SCIENCE IN LEGISLATION AND ITS ENFORCEMENT: A STUDY OF NEIGHBOURHOOD NOISE

by

Patricia Havee Lucas MSc DIC

November 1989

A thesis submitted for the degree of
Doctor of Philosophy of the
University of London

Centre for Environmental Technology
Imperial College of Science, Technology and Medicine
London, SW7 2PE

"Every body has their taste in noises as well as in other matters; and sounds are quite innoxious, or most distressing, by their sort rather than their quantity".

Jane Austen (1818), Persuasion.

ABSTRACT

SCIENCE IN LEGISLATION AND ITS ENFORCEMENT: A STUDY OF NEIGHBOURHOOD NOISE

In recent years, there has been a tendency towards the increasing incorporation of scientific and technical terms and criteria within the text of British pollution control legislation. The thesis examines the origins of this trend towards 'technical specificity', and considers the implications for enforcement and for the future of pollution regulation. The focus of the thesis is a study of neighbourhood noise policy. A unifying theme of the study is enforcement discretion - the room for decisional manoeuvre possessed by enforcement agents.

In order to appreciate better the complexities and relationships of the issues involved, a novel interdisciplinary approach has been adopted. This approach involves the use of three conceptual models as analytical tools. These models consider in turn the legal, operational and technical aspects of the policy system. The areas of overlap - or 'interfaces' - of the three models are then examined, thereby enabling their interaction in the policy process to be investigated.

The Legal Model embodies the traditional legal viewpoint, in which the process of law enforcement is considered to be determined solely by the legal mandate originating from the legislature, together with judicial interpretations and additional advice from central government and other sources. The first part of the Legal Model examines the history of neighbourhood noise legislation in order to determine how the processes underlying the enactment of legislation shape its form. In particular, the increase in the technical content of the legal mandate in recent years is considered. The second part of the Legal Model analyses the substantive provisions of the legal mandate in terms of the extent to which they constrain enforcement discretion.

The Operational Model examines the behaviour of enforcement agents from a socio-legal perspective. This model evolved out of the realisation that an extensive gap exists between the legal mandate and its practical expression. Operational constraints on the enforcement process have been identified by means of interviews with Environmental Health Officers, and from the results of a real-time survey of the procedures used by a sample of eight Environmental Health Departments to enforce their legal mandate with respect to neighbourhood noise.

The Technical Model examines the scientific process of quantifying the relationship between a pollutant and its impact on 'targets' in the environment. The development of technology to measure sound, and of methods for the determination of dose-effect relationships for environmental noise, are examined from a historical perspective in order to evaluate the scientific basis of the legal mandate. Likely future developments in acoustic technology are considered in the context of their impact on enforcement and on the design of legislation.

It is the examination of the interfaces - or 'integration' - of the three models that provides the essential value of the interdisciplinary approach adopted in the thesis. The integration of the models has enabled novel themes, recommendations and conclusions for the use of technical criteria in the law enforcement process to be made. The analytical methodology developed in the thesis is considered to be very relevant to the study of other sectors of pollution policy, particularly in view of the current developments in environmental legislation.

ACKNOWLEDGEMENTS

My special thanks are due to my supervisors, Richard Macrory and Nigel Bell, at the Centre for Environmental Technology, who guided me through the pitfalls of defining, researching and writing this thesis. I would also like to express my gratitude to John Peachey for his inspiration and lateral thinking, and for his invaluable help in defining the project. I will never forget John's 'Level 5 Seminars'.

My thanks also go to the staff and research students of the Centre for Environmental Technology, for their friendship and for their discussions both on this project and on research projects in general.

Dorothy Griffiths was very supportive in the early stages of the research, and I would like to thank her for her help concerning survey and interview techniques.

Clare Wilson transformed my scruffy sketches into the neat line drawings in the text.

This research was supported by the Joint Committee of the SERC and the ESRC. Numerous individuals provided useful information for the thesis: they are listed overleaf.

