

The Environment Agency's



**ENVIRONMENT
AGENCY**

Response to the House of Commons Environment

Committee Report on the Environmental Impact

of Cement Manufacture

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ENVIRONMENT AGENCY



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PREFACE

1. The Environment Agency recognises the significance of the Committee's report which raises issues of strategic importance as well as commenting on matters of detailed operational activity.
2. The Agency is pleased the Committee concluded
 - that there is no need for any further tightening of the Agency's existing specifications for Substitute Fuels (SF); and
 - that economic benefits have accrued from the burning of SLF (Substitute Liquid Fuel).
3. However, the Agency is disappointed that the report does not distinguish more fully between the actions of the HMIP and the new Agency. While accepting that the Agency's actions can be improved, the use of the terms HMIP and Environment Agency almost interchangeably throughout the report (recommendation 24 being an exception) has highlighted past problems at the expense of present advances.
4. Whilst recognising also the high standards expected from all working on behalf of the public, some mention could have been made of the novel nature of Integrated Pollution Control (IPC) in its early days and the "learning curve" that HMIP had to climb. HMIP had to work within the existing legal framework and some actions were taken, for example, under the Health and Safety At Work etc Act 1974 (HSWA 74) which has lower requirements for public consultation and involvement than does the Environmental Protection Act 1990 (EPA 90).
5. The Agency accepts the majority of the recommendations made by the Committee and has developed plans for improvements. The Agency hopes the Committee will be reassured by the very full nature of this response.
6. At the strategic level, the Agency will seek to influence policy on the use of SF in cement kilns, so as to realise wider environmental benefits and energy conservation gains, in accordance with the waste hierarchy principles.
7. At the operational level, there are also a number of significant issues about the way the Agency carries out its regulatory duties. Key points include the view that issues of public perception and concern must be addressed satisfactorily, and balanced alongside consideration of the principles of sound science and the management of uncertainty in making regulatory judgements. Policies and mechanisms are needed to ensure that regulatory judgements have proper regard to the political, social and economic context in which plant operations occur.

8. The Agency recognises that it must manage its professional practice, organisation, and resourcing in order to deal effectively with the environmental impact of cement manufacture.
9. Good environmental regulation depends on knowledge of those parts of the environment which operations at a particular plant may affect. The Agency will increase its understanding of the environment and develop its state of the environment report, local environment plans, and its use of the structure planning process. However, the operators of cement plants have a key role to play and it is for them, in their applications, to identify which parts of the environment might be affected by their operations, and to indicate what the effects might be.
10. The Agency must then have the skill to interpret and challenge operators' environmental assessments. The Committee has, for example, pointed out that the Environmental Assessment Levels (EAL) which underpin the BPEO methodology, depend on subjective judgement. The integration of such skills and such judgement demands considerable sophistication, spanning many sciences and extending to economics. The Agency has already recognised the need for leading-edge expertise in such areas and has set up National Centres for Environmental Data and Surveillance, Risk Analysis and Options Appraisal, and Ecotoxicity and Hazardous Chemicals.
11. Environmental modelling is not wholly accurate, yet it is essential for objective discussions between the Agency and plant operators. The Agency will advise operators of cement plants on modelling data; the standards the data should meet; and what data norms already exist for the cement industry. The Agency has initiated a major co-operative project, amongst other things, to develop best practice in dispersion modelling and will set up a similar group to develop criteria used in the BPEO methodology.
12. The Agency will review its organisation to ensure that inspectors can call upon specialist skills when needed, and that its project-management methods are adequate to deal effectively with applications for authorisation under EPA 90. The Agency will confirm that its arrangements for recruitment and continuing professional development remain appropriate.
13. Such partnership and consultative approaches should help avoid ambiguity over the Agency's requirements before a cement process may start, but for clarity, the Agency, via its one-stop-shop arrangements, will specify the approvals needed.
14. The Agency believes that operators, beyond their responsibility for producing good environmental assessments, have a responsibility for addressing the political and social contexts in which their plants operate. Whilst the Agency will urgently explore ways to encourage public understanding and fuller participation during the authorisation and subsequent operation of a cement process, the operator must also seek to satisfy the public that his operations are acceptable. The operator is key in providing the continuity that will make for future success in protecting the environment, success which the Agency will monitor and assess.

- 15 The Agency's response covers the specific points raised by the Committee, in detail. The Agency recognises that meeting the Committee's concerns will require continuing commitment. The Agency will keep its undertakings to the Committee under review, and will report to it on progress in the Autumn.

SUMMARY

16. This response shows how the Agency's actions and programmes, some already in progress, will meet the shortcomings identified by the Committee. The actions the Agency will deliver are in the attached Table.
17. The Agency accepts that misunderstanding and suspicion will be lessened if it sets out a clear policy on the use of different types of SF in cement kilns. Accordingly, the response makes clear that the Agency, in line with the principles of sustainable development, is interested in proposals to burn SF in cement kilns, provided the environment is not adversely affected. The response sets out the Agency's policy on the use of SF in cement kilns, and indicates that further details will be developed in a revised Bedford Protocol.*

** The Bedford Protocol describes the Agency's requirements for companies wishing to operate SF trials - see Annex 3.*

18. The Agency notes the Committee's emphasis on ensuring that people living near cement works are kept sufficiently informed of the nature of these operations, any changes intended in them and the likely outcome. The Agency already works to provide clear, readily available information to the public and to develop a responsive relationship with it. Nevertheless, the evidence given to the Committee has caused the Agency to consider what more it should do. The Agency will strive to provide information sufficient in scope, accuracy and comprehensibility so that, when a potentially controversial change is to be made in the operations at a works, the relationship between operators and local people will allow constructive exchanges, not confrontation.
19. Clearly, some people near cement plants, Clitheroe in particular, suffer ill health which they ascribe to the emissions from the plants. The Agency respects such views while recognising that there may be problems between sensing ill health and correctly judging its causes. Whatever the facts, however, the Agency accepts that considerable work is needed in this area, and is exploring new approaches relevant to the cement industry with DoE and the Department of Health.
20. The Agency thinks that the Committee's suggestion that it is too credulous in its dealings with operators is not supported by the evidence. This criticism goes to the heart of the relationship between the Agency and those it regulates. The Agency will keep the Committee's comments in mind to ensure proper scepticism in its dealings with operators. The Agency will take robust regulatory action when that is appropriate, yet it needs equally to continue dialogue with plant operators when that is appropriate.
21. Effective guidance and standards are necessary. The Agency will devote more resources to deriving standards, and to checking data from the cement industry. The Agency aims to supply specialist advice to its inspectors based on a full understanding of the underlying technical principles. The Agency, for example, has recently issued

the technical annex of its BPEO methodology for public consultation so that wider input to the derivation of EALs can be obtained. The Agency will establish an expert panel to derive EALs in a publicly acceptable manner.

22. The Committee made recommendations about wider waste management policy considerations in the use of SF in cement kilns. The Agency's understanding of the current legal position is that the IPC regime is not intended to deliver wider waste management policies including the waste hierarchy, and that the Government will need to consider how these are to be implemented. The Agency agrees that it should seek to inform and influence policy in this area. The Agency will therefore be undertaking appropriate research on these issues in liaison with DoE, and will seek to ensure that the preferred environmental solutions for the use of SF are identified and that the Government makes due provision for their implementation
23. The response notes the recent EU Directive on Integrated Pollution Prevention and Control. The Directive has a range of features which are unlikely to affect the authorisation of cement processes, but beyond these, it applies to various environmental impacts, e.g. energy use, not covered by EPA 90. The precise scope of the Directive is currently unclear and will be subject to interpretation and public consultation. It may, however, offer scope to take account of emissions and other environmental impacts in the chain of events before or after the operation of the installation itself. The Agency will work with the Government in implementing the Directive, while ensuring continuing delivery of the Committee's recommendations on SF in the cement industry.

ACTIONS TO BE DELIVERED BY THE AGENCY AS A RESULT OF ITS RESPONSE TO THE COMMITTEE

No	Action	Deliver by	Extra Cost
1	* Extend Agency policy on the burning of SF before authorising further trial	Immediate	
2	New Trials * Determine substantial/non substantial variation issue re charging and who advertises. * Full public consultations in all cases (see item 4). * Prepare summary consultation document on trial proposal. Agree trials programme. Agree SF specification, including wastes not allowed. * Obtain advice from SFTAP (compare Annex 2). * Issue a variation to allow trials to proceed. * Produce a decision document for public registers. Check monitoring by Agency. Operator returns to previously authorised fuel firing at the end of trials.	Immediate	26 man weeks/trial
3	Continued Burning Determine whether substantial variation re charging and who advertises. * Full consultation in all cases (see item 4 below). * Prepare summary consultation document on the proposal for continued burning. * Obtain advice from SFTAP. * Monitoring branch audit operator monitoring data. * Latest BPEO methodology used. * More comprehensive monitoring reports to be placed on public registers (within 2-3 months if practicable). * Apply the provisions of the relevant Directives, e.g. Hazardous Waste Incineration Directive (compare Section A). Define conditions under which SF cannot be used. Operators to provide economic information as part of their application. * Variations to allow continued burning to be accompanied by a detailed decision document.	Immediate	30 man weeks/application
4	Wider Advertising - Both for Trials and Continued Burning * In case of non substantial variation, Agency to advertise. * Explore possibility of advertising on local radio. * Consider public notices, libraries. Attend related public meetings. * Consider public exhibitions.	Immediate	Included in 2,3 above

