to any disturbance in their environment. Sociological approaches can give insight into this, by tapping into local knowledge. They can also explore people's perceptions of proposals, which may have important consequences for how their health is ultimately affected. Sociological approaches are also useful for answering questions such as which impacts should be considered, how trade-offs between different impacts should be made and how the interests of different sections of the community should be balanced.

The weakness of the sociological approach is that it offers little guidance on how conflicting views should be resolved, the mechanisms underlying causal pathways or the thought processes by which predictions have been arrived at. Consensus is not a guarantee that predictions will be correct.

Participation by stakeholders is desirable because:

- stakeholders are a source of information;
- it encourages openness;
- stakeholders have a right to be involved;
- participation may increase acceptance of ultimate decision and conflict resolution;
- it aids community learning.

However, there are major difficulties in organising effective participation – who are stakeholders – who represents stakeholders – what is their legitimacy – practicalities of participation (meetings, focus groups, questionnaires etc)

It is important that adherents of both approaches understand the strengths and weaknesses of each. We know that existing approaches are frequently not trusted by the public. We need methods that both make the fullest use of current bio-medical understanding and engage fully with people's fears, hopes and perceptions.

Appendix 2: Environmental assessment in waste planning

M. Slater

Strategic Environmental Assessment and Environmental Impact Assessment

Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) originated in the USA in the early 1970s, following the enactment of the National Environmental Policy Act in 1969 (United States Congress, 1970). SEA and EIA are environmental management disciplines that are based on the principle that prevention is better than a cure. In practice, this involves predicting the potential environmental effects of plans, programmes and projects, consulting with the public, and then either avoiding impacts through better design and decision-making or minimising impacts on the ground by mitigation techniques and environmental enhancements.

SEA can be defined as:
the systematic appraisal of the potential environmental consequences of decision-making such as policies, plans, strategies and programmes before they are approved.
(Environment Agency, 2004c)

EIA can be defined as:
a process by which the likely impacts of a project upon the environment are collated, assessed and taken into account before the project is allowed to go ahead.
(Environment Agency, 2004d)

SEA is applied at higher levels of decision-making and objectives and decisions will cascade down the hierarchy to individual projects and permits. The relationship between SEA and EIA is illustrated in Figure A2.1

SEA and EIA in the UK

The 1985 European Council Directive on ‘the assessment of the effects of certain public and private projects on the environment’ (EEC, 1985), known as the EIA Directive, was implemented in the UK in 1988 through numerous EIA regulations. These were subsequently rationalised and revised with new planning EIA regulations in 1999, following a revised Directive in 1997 (European Council, 1997b). The Directive requires EIA to be undertaken on certain classes of projects and an Environmental Statement to be submitted with an application for development consent. These classes of projects are divided into two types and defined in Schedules 1 and 2 of the EIA regulations. Schedule 1 projects are potentially high impact projects where EIA is mandatory. This includes projects such as airports and waste disposal installations for incineration or chemical treatment of hazardous and non-hazardous wastes. Schedule 2 project classes require EIA according to defined criteria and thresholds and include developments such as waste disposal installations of a kind not specified in Schedule 1.

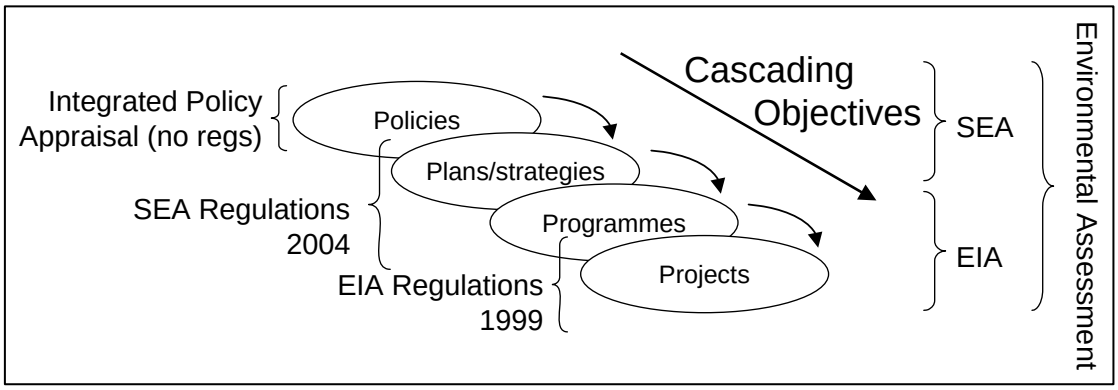


Figure A2.1 The relationship between SEA and EIA. On the left is shown the strict application of the SEA and EIA regulations to plans and programmes and projects respectively. The right hand brackets illustrate the reality that the interface between projects and programmes is often not clear and SEA and EIA are often used more broadly

Directive 2001/42/EC on the 'assessment of the effects of certain plans and programmes on the environment' (European Council, 2001) was adopted by the European Commission (EC) on 27 June 2001. Member states had until 21 July 2004 to transpose it into national law. The directive only applies to plans and programmes of public authorities, although some plans and programmes of statutory undertakers may be relevant. The Directive was implemented in the UK through secondary legislation in July 2004. For England the relevant legislation is the Environmental Assessment of Plans and Programmes Regulations (Office of the Deputy Prime Minister, 2004a), while in Wales, the Environmental Assessment of Plans and Programmes (Wales) Regulations (National Assembly for Wales, 2004) apply.