Finally, my gratitude goes to my parents for their unfailing support and to my dear friend, David French, for his encouragement, exhortations and invaluable advice.

INDIVIDUALS CONTACTED DURING RESEARCH FOR THE THESIS

- Staff from the 18 authorities which took part in the noise survey;
- Bernard Berry and Kay Moss - National Physical Laboratory, Teddington;
- David Fisk, Susan Deville and Mike Chapman - Air, Noise and Wastes Division, Department of the Environment;
- Mr D J Lyness - Vehicle Standards and Engineering Division, Department of Transport;
- Mr J Simson and staff of the Noise Group - London Scientific
- Services;
- Steve Battersby and staff at the Institution of Environmental Health Officers;
- Jane Dunmore - National Society for Clean Air;
- John Connell - Noise Abatement Society;
- Prof. D W Robinson, Ian Flindell, Tony Whatmore and Patrick Williams - Institute of Sound and Vibration Research, University of Southampton;
- Keith Hawkins and Bridget Hutter - Centre for Socio-Legal Studies, Wolfson College, University of Oxford;
- Guy Cumberbatch - Department of Applied Psychology, University of Aston;
- Andrew Sanders - Law Department, University of Birmingham;
- Conor Gearty - Emmanuel College, University of Cambridge;
- Peter Combey, Alan Clinton and Sandra Dawson - The Management School, Imperial College;
- Ian Campbell and Richard Tyler - Computer Engineering Limited;
- Dr W A Utley - Building Research Station, Garston, Watford.

LIST OF ABBREVIATIONS

BPM	Best practicable means
COPA	Control of Pollution Act 1974
DOE	Department of the Environment
EEC	European Economic Community
EHD	Environmental Health Department
EHO	Environmental Health Officer
EPA	US Environmental Protection Agency
GLC	Greater London Council
HMIP	Her Majesty's Inspectorate of Pollution
IEC	International Electrotechnical Commission
IEHO	Institution of Environmental Health Officers
ISO	International Organisation for Standardisation
LA	Local authority
NAA	Noise Abatement Act 1960
NAC	Noise Advisory Council
NAN	Noise abatement notice
NPL	National Physical Laboratory
NRA	National Rivers Authority
NSCA	National Society for Clean Air
OECD	Organisation for Economic Cooperation and Development
RCEP	Royal Commission on Environmental Pollution
WHO	World Health Organisation

CONTENTS

	Page
ABSTRACT	i
ACKNOWLEDGEMENTS	iii
INDIVIDUALS CONTACTED DURING RESEARCH FOR THE THESIS	iv
LIST OF ABBREVIATIONS	v
CONTENTS	vi
LIST OF TABLES	xv
LIST OF FIGURES	xvi
CHAPTER 1 - INTRODUCTION	1
1.1 General Aims and Background	1
1.2 Interactions Between Science and Law	7
1.3 The Focal Study	10
1.4 The Unifying Theme	15
1.5 The Interdisciplinary Approach	17
1.6 Outline of the Thesis	21
CHAPTER 2 - THE REGULATION OF POLLUTION	24
2.1 Introduction	24
2.2 Government Regulation	24
2.3 British Pollution Control Policy	25
2.3.1 Traditional Characteristics of British Pollution Policy	27
2.3.2 Pressures for Change	31
2.4 The Criminal Sanction	36
2.5 Strict Liability	38
2.6 Expression of Legal Controls	42
2.6.1 Benefits of Rules	42
2.6.2 Defects of Rules	44
2.6.3 Rules or Guidelines?	44
2.6.4 Types of Specificity in Pollution Control Legislation	46
2.7 Enforcement Agencies	48
2.7.1 Studies of Enforcement Agencies	50