No	Action	Deliver by	Extra Cost
5	SFTAP * Reconstitute.	Immediate	Included in 2,3 above
6	Revise Bedford Protocol (compare Annex 3) * To deliver the over arching Agency policy. * Will define plant information required. * Substantial/non substantial change. * Monitoring requirements etc. * Public/ industry to be consulted.	Immediate start to deliver in 97	40 man weeks
7	Initiate Research * Waste streams that may or may not be suitable for kilns. * Overseas experience/ legislation.	Immediate Start to deliver by end 97	Subcontract £50K Agency - 8 man weeks
8	Effect on other IPC processes * process changes which are likely to be of concern to the public to be treated as for SF.	Immediate	8 man weeks/application
9	Liaise with DoE * Planning/EIA issues. * Government health surveys around cement kilns. * Waste Strategy. * IPPC Directive implementation as it affects cement kilns. * If necessary, make representations to extend determination period to accommodate extended public consultations.	As required	6 man weeks
10	Liaise with DoH and Local Health Authorities * Forward Clitheroe environmental data. * Discuss further if a second monitoring exercise is necessary in 1998/99. Liaison with local health authorities on health related issues.	Starts June 97	4 man weeks
11	Castle Cement, Clitheroe * Issue Clitheroe monitoring report * Take appropriate action in the light of DoH advice * Depending on the outcome of Castle appeal, enforce action on clinker storage * Repeat environmental monitoring exercise in 1998/99 if appropriate	June 97	Regional contract

No	Action	Deliver by	Extra Cost
12	Other Supporting Actions * Set up an expert panel to review EAL values used in BPEO. * Disseminate conclusions of "wider BPEO" research and seek to implement by influence/information. * Advise operators on need for clearer information for public. * Frequent checks on public registers to ensure these are up-to date. * Use peer reviews to ensure inspectors' continuing professional competence. * Develop means to check if communications with public are effective. * Explore the possible use of remote emission monitoring systems.		

* New or developing commitment

THE AGENCY'S RESPONSE

A THE AGENCY'S NATIONAL REGULATORY POLICY ON BURNING SUBSTITUTE FUELS IN CEMENT KILNS

Recommendation 26 *

Further trials of fuels in cement kilns should not go ahead until a national regulatory policy for each type of fuel has been drawn up at Director level by the Agency. (Para 160).

** The Committee's Conclusions and Recommendations are set out in Annex 1.*

24. The Agency agrees that it needs to set out its policy on the burning of SF in cement kilns. Such a policy, approved by the Agency's Board, is given below.
25. The Agency is committed to the principles of sustainable development, which include the sound management and conservation of energy and resources. The Agency seeks to encourage proposals which result in moving materials up the waste hierarchy. Recovery of energy, for example, from tyres and waste solvents then must be a proposition that the Agency would want to explore seriously.
26. Consequently, the Agency is interested in proposals for SF to be burned in cement kilns, rather than sent for disposal, provided proper safeguards are in place. Continued burning of SF will not be permitted where it might adversely affect the environment when compared with conventional fuel. Assessment based on an appropriate BPEO methodology to demonstrate this is a prerequisite, paying full regard to relevant health advice in relation to the cement process in question. Emissions from SF processes will naturally be required to accord with UK, EU and international standards.
27. In evaluating such proposals, the Agency will be examining very closely any potential disbenefits which may be demonstrated during trials. As an interim requirement, following the precautionary principle and pending early research, the Agency will exclude PCBs, other highly halogenated wastes, and radioactive wastes from SF used in trials. The Agency will seek to avoid the blending of waste streams into SF which do not contribute to its performances as fuel, and hence to the energy recovery principle.
28. Against this general background, the Agency has particular requirements which will apply when the operator of a cement process proposes to use a specified SF. The issue to be addressed in that circumstance is whether the proposal meets BATNEEC requirements for the cement process in question, not whether burning in cement kilns per se is the most appropriate use of the SF.

29. The Agency's Substitute Fuels Trials Assessment Panel (SFTAP) (Annex 2) will be re-convened and extended to underpin this policy. The Bedford Protocol (Annex 3) will be revised, in particular to cover greater public awareness and other recommendations from the Committee.
30. Most applications for SF trials will need a "substantial change" variation to the existing authorisation, requiring full public consultation. In future, the Agency will ensure that full public consultation is carried out, even when trials do not involve "substantial change".
31. The Agency will issue press releases for all applications and will allow an extended period for representations to be made to it. Representations will be reviewed before any trial proceeds, and a decision document will be issued to explain how the Agency reached its decision.
32. The Agency will agree a trials programme with the operator, setting limits in accordance with legislative requirements. Emission limits, and a detailed trials schedule and monitoring requirements will form part of a variation issued prior to commencement of the trial. When trials are complete, operators will be required to return to the fuel stipulated in their existing authorisation, even if they have applied to burn SF on a continuing basis.
33. Where appropriate, the relevant provisions of the Waste Framework Directive (75/442/EEC as amended by 91/156/EEC); the Municipal Waste Incineration Directive (89/369/EEC); and the Hazardous Waste Incineration Directive (94/67/EC) will be applied.
34. Air emission limits for SF which uses municipal wastes will conform to EU Directive (89/369/EEC); for all other SF, pro-rata limits will apply, with air emission limit values being derived from the formula specified in the Hazardous Waste Incineration Directive for hazardous waste and from Agency IPC Process Guidance Notes for other waste. BATNEEC considerations will apply in all cases and where these require tighter limits than those under the Directives, BATNEEC limits will take precedence.
35. Permission to burn SF on a continued basis will only be given where its use represents BATNEEC for the process concerned, and where the operator has demonstrated this using the Agency BPEO methodology or equivalent on the results of an agreed trials programme. The Agency will consider the extent to which authorisation conditions may be able further to ensure that the blending of waste streams into SF which do not contribute to its performance as a fuel is prevented.
36. Where an authorisation is granted for continued burning, the range of composition of the SF actually used during the trials will limit the allowable SF specification.
37. The Agency will place a decision document on the public register, if it decides to allow continued SF burning, after trials.

B PUBLIC CONSULTATION PROCEDURES AND ACCESS TO INFORMATION

Recommendation 5

We recommend that the public consultation procedure for a new authorisation or substantial change under Integrated Pollution Control be improved so as to allow greater public access to the decision making process. For example, notices in the press regarding SLF or other waste-derived fuels should refer specifically to waste or hazardous waste, and it should be easier for the public to make representations. Local peoples' objections should not be dismissed where they are backed up by reliable evidence, or when there is little evidence to back up the industry's contradicting claims. The statutory requirements concerning advertising and consultation should be regarded as a minimum starting point by the Agency. (Para 51)

Recommendation 6

We also recommend that in future, the public consultation process should begin before trials commence, not after companies have already invested large sums in new equipment. The Agency should prepare a formal public document listing and explaining the potential environmental effects of the proposed "substantial change" at the beginning of the consultation process. (Para 52)

Recommendation 22

The Agency must ensure that its public registers are kept fully up to date. (Para 148)

Recommendation 25

This Inquiry has brought to light examples of inefficiency and lack of foresight on the part of the Agency, both in its local enforcement role and in its central decision-making functions. We are concerned that the kinds of mistakes made at Clitheroe should not be repeated elsewhere and therefore recommend that the Environment Agency treat all novel processes, including the trial burning of all fuels in cement kilns, as involving a "substantial change". (Para 159)

38. The Agency is committed to providing freedom of access to environmental information and to involving the public in decisions about the environment. The Agency recognises the Committee's criticism of its procedures for dealing with applications to use SF and will develop a detailed procedure for handling these applications, in the revised Bedford Protocol, to address the Committee's concerns. Consultative procedures will be put into operation to deal with such applications.

39. Statutory consultation is required only where an application is deemed to be a substantial change within the meaning of EPA 90, where there is "a substantial change in the substances released from the process or in the amount or any other characteristic of any substance so released". The Agency has considerable information on the way releases to the environment change when SF is burned in cement kilns and now believes that all applications for SF trials or subsequent continued use are likely to be substantial changes. While each application must be judged in its own right, the Agency proposes to ensure that full public consultation is undertaken for all applications, whether or not they involve "substantial change".
40. Statutory consultation requires the operator to place an advertisement in a local newspaper and the London Gazette, between 14 and 42 days after the application is received. The public have 28 days from the date of the advertisement to make representations to the Agency. The Agency has 4 months from the date of receipt of the application to determine it, unless the operator agrees to an extension. The Agency will now allow an extended period for public representations. If the 4 months statutory limit proves a difficulty, the Agency will approach the Government to amend the Regulations.
41. The Agency has already expanded the consultation procedures in other ways, whilst always ensuring full compliance with the statutory procedures set out above. Non-statutory consultations have been undertaken and press releases issued; local, public and council meetings have been addressed; extensive correspondence has been undertaken with persons concerned about specific applications (e.g. the Weardale Action Group), including sending public register information directly to them as it was sent to the public registers; and where important additional information has been received during the determination of an application, further press releases have been issued and representations sought. Decision documents have been issued at the time of determination of applications which provide extensive information on the applications, on environmental assessments, on the conditions to be imposed and on answers to representations received. The Agency proceeds in a proper manner, regardless of whether companies have already invested in new equipment.
42. The Agency strives to ensure that information is placed promptly on its public registers, but unavoidable delays can occur with the present system of producing reports for the Agency by the contractors who monitor trials. Typically, the work in producing these reports takes two to three months before they are ready to be placed on the public registers. The Agency will take further steps to avoid delays in this process and is working on longer term improvements across all its public information systems.
43. Information for the register may be delayed if operators ask that it be treated as commercially confidential under EPA 90. The procedure delays the information reaching the registers even if the Agency ultimately rejects the request. After such a rejection, the Agency may not place the information on the registers until the operator has indicated whether he intends to appeal against the decision. Once the operator has confirmed that he does not intend to appeal, the report is placed

promptly on the register. Given the statutory deadlines, it may take two months before the information reaches the register, even if the operator does not appeal.