The scope of the Directive is very broad, encompassing sectors such as land use planning, tourism, telecommunications and waste management. The application of SEA to plans and programmes within these sectors is dependent on a complex series of tests including whether significant environmental effects are likely (Office of the Deputy Prime Minister, July 2004).

A number of waste plans at the national, regional and local level require SEA. An indicative list issued by the Office of the Deputy Prime Minister (ODPM) in July 2004 (Office of the Deputy Prime Minister, 2004b) identified the following waste management and land use plans requiring SEA: revisions to the Waste Strategy 2000 and the Wales Waste Strategy; Waste Local Plans; combined Minerals and Waste Plans; Municipal Waste Management Strategies; Regional Strategies including their component strategies for waste; Regional Waste Plans for Wales and Local Development Documents. The Directive requires plan-makers to undertake an SEA during the development of the plan or programme and publish an Environmental Report with the draft plan describing the significant environmental effects of plan options and the preferred option with mitigation measures and proposals for monitoring the implementation of the plan. At the end of the process the plan-maker must publish a statement describing how the SEA and public consultations have influenced the plan and must justify the preferred option.

Assessment of health effects

Annex I of the SEA Directive specifies a number of environmental factors to be assessed during the SEA, including potential impacts on the soil, air and water environments, and biodiversity. The SEA Directive also includes human health as a factor to be assessed. The European Union Guidance on the Directive (European Council, 2003) does not define these terms; however, it states that human health should be considered in the context of the other environmental factors listed in Annex I of the Directive. The guidance advises:

...*and thus environmentally related health issues such as exposure to traffic noise or air pollutants are obvious aspects to study*.

Similarly, although the ODPM draft SEA guidance (Office of the Deputy Prime Minister, 2004) does not provide a definition of human health, it does provide guidance which aggregates human health with the term population and gives a number of objectives and indicators:

- Protect and enhance human health as expressed via key indicators – years of healthy life expectancy, mortality by cause.
- Decrease noise and vibration as expressed via key indicators – number of people affected by ambient noise levels and proportion of tranquil areas.

It goes on to advise on various sources of health-related baseline data available from the Department of Health, Health and Safety Executive, Health Development Agency Evidence Base and HealthPromis.

Role of the Environment Agency

The Environment Agency has a dual role in both EIA and SEA. It is both a proponent of projects, plans and programmes requiring EIA and SEA (e.g. for many water management activities) and also a statutory consultee under the EIA and SEA regulations. As a statutory consultee it is required to provide an opinion on the issues and information that should be considered by the project proponent or plan-maker and must be consulted on the resulting project Environment Impact Statement or Environmental Report and Draft Plan. It has produced SEA Good Practice Guidelines, which provide web-based advice and guidance on undertaking SEA (see http://www.environment-agency.gov.uk/seaguidelines).

The SEA Directive provides a new opportunity for the Environment Agency to influence waste planning and land use planning to deliver its objectives, targets and aspirations for sustainable waste management and for effects on human health to be considered. This is particularly important for the Environment Agency to influence, as many of the important decisions on waste management options and broad locations of facilities may have been taken at the plan level and before the Environment Agency is consulted on individual planning applications and waste management licences and other pollution permits.

Conclusions

SEA requires the impacts on human health to be assessed at the plan level, which is a new requirement compared with EIA. The technical challenge of making robust predictions on human health and populations at the plan level is considerable and will require development of new tools and techniques as well as new demands on data and information. SEA will undoubtedly bring the discipline of health impact assessment into

plan-making and will require greater co-operation between health professionals and Environment Agency environmental scientists and planners.

Appendix 3: Permitting of municipal waste incinerators under the Environmental Permitting Regulations

A. Anjum

Introduction

The Environment Agency regulates all municipal waste incinerators in England and Wales. These incinerators are subject to the Waste Incineration Directive (WID) (2000/67/EC), which applies to the incineration and co-incineration of both hazardous and non-hazardous waste and came into force on 28 December 2000. The WID requires the setting and maintaining of stringent operational conditions, technical requirements and emission limit values for facilities incinerating and co-incinerating waste throughout the European Community. The WID was transposed into national legislation by means of the Waste Incineration (England and Wales) Regulations 2002 (SI 2002 No 2980), the Pollution Prevention and Control (PPC) (England and Wales) Regulations 2000 (SI 2000/1973), and by the Secretary of State's directions to Regulators. The WID has applied to new incinerators from the end of 2002 and to existing incinerators from the end of 2005. From 6 April 2008, the PPC regime has been replaced by the Environmental Permitting (England and Wales) Regulations 2007 (SI No. 3538, 2007) (EPR). This regime covers facilities previously regulated under PPC Regulations and Waste Management Licensing Regulations. Secretary of State's Directions on the implementation of the WID have now been incorporated into EPR. As such, all municipal waste incinerators are subject to EPR and the WID.

Pre-permitting

The public should be aware of a proposal to build an incinerator in their area because of the processes set down to deliver waste and planning strategies; however, this may not always be the case. The awareness should start with the local council publishing its waste plan or strategy, which details the waste disposal options available to them. Depending on local circumstances, these options may or may not include an incinerator. Having established its strategy, the local authority will put the options suggested out to public tender. These tenders will be assessed and the council will announce the successful bidder and the chosen disposal options.