2.7.2 Studies of Pollution Agencies..... 56

CHAPTER 3 - THE LEGAL MODEL I
THE HISTORY OF NEIGHBOURHOOD NOISE LEGISLATION 60
3.1 Introduction..... 60
3.2 The Common Law..... 61
3.3 Early Noise Legislation..... 63
3.3.1 Private Local Acts..... 66
3.4 The Noise Abatement Act 1960..... 68
3.4.1 Antecedents to the Noise Abatement Act..... 69
3.4.2 The Noise Abatement Bill..... 70
3.4.3 Lack of Technical Specificity..... 73
3.4.4 The Ice-Cream Vendors' Exemption..... 73
3.4.5 The Statutory Nuisance Procedure..... 74
3.5 The Committee on the Problem of Noise: "The Wilson Committee"..... 77
3.5.1 Emphasis on Noise Standards..... 78
3.5.1.1 Standards for Neighbourhood Noise.. 80
3.5.1.2 Training in Noise Control..... 85
3.5.2 General Recommendations for Neighbourhood Noise..... 86
3.5.2.1 The Noise Abatement Act..... 87
3.5.2.2 Construction Noise..... 88
3.5.2.3 Industrial Noise..... 89
3.6 The Noise Advisory Council..... 91
3.6.1 Pollution Issues..... 91
3.6.2 The "Scott Committee" Report on Neighbourhood Noise and Part III of the Control of Pollution Act..... 92
3.6.2.1 Noise Abatement Zones..... 94
3.6.2.2 Technical Specificity of the Noise Abatement Zone Provisions..... 97
3.6.2.3 Machines: Rating and Limitation of Noise Output..... 99
3.6.2.4 The Definition of 'Best Practicable Means'..... 100

3.6.2.5 Modifications to the Statutory Nuisance Procedure..... 100
3.6.2.6 Noise from Construction and Demolition Sites..... 102
3.6.2.7 COPA Codes of Practice..... 103
3.6.3 Planning and Noise..... 105
3.6.4 Noise in Public Places..... 108
3.6.5 Promoting Public Education About Noise..... 109
3.6.6 Disbandment of the NAC..... 110
3.7 EEC Policy on Neighbourhood Noise..... 111
3.7.1 Introduction..... 111
3.7.2 Construction Plant..... 113
3.7.3 Lawnmowers..... 114
3.7.4 Household Appliances..... 114
3.7.5 The Action Programmes on the Environment... 114
3.8 Future Prospects for Neighbourhood Noise Control.. 116
3.9 Conclusions..... 118
3.9.1 Influences on the Development of the Legal Mandate..... 120
3.9.2 Increase in Technical Specificity?..... 123
3.9.2.1 Factors Encouraging Technical Specificity..... 123
3.9.2.2 Factors Discouraging Technical Specificity..... 125

CHAPTER 4 - THE LEGAL MODEL II
THE LEGAL CONTROL OF ENFORCEMENT DISCRETION IN PART III OF COPA 127
4.1 Introduction..... 127
4.2 The Legal Model..... 128
4.2.1 The Legal Mandate..... 128
4.2.2 Discretion in the Legal Mandate..... 130
4.2.3 Relationships Between Law and Discretion... 131
4.3 Structure of the Chapter..... 132
4.4 Legalisation of Part III of COPA..... 132
4.4.1 Goal Discretion in Part III of COPA..... 132

4.4.2 Discretion to Determine Unlawful Behaviour in Part III of COPA..... 133
4.4.2.1 Statutory Nuisance..... 136
4.4.2.2 Byelaws..... 149
4.4.2.3 Noise in Streets..... 150
4.4.2.4 Control of Noise on Construction Sites..... 153
4.4.2.5 Codes of Practice..... 155
4.4.2.6 BS 4142: Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas..... 163
4.4.2.7 Noise Abatement Zones..... 164
4.4.3 Sanctioning Discretion..... 171
4.4.3.1 Sanctioning Discretion in Statutory Noise Nuisance..... 172
4.5 Judicialisation of Part III of COPA..... 175
4.5.1 Appeals..... 175
4.5.2 Default Powers of the Secretary of State... 175
4.5.3 Judicial Review of Administrative Action... 176
4.5.4 Local Commissioners for Administration or "Ombudsmen"..... 176
4.6 Conclusions..... 177
4.6.1 Critique of the Legal Model..... 180