44. The Agency pays close regard to the views of local people and has made extensive efforts to respond to representations made by them, as described above. However, it fully accepts the Committee's advice that problems remain. For the future, therefore, the Agency proposes a detailed procedural policy, to be incorporated in the Bedford Protocol, which will derive from the above ideas and others, including:-
 1. Consultation documents to explain in more detail than the statutory advertisements what the application entails, particularly in relation to the type of SF to be burned;
 2. Wider use of press releases, advertisements, local radio and public notices to provide more information than the statutory adverts, and to indicate how the consultation document may be obtained. The document could, for example, be available on request and at local libraries, Council and Agency offices;
 3. Use of public exhibitions or presentations by the Agency, preferably involving the operators, to explain the implications of the application;
 4. More guidance to operators to ensure that the information contained in their applications is presented clearly;
 5. An extended period for the receipt of representations from the public;
 6. Redoubled efforts to keep the Agency's public registers up to date, and frequent checks that local authorities' registers are similarly up-to-date;
 7. Comprehensive decision documents on the reasons behind any decision and responding to the representations received.
45. The revised Bedford Protocol, covering such matters, will be issued for consultation as soon as possible. Thus, the public will have the opportunity to contribute their ideas on how SF applications could be better handled.
46. In all of this, the Agency sees a need to know if it is being successful in involving the public. Thus, it will develop means of indicating how effectively it is actually communicating with them.

C INTERACTION WITH PLANNING CONTROLS

Recommendation 3

We believe that in order to remove uncertainty the Secretary of State should make clear the Government's view on how the material change of use test should be applied to

applications to burn alternative fuels as part of a large-scale industrial process. (para 38)

Recommendation 4

If our recommendations for improving the Agency's regulatory and enforcement procedures are accepted and implemented promptly and in full, we conclude that the environmental consequences of applications to burn alternative fuels in cement kilns will receive appropriate consideration. In these circumstances, separate environmental assessment under the planning regime should be unnecessary. Otherwise - and we would regard this as highly unsatisfactory - we accept that the planning system may have to compensate for any failure of the Agency's procedures to command public confidence. (para 41)

47. Recommendation 3 is for the Government to address. Regulation by the Agency of processes under EPA 90 is independent of the planning process. Nevertheless, the Agency works closely with local authorities, encourages interaction with them on planning applications which affect processes it regulates and welcomes consultation on these.
48. The Agency, to deliver its responsibilities under EPA 90, requires sufficient information to assess the environmental effects of the processes it regulates. Such assessments cover many aspects addressed in the planning process. The Agency is confident that there will be no need for the planning system to compensate for any failure in its procedures, given the existing close liaison between it and planning authorities. This liaison will be reinforced by the proposals, outlined in Section B above, for keeping the public fully informed and for the wider initiatives noted elsewhere in this response which the Agency will take to improve its performance in relation to the problems of SF in cement kilns. The Agency recognises the highly unsatisfactory nature of failure in this area.

D HEALTH ISSUES

Recommendation 10

We recommend that the Agency should retain its existing tight specifications for SLF, but recognise that provided the emissions comply with the authorised limits, there is no need for any further tightening, subject to continuing review particularly arising from the survey of health effects which we recommend in paragraph 124. (Para 86)

Recommendation 16

We recognise the difficulties inherent in carrying out epidemiological studies where there are many possible causes for the reported symptoms. Nevertheless, we reiterate our previous recommendation that the Government should carry out a survey of health effects in the vicinity of cement kilns. (Para 124).

49. The Agency appreciates the Committee's comment that there is no need to tighten the SLF specifications, provided the authorisation limits are not exceeded. The Agency will enforce these limits, and will tighten them if environmental protection so demands. The Agency always keeps health matters under review and, in particular, follows the advice of Government advisory committees on such issues.
50. The Committee has reiterated its view that the Government should carry out a survey of health effects in the vicinity of cement kilns. The Agency welcomes this and will assist in any way possible. The Agency is in discussion with the Department of Environment (DoE) on its role as an active participant in any such surveys and will cooperate by providing information, for example, on fuel uses, emission monitoring, and dispersion modelling. The Agency will liaise, as appropriate, with local health authorities.
51. The Committee is aware that the Agency sought advice from the Department of Health (DoH) on the authorisations for the plants at Castle Cement, Clitheroe, and Rugby Cement, Barrington, to burn SF. Some of the data supplied to DoH were based on monitoring carried out by a mobile laboratory operated for the Agency by the National Physical Laboratory. The Agency commissioned a further comprehensive air quality monitoring exercise in the Clitheroe area for eight weeks during October-December 1996 (Section H below). This involved environmental monitoring, stack monitoring at three local industrial sites including Castle Cement, and a mobile laboratory which took air samples at points where on-going plume grounding was detected both on the basis of telephone calls from the public and by LIDAR monitoring. The data from this exercise will be placed on the public registers, and forwarded to the DoH for its advice. The Agency will take action based on this advice.

E CONFIDENCE IN THE AGENCY'S ENFORCEMENT IN RELATION TO THE CEMENT INDUSTRY

Recommendation 13

Whilst recognising that SLF is a hazardous substance which must be handled with care, we believe that the existing regulatory regimes are adequate to manage the risks which it presents in transport and handling, so long as they are properly enforced. (Para 106)

Recommendation 23

The Environment Agency must act to restore confidence in its regulation of the cement industry. We expect the response to this Report to include a full statement of the measures which will be taken. Wherever practicable, inspections should be unannounced. Inspectors should not automatically believe what they are told by the industry (Para 151).

52. The Agency is pleased that the Committee is content with the existing regulatory regimes on the transport and handling of SF. On handling, the Agency puts great emphasis in particular on safe and adequately bunded storage. Where appropriate, the Agency will take vigorous enforcement action, as for example in the recent prosecution of Castle Cement, Clitheroe, after an SF storage tank overflowed into the bund as a tanker was being unloaded.
53. The Agency is concerned that the Committee found a lack of confidence in its regulation of the cement industry, and is urgently addressing the problem. The Agency has committed heavy resources to the cement industry, especially to deal with SF applications. The Agency has modified its procedures as it has recognised that burning SF requires more than average regulatory effort. The measures the Agency will adopt to restore public confidence in its regulation of the cement industry are contained throughout this response, but the Agency hopes that the regulatory policy set out in Section A will go much of the way towards meeting the Committee's concerns.
54. On general enforcement, the Agency has issued an interim policy code of guidance to its enforcement staff. The guidance emphasises the need for proportionality, targeting, and transparency in enforcement action and provides a basis for consistency in the exercise of the Agency's enforcement powers. The policy will be applied in the cement industry to assist consistent enforcement.
55. The Agency investigates incidents, and contacts all complainants, so far as practicable. It inspects the process in question and ensures remedies. The Agency informs complainants of the outcome of any investigation. For regular complaints about an existing issue for which there is an agreed remedial programme, the Agency may not always visit the plant, but it will take action if the programme is not being delivered.
56. The Agency does not rely wholly on the self-regulatory requirements of the IPC regime. The Agency routinely makes unannounced inspections of cement plants, at frequencies adjusted to take account, amongst other things, of the environmental problems which each plant presents. Sufficient unannounced inspections take place at all plants burning SF. In addition, methods being evaluated by the Agency for the remote sensing of pollutant emissions from stacks might become available in the longer term to monitor plants without going on site.

57. Equally, the Agency makes plant visits for reasons which require inspectors to arrange for relevant company representatives to attend for meaningful discussions. Much inspectors' time is spent discussing plant improvements with operators; or discussing monitoring results, especially exceedences of emission limits.
58. Inspectors do not automatically believe what they are told by operators but that does not mean they have no trust in them. Inspectors have sufficient experience and skills to form an independent view. Most processes regulated by the Agency are operated by professionally-run companies, and in any event the Agency sets comprehensive conditions on operators in authorisations and audits them against these. Notwithstanding, the Agency will explore the use of peer review and consultation to promote a continuing proper relationship between individual inspectors and the plants they regulate. The Agency is developing quality assurance to control its internal procedures, and will ensure this fully covers this relationship.
59. The Agency strives to ensure that monitoring results are accurate. The SF trials results were scrutinised by inspectors to the extent that individual data from continuous monitors were checked against summary data from the operators. The Agency did its own check monitoring on the manual sampling done by operators; and the methods used by operators were checked by the Agency against standards. In a number of environmental assessments, the Agency disagreed with the operator and reworked the assessments itself using more appropriate analytical results.

F HANDLING AND INTERPRETATION OF ENVIRONMENTAL MONITORING DATA

Recommendation 18

Our evidence has revealed a number of deficiencies in the Environment Agency's handling and interpretation of environmental data. The Agency must ensure that all its monitoring exercises and environmental assessments are based on sound science. (Para 133)

60. The Agency developed the Bedford Protocol, amongst other things, to obtain data for meaningful environmental assessments of SF trials. The Protocol provides minimum requirements for testing and monitoring, by operators, bearing in mind the need to get statistically relevant results, the very high costs of tests, and the fact that the Agency also undertakes monitoring independent of that by the operators. It is apparent, in the light of the Committee's comments, that the Agency's requirements should be strengthened. Thus, as has been said, the Agency will issue an updated version of the Protocol.
61. Concern has been expressed over the accuracy of the monitoring, selective reporting of the data and whether sound science has been employed. HMIP set up the SFTAP in early 1995 to deal with these issues (see Annex 2). SFTAP found inconsistencies,

errors and assumptions in the trials data from the cement companies. Clarification was sought from the companies about dispersion modelling, the averaging and accuracy of results and the reasons why certain information and data had been selectively reported. After this information had been supplied, SFTAP carried out separate assessments in several instances. Thus, the Agency verified the most reliable data and reached its own conclusions on their significance.