The chosen operator will at this stage begin developing their proposals, which will include submissions for planning consent and an application for an EPR permit. Both the planning process and EPR permit approval require public consultation. There is no legal duty on the operator, the local authority or the Environment Agency to call public meetings. When public meetings do take place, usually requested by 'concerned' residents, the meetings are advertised in the local papers, and Environment Agency Area staff attend to explain our regulatory role and answer questions. The Environment

Agency has also organised ‘surgeries’ where we meet smaller groups from the community and answer their questions.

Meetings between the applicant for an environmental permit and the Environment Agency are an opportunity to discuss choice of technology, firing systems, boiler design, abatement equipment etc. The Environment Agency also outlines the applicable legislation, technical standards and the permitting procedure with the applicants. While the technical nature of the meetings may not be suitable for public participation, and the meetings are not open to the public, the subject matter will certainly be of interest to the public.

Permitting procedure

The Environment Agency engages with potential applicants for incinerator permits well before an application is received. At these meetings, the Environment Agency will explain the technical, environmental and regulatory requirements with which the applicant will have to comply. The main emphasis is on minimising emissions that may harm human health or the quality of the environment. Operators also have available to them the Environment Agency’s Technical Guidance (Environment Agency, 2004b) and environmental assessment guidance (Environment Agency, 2002), relevant directives and any guidance issued by Government (e.g. Guidance on Directive 2000/76/EC on the Incineration of Waste). No requirement is placed on the applicant to engage in discussions with the public before an application is lodged with the Environment Agency. An operator must make an application to obtain an EPR permit. This application must contain a range of data, including proposed facility design, type of waste to be incinerated, location, site survey, substances to be used, type and level of emissions, stack height calculations and dispersion modelling results, abatement technology, monitoring proposals, measures for dealing with resulting waste, effects on the environment and any other factors that the applicant wishes to be taken into account.

Once an application has been received and the initial checks show that it is a valid application, the formal permitting procedure starts. The main steps of this permitting procedure are described below.

Consultation

We want to make the best decision when permitting. Listening to the views of others helps us to take account of concerns that we would not otherwise be aware of. EPR make provisions for us to consult interested individuals and organisations as appropriate. For this consultation, we take the following steps:

- Validated application is placed on our public registers (held in our local offices and the offices of the relevant local authority).
- We will advertise the application, usually within 14 days and invite the public and relevant organisations to comment on the application. Our advertisement will include information on where the application can be viewed and advise on where to send the comments. This consultation is for 28 days.
- We consider the application together with comments we receive from consultation.
- Based on the application and comments received we will decide whether or not to grant a permit.
- We will publish our draft decision together with an explanation and ask for further comments.
- We will publish our final decision and explanation.

EPR requires us to take appropriate steps to consult public consultees (public consultees means a person who in our opinion is affected by or likely to be affected by or has an interest in the application). Apart from the public, some statutory organisations have an interest in aspects of environmental permitting. We will agree ways of working together with them and we will publish these details on our website. These organisations include:

- Natural England/Countryside Council for Wales
- LACORS (the Local Authority Co-ordinators of Regulatory Services)
- Local authorities (Planning and Environmental Protection departments)
- Food Standards Agency
- Health and Safety Executive
- Water UK
- Primary Care Trusts (England)/Local Health Boards (Wales)

Main issues for consideration in determining an application

EPR is a regulatory system that employs an integrated approach to control the environmental impacts of the listed industrial activities (e.g. incinerators). This involves the regulator determining the appropriate controls of the activity to protect the environment through a permitting process. These regulations require that the regulator must exercise its relevant functions so as to ensure compliance with various provisions of the IPPC Directive. A general requirement of the PPC regulations is that the facility is operated in such a way that: (a) all preventive measures are taken against pollution, in particular through the application of BAT (Best Available Techniques); and (b) no significant pollution is caused. EP regulations define pollution as ‘emissions as a result of human activity which may be harmful to human health or the quality of the environment, cause offence to any human senses, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment’. The aim of an Environment Agency permit is to ensure that the facility is operated in such a way and under such conditions that the above statutory requirements are delivered.

BAT review

In making their application operators should demonstrate that the techniques they are using or proposing to use represent BAT for that installation and meet certain other requirements taking relevant local factors into account. This would involve a comparison of the available techniques (e.g. furnace types, abatement techniques etc) by using the Environment Agency methodology (or equivalent) on Environmental Assessment and Appraisal of BAT. The Environment Agency officers will check this appraisal thoroughly to ensure that the best techniques are being proposed.

BAT includes technical components, process control, and management of the installation and benchmark levels of emissions. Indicative BAT standards are given in Environment Agency Guidance Notes and, where relevant, should be used unless a different standard can be justified for the installation. Any mandatory limits in applicable Directives (e.g. the WID) must be met but BAT may go beyond these limits.

The BAT approach complements but differs from regulatory approaches based on Environmental Quality Standards (EQS). Essentially BAT requires measures to be

taken to prevent or, where this is not practicable, to reduce or limit emissions. Thus, if emissions can be reduced further, or prevented altogether, at reasonable cost, then this should be done **irrespective** of whether any EQS are already being met. The environment should not be considered as a recipient of pollutants and waste, which can be filled up to a given level, and all that is practicable should be done to minimise the impact of industrial activities. The BAT review process considers what can be reasonably achieved within the installation first and only then checks to ensure that the local environmental conditions are secure. The BAT approach is, in this respect, a more precautionary one, which may go beyond the requirements of EQS.