CHAPTER 5 - THE TECHNICAL MODEL 181
5.1 Introduction..... 181
5.2 Detection of Noise..... 183
5.2.1 Perception of Sound..... 183
5.2.2 Other Types of Noise..... 184
5.2.2.1 Ultrasound..... 184
5.2.2.2 Infrasound..... 185
5.2.2.3 Vibration..... 185
5.3 Measurement of Noise..... 186
5.3.1 Instruments for Measuring Sound..... 187
5.3.1.1 The Microphone..... 188
5.3.1.2 The Amplifier..... 191

5.3.1.3 The Rectifier..... 191
5.3.1.4 The Indicator..... 191
5.3.2 Physical Analogues of the Ear..... 192
5.3.2.1 Subjective Sound Level Meters..... 192
5.3.2.2 Objective Measurements of Noise: Frequency Weighting Networks..... 193
5.3.2.3 The Ubiquity of the A-Weighting Scale..... 196
5.3.2.4 Problems with Low Frequencies..... 197
5.3.2.5 Transistorisation..... 198
5.3.3 Growth of Regulatory Interest in Noise Control..... 198
5.3.4 Statistical Distribution Analysis..... 200
5.3.5 Automatic Integrating Meters..... 202
5.3.6 Environmental Noise Analysers..... 203
5.3.7 The Incorporation of Microprocessors..... 204
5.3.8 The Zwicker Phon Meter..... 204
5.3.9 Frequency Analysis..... 205
5.3.9.1 Real Time Frequency Analysis..... 206
5.3.10 Sound Intensity Measurements..... 206
5.4 Accuracy and Precision of Sound Measurement..... 207
5.4.1 Sources of Instrumental Inaccuracy..... 208
5.4.2 Sources of Procedural Inaccuracy..... 208
5.4.3 Calibration..... 209
5.4.4 Traceability Chain..... 210
5.4.5 Standardisation..... 211
5.5 Effects of Environmental Noise..... 214
5.5.1 Scale of the Problem..... 216
5.6 Quantifying the Dose-Effect Relationship of Environmental Noise..... 217
5.6.1 Noise Rating..... 217
5.6.2 Proliferation of Noise Ratings..... 219
5.6.3 Procedures for Developing Scales and Indices for Annoyance Caused by Noise..... 221
5.6.4 Problems with Assessing the Annoyance Response..... 224

5.6.4.1 Acoustic Variables..... 224
5.6.4.2 Non-Acoustic Variables..... 227
5.6.4.3 Annoyance due to Low Intensity Noise..... 229
5.6.5 BS 4142: Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas..... 230
5.6.6 ISO Recommendation 1996: Assessment of Noise With Respect to Community Response..... 232
5.6.7 BS 4142 in Practice..... 233
5.6.8 Noise Rating Curves (NR Curves)..... 234
5.7 The Need for a Unifying Noise Rating..... 236
5.7.1 The Equivalent Continuous Sound Level..... 237
5.7.2 Refinements of Leq - the Noise Pollution Level..... 239
5.7.3 Criticisms of the Equivalent Continous Sound Level..... 239
5.8 Conclusions..... 240
5.8.1 Noise and Pollution..... 243

CHAPTER 6 - THE OPERATIONAL MODEL 246
6.1 The Operational Model..... 246
6.2 Studies of the Enforcement of Neighbourhood Noise Law..... 247
6.3 Enforcement Statistics..... 248
6.4 The Noise Survey..... 249
6.4.1 Diversity of Local Government..... 251
6.4.2 The Authorities..... 252
6.4.3 The Noise Complaint Questionnaire..... 253
6.5 Operational Constraints on the Enforcement System. 260
6.5.1 The Role of the Environmental Health Officer..... 260
6.5.1.1 Brief History of the Environmental Health Profession..... 262
6.5.2 The Organisation of Enforcement..... 264
6.5.2.1 The Departmental Hierarchy..... 264