62. Problems with the accuracy of results reflect complex issues, involving the accuracy and precision of monitoring methods and the type of substance measured (see Annex 4). For many substances, e.g. heavy metals or dioxins, monitoring methods are operating close to their limits of detection and this affects the accuracy of the results. The Agency expects operators to use national, European or international standards and to employ contractors accredited by the United Kingdom Accreditation Service for both sampling and analysis. The Agency took all these factors into account when assessing SF trials.
63. Comments were made that testing should be carried out to cover all facets of plant operation, including start up and periods when high carbon monoxide levels require the electrostatic precipitators to be turned off for safety. The Agency accepts that operating circumstances affect emissions and that this must be taken into account in environmental assessments. SF is easier to burn than the normal coal/petcoke fuel and there is steadier, more easily controlled combustion. Consequently, the Agency does not expect start-up problems, but nevertheless, it will continue to ensure that conditions are placed in authorisations to prevent SF being burned during start-up. The revised Bedford Protocol will confirm that carbon monoxide excursions must be minimised before trials start and that SF is to be cut off when the electrostatic precipitators are not working.

G CONSISTENT APPROACH TO THE APPLICATION OF THE BPEO METHODOLOGY

Recommendation 19

We recommend that the Agency take a more rigorous and consistent approach to the application of its Best Practicable Environmental Option methodology, so that it will no longer be open to charges of manipulating the data to produce a desired result. (Para 143).

64. Since the inception of EPA 90, HMIP and now the Agency have conducted extensive research to develop a BPEO methodology. This programme has been subjected to wide consultation.
65. In July 1993, HMIP organised a seminar on "Environmental and Economic Assessment for Integrated Pollution Control" to explain its proposals to industry and others. Comments from participants led to the publication of HMIP's consultation

document "Environmental, Economic and BPEO Assessment Principles for Integrated Pollution Control" (the "Orange Book") in April 1994. About 1500 comments were received from 91 organisations. In the light of these, HMIP ran case studies with site operators to test the developing principles.

66. Revised drafts of the methodology ("the Blue Book") published in 1995 took account of the consultation exercise and the case studies. A wide range of bodies (industry, trade associations, non-Government Organisations, independent experts, other regulatory bodies, Government Departments and others) produced further comments which yet again were taken into the developing methodology. This led to the publication by the Agency in April 1997 of "Technical Guidance Note E1 - Best Practicable Environmental Option Assessment for Integrated Pollution Control: Guidance for Operators and Inspectors of IPC Processes" (see Annex 5).
67. The guidance suggests how to assess harm and compare process options to determine BPEO, as well as outlining economic information required to rank the options for BATNEEC purposes. Use of the methodology is not compulsory. The guidance contains preliminary data, particularly EALs, which are necessary to apply the methodology.
68. There is no consensus yet on how EALs should be derived. Recognising this, Volume II of the 1997 guidance has been issued for consultation, with the proposal that a group from industry, the universities, the Agency and others be set up to derive EALs for particular substances. The Agency will develop the group as a partnership in such a way that the data it produces will be based on agreed principles and will have common consent.
69. Against this background, HMIP, in early 1995, set up the SFTAP to evaluate cement companies' SF trial reports, using HMIP's developing methodology for BPEO assessment. The "Orange Book" was the only tool available initially, but the "Blue Book" replaced it in due course.
70. These developments in the methodology coincided with the SF trials at Rugby Cement, Barrington, over which assertions arose that HMIP was manipulating the data. The data were not manipulated. HMIP recognised the importance of the changes in methodology and guarded against "changing-goal-post" effects by undertaking sensitivity analyses and worst case scenario studies.
71. Environmental groups and others criticised companies' assessments, as did HMIP. The Agency will continue to review such assessments rigorously. In the case of Blue Circle Cement, Weardale, for example, the Agency was robustly challenging the SF trials results when the company withdrew its application on 21 April 1997.
72. The Committee suggests that the assessment process might be independently reviewed, but it should be noted that the responsibility for producing assessments lies with the operators, while the Agency makes an independent review of their proposals. It would be unfortunate were the Agency seen not to be independent, especially given

the work it is doing via public consultation on the BPEO methodology, and the general efforts it is making to improve the openness of all its decisions.

H THE BURNING OF CEMFUEL AT CLITHEROE

Recommendation 14

We are concerned that the Agency has allowed the continued burning of Cemfuel at Clitheroe in spite of the fact that the plume from kilns 5 and 6 continues to ground, and consider this is counter to the purpose of our 1995 recommendation concerning SLF trials.

Recommendation 15

We welcome Castle Cement's decision to install a wet scrubber on kiln 7 at Clitheroe to remove pollutants from the plume and the Agency's new requirement that the odour and haze be eliminated. The Agency must ensure that this requirement is fully complied with.

Recommendation 17

We look to the Environment Agency to ensure that the cause of the respiratory problems and odour nuisance at Clitheroe is discovered and dealt with effectively by April 1998.

Recommendation 21

We welcome the news that on 7 February 1997 the Agency issued a variation to Castle Cement's IPC authorisation requiring that clinker storage must be inside the site boundary and under cover and look to the Agency and Castle Cement to ensure with due rigour that this requirement is complied with by June 1997.

Recommendation 24

The introduction of SLF at Clitheroe appears to have been handled clumsily and without adequate forethought by Her Majesty's Inspectorate of Pollution. A subsequent lack of openness concerning the specific situation at Clitheroe has caused unnecessary misunderstanding and suspicion amongst members of the public towards the whole SLF programme.

73. The Agency takes the issue of plume grounding from Castle Cement very seriously, and will deliver an early solution. To guard against problems even after the

introduction of the scrubber, the Agency has imposed a condition on Castle which requires that emissions from kilns 5, 6 and 7 shall not result in persistent haze or odour which causes offence at ground level outside the site boundary, from 1 April 1998. The Agency will enforce this.

74. There is no doubt that the introduction of SF at Clitheroe caused suspicion amongst the public over SF proposals for the Clitheroe works, and that this led to concerns over SF at other works. Castle proposed burning SF at Clitheroe to HMIP in 1991, planning permission for SF storage was granted by the local authority in January 1992, and trials later that year showed reduced emissions when burning SF. Regulation was under HSWA 74, which does not provide for informing the public about pollution control issues.
75. HMIP recognised the value of openness over the SF proposals at Clitheroe and other works. Thus, inspectors spent increasing time addressing public complaints, attending liaison meetings, seeing to the publication of comprehensive trials reports and so on. This process of increasing openness continues in the Agency as described in Section B above.
76. The Agency has engaged consultants to predict the effectiveness of the proposed wet scrubber in abating sulphur dioxide emissions, persistently visible plumes and offensive odours. The consultants have taken account of world-wide experience with such scrubbers and have concluded that they represent a proven air pollution control system, which will achieve a significant reduction in sulphur dioxide emissions. They have also concluded that plume visibility should be significantly reduced. Consequently, the Agency believes the scrubber will produce appreciable benefits and is BATNEEC for resolving the Clitheroe problems.
77. Odour problems and some health impacts of sulphur dioxide involve short-term concentration fluctuations, which atmospheric dispersion models generally do not cover. These models have not typically included up-to-date descriptions of atmospheric convection or the effects of complex terrain. Agency consultants have developed a model which is capable of predicting short-term concentration fluctuations within industrial plumes over complex terrain. This model has been tailored to Clitheroe and validated with on-the-ground monitoring data. The model is being used to define operational and regulatory parameters for the scrubber.
78. The Agency ran an intensive monitoring campaign, in consultation with the local authority, between October-December 1996 (Section D above). This provides detailed information on air quality in the Clitheroe area and on the contributions of several industrial processes to that air quality before the scrubber is installed. As well as fixed-site monitoring, remote sensing and a mobile laboratory, the campaign included a 24-hour telephone hot-line service for the public to report incidents, and sampling and analysis of all inputs and outputs from the kilns to allow detailed mass balances.
79. The weather, during the study, covered most dispersion conditions and work at the three main industrial sites (Castle Cement, ICI and Tarmac) was typical of normal

operation. Indications are that concentrations of sulphur dioxide and PM₁₀ in the environment are not unusually high for a semi-rural location like Clitheroe and that air quality generally conforms to the UK National Air Quality Strategy objectives.

80. The Agency's report on this work will be sent to the Department of Health for advice on the findings. If necessary, the Agency will repeat the monitoring campaign or parts of it, once the scrubber is operational, and reports will again be forwarded to DoH for advice.
81. The pile of clinker which the Committee mentioned is remote and not visible from the main works. Immediately after the Committee hearing in December, the site inspector made a detailed investigation and located the clinker. He wrote to Castle requesting proposals for its removal and, when the company did not reply, issued a variation notice requiring that the clinker be moved and stored under cover. Castle has appealed against under-cover storage, but not against moving the stockpile. Enforcement by the Agency awaits the outcome of the appeal. Depending on the appeal, the Agency will ensure the clinker problem is solved.
82. The Agency is auditing the operations at Castle Cement's Clitheroe site, including surveying the quality of neighbouring water courses. Comparison of data from before and after the introduction of SF shows that the water quality has not deteriorated. However, an unconsented discharge of leachate into the River Ribble has been found and a prosecution under the Water Resources Act 1991 initiated. The audit includes examination of the SF supply chain from production to use, as well as site management practices and the disposal of cement kiln dust (compare Section I).