The environment

A general principle of EPR is to achieve a high level of protection of the environment and thus installations should be operated in such a way that no significant pollution is caused. Therefore, applicants must provide information on 'the nature, quantities and sources of foreseeable emissions from the installation or mobile plant into each environmental medium, and a description of any foreseeable significant effects of the emissions on the environment'. The installation-wide environmental assessment should always be conducted once the operator has identified proposed BAT for the installation as a whole, in order to confirm that the combination of the techniques will not lead to significant pollution.

The Environment Agency has produced a Guidance Note for Environmental Assessment and Appraisal of BAT (Environment Agency, 2002), known as H1, to assist applicants in responding to the requirements of BAT and environmental assessment. In particular, this note provides:

- Methods for quantifying environmental impacts to all media based generally on prevention of harm to human and ecological receptors, using a set of defined environmental benchmarks which represent the maximum acceptable level of that substance to a receptor in that medium. The assessment of non-local or indirect impacts of emissions, where no maximum thresholds for the prevention of harm are available, is based on quantification of overall environmental burdens.
- A method for calculating costs of environmental protection techniques.
- Guidelines on resolving cross-media conflicts and making cost/benefit judgements.

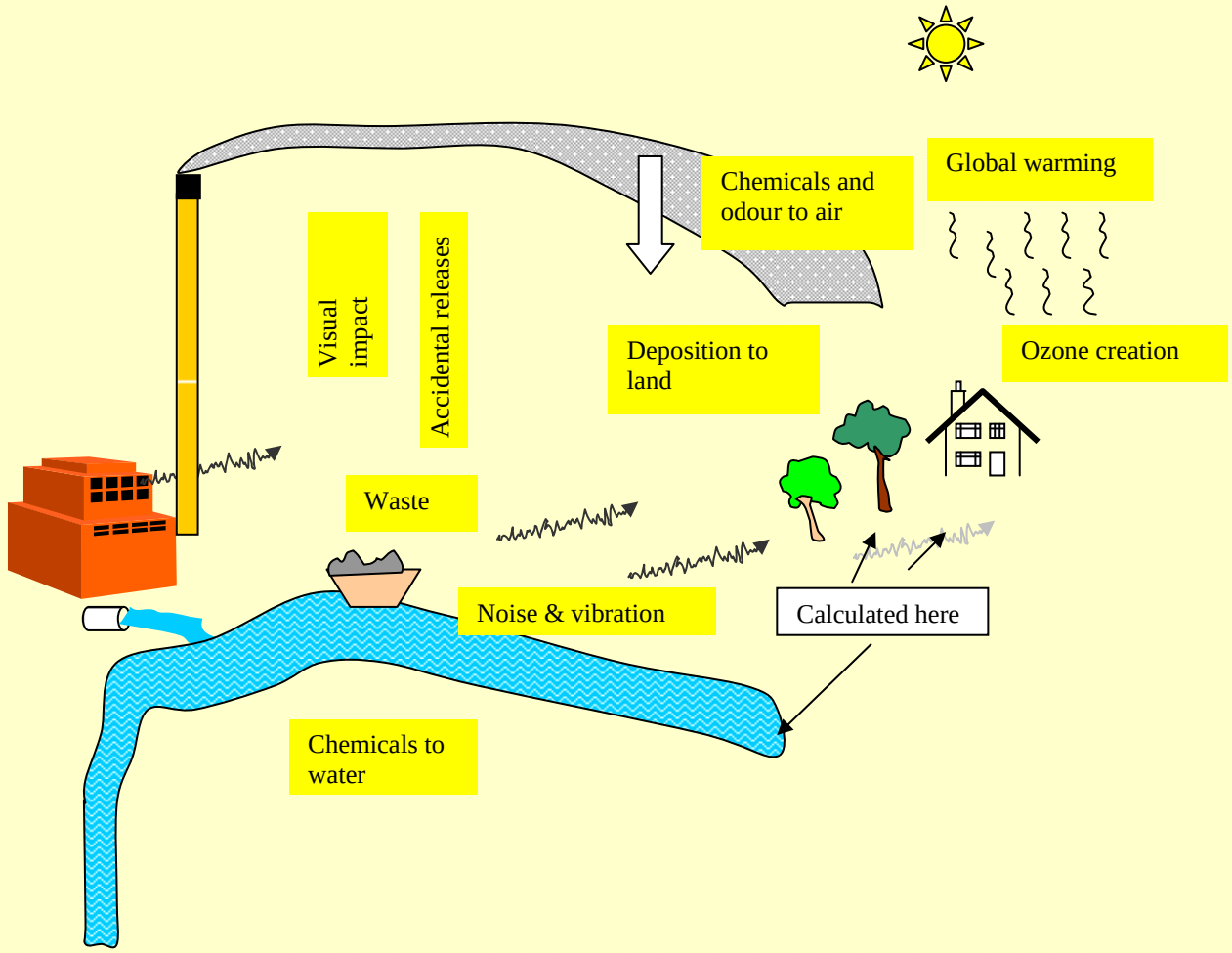
The H1 methodology employs a five-stage process to assess the local environmental impacts of the installation. These are summarised pictorially in Figure A3.1 and discussed briefly below:

1. Estimate both the long-term and short-term process contributions (PC) of all substances released to air, using the following simplified calculation method.