6.5.2.2 The Organisation of Neighbourhood Noise Control..... 265
6.5.3 Resources for Enforcement..... 268
6.5.3.1 Training in Environmental Health... 268
6.5.3.2 Staffing Level..... 269
6.5.3.3 Technical Support Staff..... 269
6.5.3.4 Provision of Noise Monitoring Equipment..... 270
6.5.3.5 Equipment Sharing..... 271
6.5.3.6 Dissemination of Technical Information..... 272
6.5.4 The Process of Enforcement..... 272
6.5.4.1 The Reactive Approach to Enforcement..... 272
6.5.4.2 The Role of Administrative Personnel..... 275
6.5.4.3 Departmental Records..... 276
6.5.4.4 The Types of Noise Complained About 277
6.5.4.5 The System of Extended Cautioning.. 283
6.5.4.6 Visiting..... 287
6.5.4.7 The Need to Witness the Noise..... 291
6.5.4.8 Out-of-Hours Arrangements..... 292
6.5.4.9 The Noisy Party Patrol..... 293
6.5.4.10 Automatic Noise Monitoring..... 295
6.5.5 Procedures for Domestic Noise..... 297
6.5.5.1 Departmental Policies for Domestic Noise..... 297
6.5.5.2 Actions by Occupiers..... 301
6.5.5.3 Use of Byelaws..... 301
6.5.5.4 Routinisation..... 302
6.5.5.5 Assessing Domestic Noise Nuisance.. 303
6.5.5.6 A More Sanctioning Style of Enforcement for Neighbourhood Noise 306
6.5.6 Procedures for Industrial and Commercial Noise..... 309

6.5.6.1 Monitoring Industrial and Commercial Noise..... 309
6.5.6.2 Best Practicable Means..... 310
6.5.6.3 Consultancy..... 311
6.5.7 Alternative Statutory Arrangements..... 312
6.5.7.1 Sound Insulation Requirements..... 312
6.5.7.2 Planning Control..... 313
6.5.7.3 Entertainment Licensing..... 314
6.5.8 Construction Site Noise..... 316
6.5.9 Ice Cream Chimes and Burglar Alarms..... 317
6.5.10 Noise Abatement Zones..... 318
6.5.10.1 The National Picture..... 318
6.5.10.2 Authority 1's Noise Abatement Zones..... 321
6.5.10.3 'Alternative' Noise Abatement Zones..... 322
6.5.11 'Going Formal'..... 323
6.5.11.1 Delegated Powers..... 323
6.5.11.2 The Political Setting of Local Authorities..... 325
6.5.11.3 Service of Statutory Notices..... 327
6.5.11.4 Content of Statutory Notices..... 327
6.5.11.5 Taking Cases to Court..... 329
6.5.11.6 The Magistrates' Court..... 330
6.5.11.7 Technical Evidence in Court..... 331
6.5.11.8 Sentencing and Costs..... 334
6.5.11.9 EHOs' Perceptions of Magistrates' Courts..... 337
6.5.11.10 Pre-empting the Courts..... 337
6.5.11.11 Efficiency of EHDs..... 339
6.6 Conclusions..... 339
6.6.1 The Role of the Enforcement Agent..... 340
6.6.2 The Organisation of Enforcement..... 340
6.6.3 Resources for Enforcement..... 341
6.6.4 The Process of Enforcement..... 342
6.6.5 The Environment of Enforcement..... 342