I PROBLEMS WITH CEMENT KILN DUST

Recommendation 11

Evidence indicates that the cement kiln dust produces an alkaline run-off which could cause serious harm to those who come into contact with it. This should be given very serious consideration when the Agency decides whether to treat the dust as Special Waste. (Para 97)

Recommendation 12

We have not received conclusive evidence to indicate whether the metals present in cement kiln dust present a hazard to the environment. We therefore reiterate our 1995 recommendation that the Agency carry out a more detailed analysis of the dust and its potential to contaminate soils and groundwater. We urge the Agency to ensure that cement kiln dust is landfilled in properly licensed sites and in accordance with good waste management practice. (Para 101)

83. Cement kiln dust (CKD) is a normal waste from cement manufacture. It contains raw materials, combustion products and cement. The gases in the kiln carry CKD away from the process into the electrostatic precipitators. At many cement kilns, this CKD can be returned to the kiln.
84. Return to the kiln is the option preferred by the Agency because it avoids dusty material for disposal, and makes the cement process more efficient, with less fuel, more product and less waste. However, in some kilns, alkalis in the cement prevent all the CKD being recycled, when it has to be landfilled or sold as a by-product.
85. CKD contains metals which must be in the cement raw materials to produce good quality clinker. Before determining the SF trials, the Agency confirmed that satisfactory leaching tests had been carried out by the cement companies concerned. These showed that insignificant amounts of metals were leached from the CKD. This information was reviewed by the SFTAP.
86. CKD is normally landfilled in disused limestone or chalk quarries, which have their own alkalinity. Nevertheless, the CKD run-off is more alkaline. Such CKD alkalinity is a potential environmental hazard only if the landfill is inadequately managed. Adequate management is a condition of the site licence under EPA 90. All quarries accepting CKD will require a Waste Management Licence.
87. The Agency, in responding to the Committee's written questions, cited the conditions imposed by the Waste Management Licence for CKD at Clitheroe. The licence requires Castle to monitor the alkalinity of the run-off from the CKD at the waste site; to dose the CKD with acid to reduce its alkalinity; and to prevent leachate discharge when its alkalinity exceeds specified limits.
88. CKD at BCC Weardale is returned to the excavations from whence the raw material comes. These excavations are not lined, but the CKD must be encapsulated in overburden as part of the Waste Management Licence condition when replaced in the excavations. Alkaline run off is not a problem at BCC, Weardale.
89. Thus, site licences that include appropriate provisions, properly enforced, for the control of alkalinity in leachate provide effective environmental protection. The Agency already requires companies, as explained in the Bedford protocol, to carry out leachability tests and in future will also require alkalinity tests. Results of leachate testing by the Agency at Clitheroe are awaited.
90. The calcium oxide content of CKD is normally in the range 4% to 8%. The Agency believes, therefore, that CKD would not be Special Waste under the Special Waste Regulations 1996 by virtue of its alkalinity.

J SLF AND WASTE MANAGEMENT POLICY

Recommendation 1

Our evidence indicates that considerable economic benefits have accrued to the cement and solvent recovery industries from the burning of SLF. However, it is difficult to assess whether there will continue to be a net economic benefit to the United Kingdom as a whole. Considerable investments have been made by the cement and solvent recovery industries, and also by the high temperature incinerator operators; whatever is decided concerning the future of SLF, one or more of these industries is likely to face economic loss. (Para 26)

Recommendation 2

We conclude that where wastes of high calorific value are used as a kiln fuel, they are being *recovered* in legal terms. However, it is our view that wastes of lower calorific value, which do not contribute to the performance of the fuel, are being disposed of when burned in a kiln. Where a consignment of SLF contains both types of waste, its combustion in a kiln is a mixture of disposal and recovery. (Para 34)

Recommendation 7

Our evidence indicated that as a result of the SLF programme, a considerable amount of solvent is being moved up the "waste hierarchy", both from disposal to energy recovery and from disposal to materials recovery. The diversion of materials from landfill is to be welcomed. However, the situation is not at all clear and we are concerned that if the use of SLF expands in the future, large quantities of recoverable solvent might be diverted into SLF. (Para 61)

Recommendation 8

We therefore recommend that the Environment Agency investigate the extent to which "closed loop" solvent recovery has declined as a consequence of the SLF programme. When making decisions regarding SLF, the Agency should have regard to their likely effects on the movement of wastes up and down the waste hierarchy. (Para 62)

Recommendation 9

The high temperature incinerators provide an important environmental service in disposing of hazardous wastes which cannot be safely disposed of by any other route. We consider it important to safeguard the future of this industry and recommend that the Government, in consultation with its European partners and industry, draw up a list of:

- (a) those wastes of lower calorific value, combustion of which in cement kilns is recognised to be "disposal" rather than "recovery" according to criteria to be laid down by the Government in accordance with the *United Kingdom Management Plan for Exports and Imports of Waste*, and

- (b) those particularly hazardous or difficult wastes for which the Best Practicable Environmental Option is disposal in a high temperature incinerator. The Agency should ensure that such wastes are excluded from SLF. (Para 68)

Recommendation 20

The concept of Best Practicable Environmental Option as currently applied by the Agency has, in the case of SLF, impeded the Agency from fulfilling its new duty under the Environment Act 1995 to look at the environment as a whole. Significant new developments like the burning of alternative fuels in cement kilns should be assessed in terms of their impact on the United Kingdom environment as well as the local environment, and the assessment of the BPEO should take into account established environmental policies such as the national waste strategy. (Para 145)

91. The IPC regime is not currently intended to secure either the implementation of the waste hierarchy or the viability of the waste disposal industry in the interests of waste management policy generally. Whilst the Agency's principal aim and the general guidance which has been issued to it under the Environment Act 1995 (EA 95) require it to look at the environment in the widest possible way, the Agency's ability actually to implement such wider environmental considerations is subject to the need to fulfil its duties in other particular areas, such as the IPC regime under EPA 90 Part I.
92. Under EPA 90, the Agency must place conditions on the operation of a prescribed process, such as cement manufacture at a particular plant, which secure that the process in question at that plant uses BATNEEC to prevent or minimise and render harmless the release of substances from the process. If, in a particular case, the use of SF represents BATNEEC, then this determines the Agency's regulatory decision for that case. In other words, were the Agency to be satisfied that, for example, the "wider BPEO" for the disposal of a certain SF stream was in fact incineration, it could, nevertheless, not lawfully prevent its use in a particular cement plant, provided this was BATNEEC for that process.
93. Given this, the Agency will approach the Government on the tensions between broad waste management policies and the highly specific IPC regulatory regime. The Government will have the opportunity to address the issue in formulating the National Waste Strategy under EA 95 and in implementing the IPPC Directive (compare Section K). The Directive is to be implemented by 30 October 1999. The Directive requires consideration of indirect, as well as direct, releases; of the consumption of raw materials; of energy efficiency; and that waste be recovered or disposed of with minimum impact on the environment.
94. These deficiencies in the Agency's powers may therefore be shortlived. In the meantime, the Agency is thinking more broadly than the ambit of EPA 90, to study how it might approach "wider EA 95 BPEO" opportunities and how these might relate to its "narrower EPA 90 BPEO" duties.

95. The Agency agrees that it should engage in research on these issues, in liaison with DoE, which will enable it to use its powers to inform, educate, and influence views on the best use of SF, to secure the optimum environmental outcome. Such research will include investigation of "closed loop" solvent recovery compared with energy recovery, the source and types of wastes that are generated and their disposal routes.
96. Despite all of this, there are a great many issues which the IPC BPEO regime is able to take into account. These include wider environmental matters such as global warming, photochemical ozone and both short and long term effects on all environmental media which feature in considering BATNEEC. The Agency's BPEO methodology gives guidance on all these.
97. Equally, IPC addresses the economic benefits of the use of SF by cement manufacturers in the BATNEEC determination: The cement companies had to submit an economic report to the Agency on how the use of SF would affect their profitability. Companies provided financial data for outturn and forecast years. Generally start up costs exceeded benefits in the first two years and only in the fourth year did cumulative cash flow become positive. Companies argued it was not possible to be sure the project would continue to produce a surplus as the cost advantages would decrease as demand for SF increased. However, the Agency sought to ensure that some financial gains would be set aside to improve pollution abatement. Thus, some of the companies' abatement programmes were brought forward to earlier completion dates. The Agency will continue to require such economic pay-back to the benefit of the environment when companies seek authorisation for continued burning of SF.
98. So far as liquid SF is concerned, the Committee also made recommendations on whether burning should be considered to be disposal or recovery. The distinction principally affects the relevant objectives and other terms of the Waste Framework Directive. The Committee's approach is to categorise the different waste streams which make up the SF, rather than to look at the final SF itself. It has thus formed the view that the burning of SF, i.e. the set of its component waste streams, might in particular cases be a mixture of recovery and disposal. The Agency believes, however, that the right approach is to look at the SF itself as a whole. Since different legal consequences flow from the different categorisations, it must be necessary, as a matter of law, to decide whether the burning of the SF blend as a whole in cement manufacture is better described as "incineration of waste on land" (being the possible "disposal" activity) or "use of waste principally as a fuel" (being the possible "recovery" activity).
99. The Agency ensures by means of its specification requirements for SF, including in particular the imposition of a 21 MJ/kg minimum calorific value (CV), that the SF blend has a comparable fuel value to conventional fuels. In addition, this relatively high overall CV limit does, it is considered, having regard to the CVs of the normal range of waste streams contained in SF, ensure that the addition of waste streams to the blend which do not contribute to the performance of the fuel is minimised. Thus, the Agency believes that the inclusion of "non-contributory" streams can, in view of the specification duty, only be minimal and therefore that the correct description of

the overall activity must inevitably be "use of waste principally as a fuel" rather than "incineration on land". It should be noted in this regard that the description of the recovery activity uses the word "principally" as opposed to "exclusively", and that further support for the above view can be found in para. 6.26 of the UK Management Plan for Exports and Imports of Waste which states that the essential consideration in determining whether the burning of waste is a disposal or recovery operation is "the primary purpose of the facility or process to which the waste is being submitted".