$$PC_{air} = DF \times RR$$

PC = process contribution ($\mu g/m^3$);
RR = release rate of substance in g/s, and,
DF = dispersion factor, expressed as the maximum average ground level concentration per unit mass release rate ($\mu g/m^3/g/s$), based on annual average for long-term releases and hourly average for short-term releases.
EQ = environmental quotient, i.e. process contribution divided by EAL
EAL = environmental assessment level
EQS = Environmental Quality Standard

Figure A3.1 Quantifying the environmental impacts



QUANTIFY LOCAL IMPACTS

- **ESTIMATE** the levels in the environment after dispersion using simple formulae (e.g. calculate PC)
- **SCREEN** out emissions that are unlikely to have significant impact (e.g. PC<1%EAL)
- Use the guidelines to see if detailed **MODELLING** is required. Refine process contributions if needed
- **COMPARE** levels against EQSs or EALs and other benchmarks and **REJECT** situation for any releases which are unacceptable
- **SUMMARISE IMPACTS,** using **NORMALISATION** against **BENCHMARKS** where appropriate, e.g. $EQ_{(air)}$, $EQ_{(water)}$, $EQ_{(land)}$

QUANTIFY NON-LOCAL IMPACTS

Calculate **ENVIRONMENTAL BURDEN** of:

- **GLOBAL WARMING POTENTIAL** using relative activity indices
- **OZONE CREATION POTENTIAL** using relative activity indices
- **WASTE HAZARD & DISPOSAL** using relative score
- **SUMMARISE** non-local impacts, using **TOTAL BURDEN** where appropriate

2. Identify the emissions that warrant further investigation of their impacts, by screening out those which are emitted in such small quantities that they are unlikely to cause a significant impact on the receiving environment. This is done using the method below:

    - Compare the short-term and long-term process contributions (PC) of substances emitted to air against the relevant short-term and long-term environmental benchmarks for emissions to air.
    - Identify which emissions warrant further assessment by applying the criteria below:

    $$PC_{long\ term} > 1\% \text{ of the long-term environmental benchmark}$$
    $$PC_{short\ term} > 10\% \text{ of the short-term environmental benchmark}$$

    - Ensure that the same statistical basis for mass concentration as the environmental benchmarks is used.

3. Identify whether any emissions require detailed modelling, taking the following guidelines into account:

    Long-term effects
    Obtain information on the long-term ambient concentrations for releases to air. Then calculate the total predicted environmental concentration (PEC) of that substance by summing the background concentration and the process contribution.

    $$PEC_{air} = PC_{air} + background\ concentration_{air}$$

    Modelling of long-term effects may be appropriate if the long-term PEC is above 70% of the relevant environmental benchmark (EQS or EAL), or in locations where there is an Air Quality Management Plan for a substance emitted by any of the options. Modelling of long-term effects may also be appropriate if the PC forms more than 20% of the headroom between the background concentration and the EQS or EAL.

    Short-term effects
    Modelling of short-term effects may be appropriate if the short-term PC is more than 20% of the difference between the (long-term) background concentration and the relevant short-term environmental benchmark (EQS or EAL).

    Sensitive receptors
    If there are any local receptors which are sensitive to any of the emissions that have not been screened out, then modelling of long-term and short-term effects may be needed.

    Small point sources
    For small point sources such as vents and short stacks, a case may be made by the operator that the scale of the release does not warrant detailed modelling on the basis of limited environmental risk. This should be done preferably in discussion with the regulator.

4. Assess acceptability against local environmental requirements by:

    - Checking whether the emissions of substances from the proposed options are acceptable in relation to the existing local air quality and any statutory requirements. This should be done for long-term emissions by comparing the

long-term PEC of each substance released to air with the corresponding long-term EAL or EQS for that substance. For short-term emissions the PEC should be calculated by adding the short-term PC to twice the long-term ambient concentration and then the PEC should be compared with the short-term EAL or EQS.

- Identifying any releases where the EAL or EQS is already exceeded, or where the contribution from the installation will result in the EAL or EQS being exceeded. Such options are unlikely to be considered acceptable and should normally be ruled out of further consideration in this appraisal.

5. Summarise the impact of emissions to air

For each option, list all substances emitted to air that have not been screened as insignificant in point 2 above. This should be done for long-term emissions only. Where there are no emissions to air for any or all of the options, the operator should state that this is the case.

Normalise the process contribution (PC) of each substance (calculated in (1) above) against the appropriate environmental benchmark (EQS or EAL) for that substance, according to the formula below. The resulting figure is known as the environmental quotient (EQ).

$$EQ_{(substance)} = \frac{PC_{(substance)}}{EAL_{(substance)}}$$

Sum the environmental quotients to provide total impact of emissions to air for each option. If the environmental benchmarks used for normalisation are derived on the same basis (e.g. protection of human health), then the environmental quotients (EQ) can be added to obtain a cumulative total impact, i.e.

$$EQ_{air} = EQ_{substance\ 1} + EQ_{substance\ 2} + \ldots\ldots$$

The above relates to air emissions only. However, H1 contains guidance on the calculation of other impacts that should be included in the application. These are:

- deposition from air to land
- emissions to water (surface water, rivers and estuaries)
- noise
- accidents
- visual impacts
- odour
- waste hazards and disposal

The level of detail provided in the application should correspond to the level of risk to the environment from the emissions. Installations that have important or sensitive receptors located within the receiving environment, or emit substances of a nature and quantity that could affect environmental receptors, may require a more detailed assessment. Important and sensitive receptors include:

- Habitats Directive sites within a defined distance
- Habitats Directive sites which are downwind (at any distance)
- Sites of Specific Scientific Interest (SSSI) within 2 km
- Human population (e.g. schools, hospitals, neighbouring properties)
- Food production areas

- Cultural heritage sites
- Sensitive soils
- Sensitive watercourses

Health

The Environment Agency uses information provided by the applicant to consider health effects of the new incinerator by:

- Comparison of stack emission concentrations with guidance and regulations, e.g. Waste Incineration Directive has limits that should prevent any unacceptable impact for the majority of locations.
- Modelling of emissions to determine the ground level concentrations of pollutants and comparing these with Air Quality Standards. This includes food uptake paths for dioxins and using Department of Health guidance.
- Consideration of scientific opinion on health effects due to emissions using, for example, publications of expert committees (e.g. Committee on Carcinogenicity of chemicals in food, consumer products and the environment) and research reports (e.g. Defra, 2004).
- Seeking advice from expert bodies like the Food Standards Agency and the local Primary Care Trust (England) or Local Health Board (Wales). If specific issues need to be addressed the Environment Agency uses external experts for advice.

How does the Environment Agency come to a decision?

Before reaching a decision to grant a permit, the Environment Agency must be satisfied that:

- The applicant has demonstrated that the proposed facility meets the requirements of the EPR and uses BAT in its design and operation. It must also meet criteria set out in other relevant legislation.
- That the standards proposed for the design, construction and operation of the facility meet or exceed the Environment Agency's guidance, national legislation and relevant directives.
- The comments received from the public and the statutory consultees have been taken into account.
- As far as practicable, the energy generated by the incinerator will be recovered for use.
- The residues will be minimised in their amount and harmfulness and recycled where appropriate.
- Proposed measurement techniques for emissions are in line with those specified in national legislation and relevant directives.

In brief, a permit will only be issued if the Environment Agency is sure that the facility will be designed, constructed and operated in a manner that will not cause significant pollution of the environment or harm to human health.

If the Environment Agency is satisfied that the above criteria are met, it will issue the permit. This will be accompanied by a decision document explaining the decision and showing how the Environment Agency has taken into account the material comments it received. The permit will contain a whole series of legally binding conditions and requirements including the following:

- Staff training, awareness of permit conditions and the provision of written operating instructions.
- Reception, handling and storage of waste and raw materials.
- Categories of waste that can be incinerated.
- Facility operating conditions, e.g. residence time, temperature, ash burn out.
- Energy efficiency, accident prevention, noise and vibration control.
- Emission limit values for air, water, land, sewer and groundwater protection.
- Monitoring – techniques, equipment, standards, sampling etc. The permit specifies the frequency of monitoring and reporting. All municipal waste incinerators are required to have continuous monitors for gaseous pollutants and dust. Heavy metals and dioxin are monitored periodically but at a defined frequency.
- Record keeping, reporting and notifications, e.g. all exceedances of emission limits must be notified to the Environment Agency within 24 hours.

From 2006 onwards, all incinerators with a capacity of more than 2 tonnes/hour need to submit an annual performance report.

Post-permit regulation

The issue of a permit and subsequent start of commercial operations marks the first stage of the Environment Agency's regulation of an incinerator. The Environment Agency then starts a continued assessment of the facility operations and environmental performance in a number of ways:

- Operators must carry out monitoring of their processes at defined frequencies, use specified monitoring techniques and report the results to the Environment Agency.
- The Environment Agency inspects installations, reviews the techniques used for monitoring and assesses the results of monitoring with a view to establishing their performance against standards.
- The Environment Agency carries out independent routine monitoring of emissions (e.g. once every year for all municipal waste incinerators), as well as making spot checks to assure itself of the robustness of the monitoring carried out.
- The operators are required to inform the Environment Agency within 24 hours of any breach of the emission limits, to be followed by a fuller report of the size of the release, its impact and proposal to avoid repetition.
- Operator returns on monitoring results and the results of Environment Agency monitoring are placed on the public registers.

When an operator is found not to be complying with the conditions of his/her authorisation, the Environment Agency has a range of enforcement measures available to it including Enforcement and Prohibition Notices and prosecution in courts. The level of enforcement response is proportional to the environmental damage caused by the non-compliance, the severity of the offence, the frequency and the likelihood of recurrence.

Appendix 4: The planning system and waste

M. Southgate

Planning Policy Statement 1 includes a succinct statement on the role and purpose of the planning system in England.

Planning shapes the places where people live and work and the country we live in. Good planning ensures that we get the right development, in the right place and at the right time. It makes a positive difference to people's lives and helps to deliver homes, jobs, and better opportunities for all, while protecting and enhancing the natural and historic environment, and conserving the countryside and open spaces that are vital resources for everyone. But poor planning can result in a legacy for current and future generations of run-down town centres, unsafe and dilapidated housing, crime and disorder, and the loss of our finest countryside to development. (ODPM, 2005a)

The planning system in England originates in the Town and Country Planning Act 1947 and its predecessors. The 1947 Act introduced a system of development plans and land use control that has been updated and amended over the intervening period, but remains the foundation for the modern system. There have been a number of Acts and many secondary statutory provisions relating to planning since 1947, with the most recent being the Planning and Compulsory Purchase Act 2004 (PCPA). This is the most significant in terms of the changes it introduced to procedure and the introduction of a clear purpose for planning, 'contributing to the achievement of sustainable development' (s. 39 PCPA). Further reform is now taking place. A new planning bill is making its way through Parliament and, if enacted, will implement the key proposals in the 2007 Planning White Paper *'Planning for a Sustainable Future'*.