100. The Committee has also, whilst generally endorsing the SF specifications enforced by the Agency, suggested that a list of lower CV fuels be drawn up which represent "disposal" and that certain difficult or hazardous wastes be excluded. As explained, the Agency would be able to specify more detailed SF specifications only if this contributed to achieving BATNEEC for the process in question. The Agency accepts that in principle any waste stream which does not contribute to the performance of the SF blend as a fuel should be excluded from the blend. Whilst the Agency believes that the present specifications largely achieve this, it will consider, in the revision of the Bedford Protocol, the extent to which authorisation conditions might further preclude such waste streams, and will endeavour to draw up a list of such streams, in order to assist this process.
101. These various complications aside, however, the Agency assures the Committee that it will continue to impose emission limits on releases from cement processes which accord with UK, EU and International Standards. Thus, cement kilns burning SF are already required to meet the incinerator emission limits for heavy metals and dioxins. The Hazardous Waste Incineration Directive will be introduced shortly, and consequently all new plants burning hazardous waste at less than 40% thermal substitution of their conventional fuel will be subject to a requirement that the flue gas generated by the waste fraction achieves the same emission limits as a new hazardous waste incinerator. At higher substitution rates, the full provisions of the Directive will apply.

K THE ADVENT OF THE INTEGRATED POLLUTION PREVENTION AND CONTROL DIRECTIVE

102. The EU has adopted a Directive on Integrated Pollution Prevention and Control (IPPC) which will have a major effect on the regulation of industrial premises. The Directive, which must be implemented by 30 October 1999, uses a similar approach to that of IPC, but there are a number of differences, some of detail and some significant.
103. The subject of regulation under IPPC is the 'installation', not the 'process' as in IPC; the target of BATNEEC is differently expressed as BAT; and co-ordinated permitting is allowed as an alternative to fully integrated regulation. These features, though important, are unlikely to affect the fundamental elements of authorisation of the cement process.

104. More significantly, IPPC is much wider in scope than IPC. The Directive explicitly calls for a high level of protection for the environment as a whole and in particular for consideration of various environmental impacts not addressed in IPC. Some of these are of particular relevance to SF and include requirements for energy use to be efficient and to be considered in the determination of BAT; for consumption of resources and raw materials, including water, to be taken into account in determining BAT; and for waste to be recovered or, where that is not technically or economically possible, disposed of with minimum impact on the environment. IPPC permits must include, where necessary, measures for the prevention and recovery of waste generated by the installation.
105. In addition, there is broadening of the regulatory range over which such impacts may be addressed. For example, an emission is defined as a direct or indirect release in IPPC. Similarly BAT, when it is determined for an activity, is to take account, inter alia, of the consumption and nature of raw materials (including water) used in the process and their energy efficiency. These provisions may offer room for account to be taken of emissions or certain other environmental impacts which occur in the chain of events before or after the operation of the installation itself.
106. The Government has said that, before the Directive is implemented, it will consult the public and industry on the way forward. Therefore, it is not possible to be certain how IPPC will affect cement kilns fired with SF. However, regulation will be at least as effective and, in general terms, it seems that it will be necessary to consider the disposal of SF in the wider context above than is the case for an authorisation under IPC. Potentially, this could include considering whether the use of SF in cement kilns is the optimal solution taking account of the objectives of energy efficiency and conservation of resources, and the desirability of waste minimisation and recovery over disposal.

ANNEX 1

THE COMMITTEE'S CONCLUSIONS AND RECOMMENDATIONS

1. Our evidence indicates that considerable economic benefits have accrued to the cement and solvent recovery industries from the burning of SLF. However, it is difficult to assess whether there will continue to be a net economic benefit to the United Kingdom as a whole. Considerable investments have been made by the cement and solvent recovery industries, and also by the high temperature incinerator operators; whatever is decided concerning the future of SLF, one or more of these industries is likely to face economic loss. (Para 26).
2. We conclude that where wastes of high calorific value are used as a kiln fuel, they are being recovered in legal terms. However, it is our view that wastes of lower calorific value, which do not contribute to the performance of the fuel, are being disposed of when burned in a kiln. Where a consignment of SLF contains both types of waste, its combustion in a kiln is a mixture of disposal and recovery. (Para 34).
3. We believe that in order to remove uncertainty the Secretary of State should make clear the Government's view on how the material change of use test should be applied to applications to burn alternative fuels as part of a large-scale industrial process. (Para 38).
4. If our recommendations for improving the Agency's regulatory and enforcement procedures are accepted and implemented promptly and in full, we conclude that the environmental consequences of applications to burn alternative fuels in cement kilns will receive appropriate consideration. In these circumstances, separate environmental assessment under the planning regime should be unnecessary. Otherwise - and we would regard this as highly unsatisfactory - we accept that the planning system may have to compensate for any failure of the Agency's procedures to command public confidence. (Para 41).
5. We recommend that the public consultation procedure for a new authorisation or substantial change under Integrated Pollution Control be improved so as to allow greater public access to the decision making process. For example, notices in the press regarding SLF or other waste-derived fuels should refer specifically to waste or hazardous waste, and it should be easier for the public to make representations. Local peoples' objections should not be dismissed where they are backed up by reliable evidence, or when there is little evidence to back up the industry's contradicting claims. The statutory requirements concerning advertising and consultation should be regarded as a minimum starting point by the Agency. (Para 51).
6. We also recommend that in future, the public consultation process should begin before trials commence, not after companies have already invested large sums in new equipment. The Agency should prepare a formal public document listing and

explaining the potential environmental effects of the proposed "substantial change" at the beginning of the consultation process. (Para 52).

7. Our evidence indicated that as a result of the SLF programme, a considerable amount of solvent is being moved up the "waste hierarchy", both from disposal to energy recovery and from disposal to materials recovery. The diversion of materials from landfill is to be welcomed. However, the situation is not all clear and we are concerned that if the use of SLF expands in the future, large quantities of recoverable solvent might be diverted into SLF. (Para 61).
 8. We therefore recommend that the Environment Agency investigate the extent to which "closed loop" solvent recovery has declined as a consequence of the SLF programme. When making decisions regarding SLF, the Agency should have regard to their likely effects on the movement of wastes up and down the waste hierarchy. (Para 62).
 9. The high temperature incinerators provide an important environmental service in disposing of hazardous wastes which cannot be safely disposed of by any other route. We consider it important to safeguard the future of this industry and recommend that the Government, in consultation with its European partners and industry, draw up a list of:
 - a. those wastes of lower calorific value, combustion of which in cement kilns is recognised to be "disposal" rather than "recovery" according to criteria to be laid down by the Government in accordance with the United Kingdom Management Plan for Exports and Imports of Waste, and
 - b. those particularly hazardous or difficult wastes for which the Best Practicable Environmental Option is disposal in a high temperature incinerator.
- The Agency should ensure that such wastes are excluded from SLF. (Para 68).
10. We recommend that the Agency should retain its existing tight specifications for SLF, but recognise that provided the emissions comply with the authorised limits, there is no need for any further tightening, subject to continuing review particularly arising from the survey of health effects which we recommend in paragraph 124. (Para 86).
 11. Evidence indicates that the cement kiln dust produces an alkaline run-off which could cause serious harm to those who come into contact with it. This should be given very serious consideration when the Agency decides whether to treat the dust as Special Waste. (Para 97).
 12. We have not received conclusive evidence to indicate whether the metals present in cement kiln dust present a hazard to the environment. We therefore reiterate our 1995 recommendation that the Agency carry out a more detailed analysis of the dust and its potential to contaminate soils and groundwater. We urge the Agency to ensure that cement kiln dust is landfilled in properly licensed sites and in accordance with good waste management practice. (Para 101).

13. Whilst recognising that SLF is a hazardous substance which must be handled with care, we believe that the existing regulatory regimes are adequate to manage the risks which it presents in transport and handling, so long as they are properly enforced. (Para 106).
14. We are concerned that the Agency has allowed the continued burning of Cemfuel at Clitheroe in spite of the fact that the plume from kilns 5 and 6 continues to ground, and consider that this is counter to the purpose of our 1995 recommendation concerning SLF trials. (Para 113).
15. We welcome Castle Cement's decision to install a wet scrubber on kiln 7 at Clitheroe to remove pollutants from the plume and the Agency's new requirement that the odour and haze be eliminated. The Agency must ensure that this requirement is fully complied with. (Para 114).
16. We recognise the difficulties inherent in carrying out epidemiological studies where there are many possible causes for the reported symptoms. Nevertheless, we reiterate our previous recommendation that the Government should carry out a survey of health effects in the vicinity of cement kilns. (Para 124).
17. We look to the Environment Agency to ensure that the cause of the respiratory problems and odour nuisance at Clitheroe is discovered and dealt with effectively by April 1998. (Para 125).
18. Our evidence has revealed a number of deficiencies in the Environment Agency's handling and interpretation of environmental monitoring data. The Agency must ensure that all its monitoring exercises and environmental assessments are based on sound science. (Para 133).
19. We recommend that the Agency take a more rigorous and consistent approach to the application of its Best Practicable Environmental Options methodology, so that it will no longer be open to charges of manipulating the data to produce a desired result. (Para 143).
20. The concept of Best Practicable Environmental Options as currently applied by the Agency has, in the case of SLF, impeded the Agency from fulfilling its new duty under the Environment Act 1995 to look at the environment as a whole. Significant new developments like the burning of alternative fuels in cement kilns should be assessed in terms of their impact on the United Kingdom environment as well as the local environment, and the assessment of the BPEO should take into account established environmental policies such as the national waste strategy. (Para 145).
21. We welcome the news that on 7 February 1997 the Agency issued a variation to Castle Cement's IPC authorisation requiring that clinker storage must be inside the site boundary and under cover and look to the Agency and Castle Cement to ensure with due rigour that this requirement is complied with by June 1997. (Para 147).

22. The Agency must ensure that its public registers are kept fully up to date. (Para 148).
23. The Environment Agency must act to restore confidence in its regulation of the cement industry. We expect the response to this Report to include a full statement of the measures which will be taken. Wherever practicable, inspections should be unannounced. Inspectors should not automatically believe what they are told by the industry. (Para 151).
24. The introduction of SLF at Clitheroe appears to have been handled clumsily and without adequate forethought by Her majesty's Inspectorate of Pollution. A subsequent lack of openness concerning the specific situation at Clitheroe has caused unnecessary misunderstanding and suspicion amongst members of the public towards the whole SLF programme. (Para 156).
25. This Inquiry has brought to light examples of inefficiency and lack of foresight on the part of the Agency, both in its local enforcement role and in its central decision-making functions. We are concerned that the kinds of mistakes made at Clitheroe should not be repeated elsewhere and therefore recommend that the Environment Agency treat all novel processes, including the trial burning of all fuels in cement kilns, as involving a "substantial change". (Para 159).
26. Further trials of fuels in cement kilns should not go ahead until a national regulatory policy for each type of fuel has been drawn up at Director level by the Agency. (Para 160).

ANNEX 2

(PREVIOUS) SUBSTITUTE FUELS TRIALS ASSESSMENT PANEL

TERMS OF REFERENCE - 30 January 1995

OVERALL RESPONSIBILITY

The panel's overall responsibility is to ensure consistency of approach throughout HMIP on the evaluation of trials currently being undertaken on cement or lime kilns using substitute fuels. This extra support is needed to cover HMIP's environmental assessment of SF trial results.

OBJECTIVES

1. To ensure that companies supply sufficient and consistent information to the site inspector to enable HMIP to make an assessment which currently includes:-
 - a) Kiln and abatement operating data.
 - b) Analyses of raw materials, all fuels, products and wastes during the trials.
 - c) All testing and monitoring results.
 - d) Identification and justification of all figures (worst case or mean results) used as a basis for environmental assessments.
 - e) Dioxin audit trail.
 - f) Environmental comparison between conventional and substituted fuel trials using the methodology given in the Consultation Document on Environmental Economic and BPEO Assessment Principles for IPC.
 - g) Comparison with the standards given for new plant in IPR 3/1 and 5/1.
 - h) Justification for continuance of trials or for permanent burning.
 - i) Economic assessment of burning SF.
 - j) NEEC arguments for any rejected improvements (where appropriate).
2. To provide guidance to inspectors on advice to be given to companies on BPEO methodology, the Dioxin Audit Trail, and economic assessments.
3. To assist the site inspector in evaluating the environmental impact of burning substitute fuels.
4. To evaluate the company's environmental assessment and any NEEC arguments on rejected improvements (where appropriate).
5. To prepare a report on its findings concerning applications for permanent burning, which shall be submitted to the respective Area Manager, identifying where appropriate, what improvements are required and/or what substances need further abatement or whether rejection is appropriate (giving reasons). The Area

Manager/site inspector are responsible for making the final decision on whether to accept permanent burning of SF.

THE EXISTING BEDFORD PROTOCOL

Although the requirements below refer specifically to Cement Kilns they will be applied in principle to other processes where substitute fuels are being proposed.

Before HMIP agrees to the permanent burning of unconventional¹ substitute fuels in cement kilns, operators need to undertake strictly controlled trials to evaluate the effects of such burning. Great care has to be taken to record all relevant details and to compare these not only against Chief Inspector's Guidance Notes IPR 3/1 but where appropriate against other guidance and legislation eg IPR 5/1 and the proposed EC Draft Directive on the Incineration of Hazardous Waste. The environmental effects resulting from the use of different fuels will have to be considered.

To be able to evaluate any benefit from trials it will be necessary to consider the criteria listed below. Consideration will have to be given to introducing these criteria where trials are already under way or planned.

1. PRE-TRIAL REQUIREMENTS

Certain basic criteria must be fulfilled and data gathered before trials with substitute fuels are contemplated. These criteria are listed below:

a) The Kiln

The kiln to be used must be clearly identified. Evidence must be provided that the kiln is capable of operating within its authorisation and at less than 150 mg/m³ of particulate matter in releases to air, that it is of reasonably stable operation (ie not subject to frequent EP² outages), and is not normally subject to plume grounding (i.e. efflux velocity and chimney heights are satisfactory).

Details of kiln operation under normal operating conditions must be provided to the Inspectorate:-

- flame temperature (by estimation or pyrometry)
- temperature at kiln exit
- % recycle ep dust
- O₂ concentration at kiln exit
- fuel rate
- trip history
- feed rate
- gas residence time (in kiln and above 1100°C)

¹ Conventional Fuels in this context are petroleum coke, coal, oil and gas.

² Electrostatic Precipitator

In exceptional circumstances it may be possible for an operator to present a case which demonstrates that such trials have already been undertaken on a similar kiln with a similar substitute fuel and similar raw materials and conditions. But the location of the kiln and the nature of the topography near to it also need to be considered in relation to possible environmental effects.

b) **Substitute Fuels**

Only substitutes that can meet a specification agreed in advance with HMIP should be considered. However when the operator can demonstrate to the inspector that a proposed substitute fuel is of such a nature and composition that there will clearly be no overall adverse environmental impact, the inspector may use his discretion to amend the trials requirements.

Substitute fuels should normally only be fed in at the fuel feed end of the kiln, but in special circumstances, where justified, specified substitute fuels may be fed in at other points in agreement with HMIP (e.g. tyres, wood, and paper which do not contain significant chlorine or heavy metals).

The specification should provide a listing of appropriate substances but as a minimum, an analysis for:-

- Chlorine content
- PCB content (normally below 50ppm)
- Sulphur content
- Heavy Metal content (as per substances in IPR 5/1).

Assurance should be provided that all deliveries of the substitute fuel will meet the agreed specification.

c) **Storage and Materials Handling**

Permanent storage (temporary storage may be allowed if of an agreed standard) and approved control systems will need to be provided for the substitutes. This includes tank level indicators, suitable bunding or containment, instrumentation for controlling and measuring the flow of the substitute, appropriate cut outs in emergencies, and normal safety features.

d) **Testing and Monitoring**

The trials will be principally concerned with testing and monitoring of releases by the operator. It will therefore be vitally important to have a base case (normal operating) with which to compare the use of substitutes.

Calibrated (to the satisfaction of HMIP) continuous monitors for particulate matter, SO₂, NO_x, CO and Oxygen should be installed before trials commence. For some substances e.g. HCl, HF and TOC etc., it may be necessary, where appropriate, for operators to hire or import continuous monitors (calibrated), or to use recognised test methods.

For continuous monitors, the range and mean of hourly means should be reported to HMIP at agreed intervals over the duration of the pre-trial period.

Manual testing shall be done at appropriate intervals during steady operation of the kiln. Results will have to be corrected to 273°K and 101.3 Kpa and reported against the stack oxygen concentration and water content.

Other testing required, as an absolute minimum, prior to the substitute trials is shown in Appendix 1, covering the feed, fuel, substitute, ep dusts, clinker (for the purpose of a mass balance). Soil samples, downwind of the stack in area of maximum ground level concentration, should be taken (in agreement with the relevant Inspector) and analysed for dioxins and heavy metals.

In all cases where more than one acknowledged test method exists agreement on the method to be used shall be made in advance. Analyses should be provided progressively so that discussions on appropriate actions can take place.

e) **Time to gather base-line information**

It is unlikely that sufficient information on releases can be generated in under one week, working under normal operating conditions (compare with 2e and 2f below)).

f) **EP Criteria**

During base case testing (normal operating conditions) it is important to record the following:-

- EP make
- number of zones
- kva/ma/v of each bank
- temperature)
- CO) where available
- EP dust % recycle

g) **Training**

Staff concerned with the substitute fuels trials must have had adequate training.

2. **TRIAL CRITERIA USING SUBSTITUTE FUELS**

Operators must:

- a) Provide a specification and analysis for the substitute fuel (as above).
- b) Monitor kiln operating conditions - as in 1a) above.
- c) Test and monitor as stated in 1d) above and as tabulated in Appendix 1.
- d) Address electrical precipitator criteria - as stated above.
- e) The operator must agree a programme with the inspector with respect to progressive thermal substitution of the fuel or other criteria.

- f) Agree the length of each individual trial - the aim should be to complete new trials within a total of 6 months or less if possible. Operators must agree their trials schedule in advance with HMIP, and make ongoing reports on progress, in particular on reasons for any slippage. Existing trials should be completed as expeditiously as possible in agreement with the inspector.
- g) Where difficulties arise operators must obtain agreement from HMIP to any extended firing of substitute fuels to undertake testing and monitoring.
- h) Have arrangements to enable the trial to be discontinued if undesirable effects become apparent during the trial.
- i) Expect HMIP to carry out independent testing to verify the trials.