At a very high level, there are two main features of the planning system: the development plan and the development control process. This appendix briefly outlines the development plan, its key features and importance in the system and what this means for waste.

The development plan

Under the PCPA, the statutory Development Plan consists of:

i) Regional Spatial Strategies (RSS), or the Spatial Development Strategy prepared by the
Mayor of London; and
ii) Development Plan Documents prepared by district councils, unitary authorities, Broads Authority and National Park authorities, and Minerals and Waste Development Plan Documents prepared by county councils (ODPM, 2005b).

The development plan is important because under s.38 of the PCPA, planning applications should be determined in accordance with the development plan unless material considerations indicate otherwise. This presumption in favour of the

development plan is described as the 'plan-led system' and it aims to provide predictability and certainty for both developers and communities. This underlines the importance of the development plan preparation process.

In preparing the development plan, regional planning bodies (RPB) and planning authorities need to take into account national planning policy. National planning policy is found in Planning Policy Statements (PPS) and Planning Policy Guidance Notes where they are yet to be updated into Planning Policy Statements, Circulars and Parliamentary Statements. Most PPS are 'topic-based' such as on 'housing' (PPS3) or 'waste' (PPS10) but statements also cover cross-cutting matters such as 'sustainable development' (PPS1), and general matters such as 'regional spatial strategies' (PPS11) and 'local development frameworks' (PPS12).

A number of key features of the development plan and its preparation are described briefly below.

1. Plans should be **spatial plans**. 'Spatial planning goes beyond traditional land use planning to bring together and integrate policies for the development and use of land with other policies and programmes which influence the nature of places and how they function' (ODPM, 2005a).
2. RPB and planning authorities should prepare their development plans with a view to contributing to **sustainable development,** and the strategies and policies in regional and local development plan documents are required to be subject to **sustainability appraisal**, incorporating the requirements of Strategic Environmental Assessment (SEA) (ODPM, 2005b).
3. **Community involvement** is an essential element in delivering sustainable development and creating sustainable and safe communities. 'In developing the vision for their areas, planning authorities should ensure that communities are able to contribute to ideas about how that vision can be achieved, have the opportunity to participate in the process of drawing up the vision, strategy and specific plan policies, and to be involved in development proposals.' (ODPM, 2005a).
4. Key decisions should be taken early in the plan preparation process, a principle known as **front loading**, in order to seek consensus on essential issues early on and avoid late changes being made (ODPM, 2004c).
5. Plans are subject to **annual monitoring** as part of the Government's plan, monitor and manage approach to the system (ODPM, 2004c).
6. The preparation of documents should be **programme managed** in accordance with the local development scheme for the local development framework or the project plan for the RSS (ODPM, 2004c, 2004d).
7. Plans should be **sound** in terms of their evidence base, their content and the process through which it has been developed. Soundness of plans is assessed at an examination in public (EiP) in front of a Panel for RSS or an Inspector for local development frameworks. PPS11 and PPS12 set out the tests of soundness in more detail and are supplemented by advice from the Planning Inspectorate (PINS, 2006).

The development plan and waste

In July 2005 Defra and ODPM published a joint package of new policy which included PPS10, *Planning for Sustainable Waste Management*. Rooted in the new planning system and a response to concern from some[2] that planning was an obstacle to the

[2] Notably the Strategy Unit report *Waste Not, Want Not* in 2002 which said that: 'the planning system has caused long delays in getting permission for new waste facilities of all kinds'.

development of new waste management facilities necessary to reduce our reliance on landfill, PPS10 sets out what is expected of both RPB and local planning authorities on waste. PPS10 aims to make good use of the planning system, which places more emphasis than previously on the need for good community involvement as a way of helping deliver better decisions more quickly. Ministers contend that effort and involvement up-front will mean greater speed overall.[3]

The new policy expectation places emphasis on planning strategies delivering the key planning objectives in PPS10 including 'delivering sustainable development by driving waste management up the hierarchy, addressing waste as resource and looking to disposal as the last option, but one which must be catered for'. Compared with the previous policy in PPG10, there is greater clarity on what is expected of regional and local levels on waste, a push to consider waste alongside other spatial planning concerns and better integration between planning and municipal waste management strategies. PPS10 also underlines the importance of key characteristics of the planning system such as effective community engagement in plan preparation, full appraisal of options and annual monitoring and review.

PPS10 also identifies what is expected from RSS and local development documents on waste. PPS10 expects RSS to include a concise strategy for waste management that looks forward 15 to 20 years and comprises a distribution of waste tonnage requiring management to each waste planning authority, a pattern of waste management facilities of national, regional or subregional significance and supporting policies (ODPM, 2005c). The RSS should focus on '…matters of genuine regional and, where appropriate, subregional importance' (ODPM, 2004d) avoiding detail that is better dealt with at the local level. RSS should be developed drawing from up-to-date local planning strategies and taking account of a range of matters that help ensure that the approach to future waste management is realistic and responsible (ODPM, 2005c).

Once adopted, the strategy for waste management in RSS should be carried forward into local development documents. PPS10 expects that there should be no need to reopen consideration of either its principles or the annual rates of waste to be managed (ODPM, 2005c). The local core strategy should 'set out policies and proposal for waste management in line with RSS and ensure sufficient opportunities for waste management facilities in appropriate locations including for waste disposal' (ODPM, 2005c).