3. EVALUATION

For HMIP to evaluate the effects of using substitute fuels it will be necessary for the operator to provide information on the following:

A Environmental Assessment

- i) Provide an environmental assessment of the outcome of the trials, against BATNEEC criteria including a report of the pre-trial and trial data.
- ii) The aim shall be to show that there is no overall increase in substances released to the three media, air, water and land, and that there is no net adverse environmental impact.

B Stack Emissions

- i) Where there are lower concentrations recorded of such pollutants, these should be listed.
- ii) Where there are any elevated concentrations, these should be evaluated in the operator's report, and feature strongly in the environmental assessment referred to above.
- iii) All concentrations should be evaluated against the guide limits listed in IPR 3/1, and where appropriate against other guidance and legislation e.g. IPR 5/1 and the draft EC Directive on Hazardous Waste Incineration. Pro-rata comparisons should also be made.

C Solid Materials

- i) Any elevated levels of dioxins or heavy metals in solid materials (carried out in accordance with Appendix 1) should be listed and evaluated in the operator's report.

- ii) Where elevated heavy metal or dioxin levels are found in EP dust the operator will need to ensure (to the satisfaction of the Waste Regulatory Authority) if complete recycling is not possible, that the dust is in an acceptable state for landfilling.

4. **OTHER REQUIREMENTS**

a) **Public Registers**

Reports of the trials will be placed on the public registers, including relevant information on the fuel specification. (The operator has the right, where appropriate, to request confidentiality under EPA 90).

b) **BATNEEC**

As a prerequisite to the provision of a varied authorisation for the full time use of substitute fuels, the operator will be expected to put forward proposals for updating existing plant to meet new plant standards, taking into account BATNEEC criteria.

c) **Variations**

On completion of the agreed trials schedule, operators will be required to submit an application for variation of their authorisation, (with the appropriate trials data and assessment) for determination by HMIP. Only if their application is successful and a varied authorisation is issued, will operators be allowed to use substitute fuels on a permanent basis.

APPENDIX 1

SUBSTANCES TO BE MONITORED⁵

FOR WHICH MEDIA

MINIMUM CRITERIA

Substances or Criteria to be Measured	Number of Tests or Continuous Monitoring ⁶					
	Feed	Fuel	Substitute	Kiln Stack	EP Dust	Clinker
Particulate Matter				CM ¹		
NO _x				CM		
SO ₂				"		
CO				"		
HCl				2 ² or CM		
Oxygen				CM		
HF				2 ² or CM		
TOCs	1 ⁷			2 ² or CM		
Dioxins				2 ² ⁴	2	
Heavy Metals all ³	2	2	2	2	2	2
Chlorine Content	2	2	2			
Sulphur Content	2	2	2			
PCB Content			2			
Temperature					EP Inlet ⁷	

Notes

- 1) CM - Continuous monitors are preferred but must be calibrated to the satisfaction of HMIP.
- 2) Tests to be carried out by manual sampling to a British or other standard unless otherwise stated.
- 3) Identity and concentration of those listed in IPR 5/1.
- 4) Tests to be a minimum of 4 hrs duration.
- 5) To be carried out when each substitute fuel is used, where substance concentrations are varied.
- 6) It is important that results of testing should be accompanied by an assessment of the accuracy of the measurement.
- 7) New requirement (6.10.94)

GUIDANCE FOR SOIL SAMPLING

1. THE SITE

- a) Choose a site that is at least 100m from major roads and 500m from motorways or dual carriageways.
- b) The land should preferably be common land owned by the council, (or belongs to a company or an individual who is prepared to give permission to sample) which can be resampled every year and will retain its habitat.
- c) The area to be sampled should be identifiable by Ordnance Survey Reference and should preferably be regularly mown grassland or arable land.
- d) If possible the site should be remote from public interference.
- e) The site should also be not within 10 stack heights of any other combustion source.
- f) The site should be at approximately 10 stack heights from the chimney in question in line with the prevailing wind.

2. THE SAMPLES

- d) Where the site is grass, remove the majority of the grass and then a 3" diameter turf should be removed which is deep enough to remove the roots (say about 3").
- b) Where the site is soil, a 3" diameter core (3" deep) should be removed.
- c) Four samples should be taken from the site within 10 metres of each other and then bulked.

3. ANALYSIS

The sample should follow an established procedure, wherever possible, eg:

- a) Dry, grind and sieve the sample to remove stones etc.
- b) Use a Soxhlet Apparatus to extract organics, using Toluene, and spike sample.
- c) Blanks should be taken.
- d) Then use for example Liquid Chrom'y, HPLC, High Res Gas Spec

ACCURACY OF STACK MONITORING

Measurement accuracies depend on the types of pollutant being measured, the concentration and homogeneity of the pollutant present and the appropriateness of the location of sampling points fitted to the specific plant being monitored. The lower levels of accuracy frequently quoted tend only to apply at the lowest concentration levels close to limits of detection, and have little bearing on assessment against authorised limits.

Stack measurement accuracies for gaseous pollutants such as sulphur dioxide and nitrogen oxides using instrumental techniques are plus or minus 5-10% and for hydrogen chloride around plus or minus 20%. For particulate, except in the very worst sampling locations, accuracy may be expected to be in a range 25-40%. For metals present at a concentration of 0.001 mg/m^3 , accuracy might be plus or minus 50% because this concentration approaches analytical limits of detection. Such a concentration, however, would be typically one hundredth of the legislative release limit, and as concentrations increase accuracy rises dramatically. For dioxins being measured using USEPA Method 23 under ideal conditions in the range $0.1\text{-}1.0 \text{ ng/m}^3$ (TEQ), the precision would be approximately plus or minus 50%.

Ambient measurements are much more accurate than has been suggested in the Committee's report, with environmental measurement accuracies of sulphur dioxide and particulate being in the range of 5-10% and 10% respectively. Plume concentration measurements using differential absorption lidar have a higher margin of error but are still only of the order of plus or minus 20%.

DERIVATION OF ENVIRONMENTAL ASSESSMENT LEVELS

The Table below shows the long term Environmental Assessment Levels (EALs) used for the calculation of the Integrated Environmental Index (IEI) in the "Orange", "Blue" and April 1997 published BPEO guidance notes. A detailed description of the methods by which the values were derived was published in the relevant guidance documents.

Where Environmental Quality Standards were available, then EALs are based on these values. However, for many substances, criteria are not available from this source and alternative sources of information were used. In the Orange Book, a limited number of values were derived from the World Health Organisation Guidelines (1987). For substances where the WHO guideline was given as a risk based value, EALs were estimated on the basis of an incremental lifetime risk of 1×10^{-6} . A similar basis was also adopted for risk based values extracted from the US EPA IRIS database. If no other published values were available, then EALs were derived from the Health and Safety Executive's occupational exposure limits (EH40/93). Where the substance was listed in Table 2 of EH40/93, the long term EAL was derived by dividing the 8 hour time weighted average (TWA) occupational value by 400. If the substance was listed as having a Maximum Exposure Limit (MEL) in Table 1 of the EH40/93 standards, then the 8 hour TWA value was divided by 4000.

The consultation exercise following the publication of the Orange Book generated comments on the methodology used to set EALs. A number of these suggested that the proposed methodology was unnecessarily stringent, and consequently HMIP arranged to review the derivation of EALs.

A contract was let to the ERM consultancy to undertake case studies and make recommendations for changes to the BPEO methodology where appropriate. As part of this exercise, ERM were also asked to compare the method used by HMIP in the derivation of EALs with one proposed by ERM in their response to the Orange Book consultation exercise. In addition, advice was sought from the Robens Institute, Sussex University. In the light of this additional work, a revised approach to the derivation of EALs was devised by HMIP and amended values subsequently published for consultation in Volume III of the Blue Book in August 1995.

In the "Blue Book" methodology, long term EALs were derived from occupational exposure standards using divisors of 100 for EH40/93 Table 2 values and 500 for occupational MELs, instead of the values of 400 and 4000 which had been assumed in the Orange Book. This change led to an increase in many of the EAL values for air, e.g. for arsenic, chromium, nickel, vinyl chloride and dichloromethane, but ensured that they were derived in a consistent manner.

The "Blue Book" methodology was adopted as the basis for the values published by the Agency in 1997. Following the publication of the "Blue Book", the WHO and DOE's Expert Panel on Air Quality Standards brought out recommendations for guideline values for a number of substances and these were incorporated in the guidance where appropriate. A number of typographical errors in the "Blue Book" were also corrected.

Long Term Environmental Assessment Levels (Air) EAL ($\mu\text{g}/\text{m}^3$)			
	Orange Book	Blue Book	As Published in April, 1997
Particulate	150	80	80
SO ₂	80	80	80-120*
NO ₂	83.3	200 (in error)	40
HCl	7	7	7
CO	-	550	550
F	6.5	25	1
Hg	1	1	1
Cd	0.0075	0.005	0.005
Tl	-	10	1
Sb	1.25	5	5
As	0.0003	0.2	0.2
Cr	0.000025	0.01	0.1
Co	0.25	0.2	0.2
Cu	0.5	2	10
Pb	2	2	2
Mn	1	1	1
Ni	0.0025	0.2	0.2
Sn	5	20	20
V	-	1(24hr)	-
V ₂ O ₅ (as V)	0.13	5	0.5

* Depends on suspended particulate content of air.