Critical to the plan-led system is the predictability and certainty it provides. To help secure this PPS10 expects waste planning authorities to '…identify in development plan documents sites and areas suitable for new or enhanced waste management facilities for the waste management needs of their areas. Waste planning authorities should in particular:

- allocate sites to support the pattern of waste management facilities set out in the RSS in accordance with the broad locations identified in the RSS; and,
- allocate sites and areas suitable for new or enhanced waste management facilities to support the apportionment set out in the RSS' (ODPM, 2005c).

The future

It is probably too early to judge whether PPS10 has succeeded in delivering a policy framework for waste planning that will help deliver new waste management facilities and help the nation move towards more sustainable management and meet obligation

[3] http://www.communities.gov.uk/index.asp?id=1500775

under measures such as the Landfill Directive. The nature of any change to forward planning is that it takes time to take full effect.

However, there is evidence that where good planning strategies have come forward in the context of effective community engagement and have provided clarity on what is required and where it is required, this leads to better and quicker decisions on planning applications. Ministers have been keen to stress the help that this approach provides. In June 2006 Baroness Andrews addressed the Local Government Association and highlighted some examples of success:

Good plans should provide a framework in which communities take more responsibility for their own waste, and enable sufficient and timely provision of waste management facilities to meet the needs of their communities. This works. Viridor Waste Management sought planning consent for a 100,000 tonne per annum capacity Materials Recycling Facility at Ford Airfield, West Sussex in 2004. The site was identified in the Local Waste Plan, although local concerns regarding traffic and location remained and the initial planning application was rejected in January 2005, but a revised proposal was granted consent in December that year. Why did they make that progress? I think it was down to early engagement and consultation activities with briefings for elected members, community seminars which gave local residents input into the proposals, public exhibitions and follow-up Public Meetings – to discuss in detail the final proposals prior to submission.[4]

In the meantime the development planning system faces the prospect of more change. In December 2006, Kate Barker reported on her *Review of Land Use Planning*. The report said there is a need to: '…build on the recent planning reforms [and] aim to create planning policy and processes in England that give appropriate weight to economic benefits, are more responsive to changing circumstances (including environmental pressures), and deliver decisions in a more transparent and timely manner.' (Barker, 2006). The Government responded to the Barker Review with the Planning White Paper in 2007. and the key proposals are expected to be implemented by the enactment of the Planning Bill that is currently making its way through Parliament.

[4] http://www.communities.gov.uk/index.asp?id=1500775

Appendix 5: Group membership

Two workshops (8 August 2003 and13 January 2004) were held at the MRC Institute for Environment & Health to discuss the perceptions and attitudes to the incineration of municipal waste and its effects on human health. The individuals listed below participated at one or both of these meetings, or were involved in writing this report.

Mr Amin Anjum*	Environment Agency
Mr David Briggs	Imperial College
Mr Tim Brown*	National Society for Clean Air (NSCA)
Prof Anthony Dayan	Consultant Toxicologist
Prof Richard Derwent	Meteorological Office
Dr Mike De Silva	Department of Health
Ms Maggie Dutton	Environment Agency
Dr Jean Emeny	Institute of Environment & Health, Cranfield University
Dr Paul Harrison	Institute of Environment & Health, Cranfield University
Prof Stephen Holgate	Southampton University
Mr Vyvyan Howard	University of Liverpool
Mr Fintan Hurley*	Institute of Occupational Health
Mr John Kemm*	Department of Health
Dr Karin Koller	Institute of Environment & Health, Cranfield University
Dr Len Levy	Institute of Environment & Health, Cranfield University
Prof Robert Maynard*	Department of Health (now Health Protection Agency)
Ms Paula Orr*	Environment Agency
Professor Judith Petts*	University of Birmingham
Dr Alison Searl	Institute of Occupational Medicine (IOM)
Dr Linda Shuker	Institute of Environment & Health, Cranfield University
Mr Martin Slater**	Environment Agency
Ms Helen Smethurst*	Environment Agency/Department of Health (now Health Protection Agency)
Mr Christopher Snary	London School of Economics
Mr Mark Southgate**	Environment Agency
Ms Jackie Spiby	Health Protection Agency
Dr Derek Tinsley	Environment Agency

Dr Michael Waring	Department of Health (now Health Protection Agency)
Dr Martin Williams	Department for Environment, Food and Rural Affairs

* Participant and contributing author to the report
** Contributing author only

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List of abbreviations

BAT	Best Available Techniques
DF	dispersion factor
EAL	environmental assessment level
EC	European Community
EfW	Energy from Waste
EIA	Environmental Impact Assessment
EiP	examination in public
EPR	Environmental Permitting Regulations
EQ	environmental quotient
EQS	Environmental Quality Standard
EU	European Union
GIS	Geographical Information System
IPPC	Integrated Pollution Prevention and Control
MSW	municipal solid waste
NSCA	National Society for Clean Air
ODPM	Office of the Deputy Prime Minister
PC	process contributions
PCPA	Planning and Compulsory Purchase Act 2004
PEC	predicted environmental concentration
PPC	Pollution Prevention and Control
RPB	regional planning body
RR	release rate
RSS	Regional Spatial Strategy
SEA	Strategic Environmental Assessment
SSSI	Site of Specific Scientific Interest
WID	Waste Incineration Directive

We are The Environment Agency. It's our job to look after your environment and make it **a better place** – for you, and for future generations.

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