6.6.6 Case Specific Factors..... 343
6.6.7 Use of Technology..... 344

CHAPTER 7 - THEMES, RECOMMENDATIONS AND CONCLUSIONS FROM INTEGRATING THE THREE MODELS 346
7.1 Introduction..... 346
7.2 Legal with Operational Models..... 348
7.2.1 Will Technical Specificity Lead to a More Sanctioning Style of Enforcement?..... 348
7.2.2 The Appropriateness of Criminal Sanctions.. 357
7.3 Technical with Legal Models..... 362
7.3.1 The Acoustic Instrumentation Industry is Regulation-Led..... 362
7.3.2 Science in Court..... 363
7.3.3 Automated Justice..... 365
7.4 Operational with Technical Models..... 367
7.4.1 Appropriate Levels of Technical Specification?..... 367
7.4.2 Other Aspects of the Technical/Operational Interface..... 371
7.5 Technical, Legal and Operational Models..... 372
7.5.1 Introduction..... 372
7.5.2 The Problem of Domestic Noise..... 374
7.5.3 Alternative Options for Domestic Noise..... 378
7.5.3.1 Neighbour Arbitration and Mediation Schemes..... 380
7.5.3.2 Additional Points..... 380
7.6 Critique of the Interdisciplinary Approach..... 383

REFERENCES 386
APPENDIX 1 - KEY EVENTS IN THE HISTORY OF NEIGHBOURHOOD NOISE LEGISLATION..... 414
APPENDIX 2 - PHYSICAL DESCRIPTION OF SOUND..... 418
APPENDIX 3 - KEY EVENTS IN THE HISTORY OF NOISE MEASURING TECHNOLOGY AND NEIGHBOURHOOD NOISE RATING..... 430
SUMMARY back page

LIST OF TABLES

Table		Page
2.1	Types of Specificity in Pollution Control Legislation..	47
2.2	Sanctioning and Compliance Styles of Enforcement.....	54
3.1	Guidelines for Residential Development in Circular 10/73 - Planning and Noise.....	106
4.1	Provisions of Part III of the Control of Pollution Act 1974.....	134
4.2	Substantive Specificity of Neighbourhood Noise Provisions.....	134
4.3	Statutory Noise Nuisance.....	137
4.4	Statutory Grounds for Appeal Against a Noise Abatement Notice.....	143
4.5	Exemptions to the Prohibition on the Use of Loudspeakers in Streets.....	152
4.6	Code of Practice on Noise from Ice-Cream Van Chimes....	160
4.7	Code of Practice on Noise from Model Aircraft.....	161
4.8	Code of Practice on Noise from Audible Intruder Alarms.	162
5.1	Players in the Weighting Game.....	221
6.1	The Eight Local Authorities.....	254
6.2	The Noise Complaint Questionnaire.....	257
6.3	An Example of One of the Dated Forms Requesting Further Information on the Progress of the Noise Complaints....	261
6.4	Organisation of Pollution Control and Staff Working on Noise.....	267
6.5	Breakdown of Noise Complaints Received in the Noise Complaint Questionnaire.....	278
6.6	How Far the Complaints Progressed Along the Spectrum of Enforcement Activity After 6 Months.....	288
6.7	Initial Response to Complaint.....	289
6.8	Use of Monitoring Equipment.....	296
6.9	Prosecution Rates for Confirmed Nuisances.....	307
6.10	Level of Delegated Powers in the Eight Authorites.....	324

6.11 Typical Fines for Offences Under Part III of the Control of Pollution Act 1974..... 335

LIST OF FIGURES

Figure		Page
1.1	Percentage of People Bothered by Noise Heard at Home...	14
5.1	Block Diagram of a Typical Sound Level Meter.....	189
5.2	Frequency Response of a Condenser Microphone.....	190
5.3	Weighting Networks of a Sound Level Meter as Proposed by the International Electrotechnical Commission.....	195
5.4	The Evolution of Standards.....	213
5.5	Correlation of Mean Subjective Rating with Sound Level of Road Vehicles.....	223
5.6	Waveforms of Two Synthetic Impulse Noises.....	226
5.7	Noise Rating Curves from BS 4142.....	235
6.1	Structure of a Typical Urban EHD.....	266
6.2	Types of Noise Complaints Received by the 8 Authorities in the Noise Complaint Questionnaire.....	279
6.3	Noise Complaints Received by Environmental Health Officers About Noise Sources Controlled by Noise Abatement Act 1960 and Control of Pollution Act 1974...	281
6.4	Percentages by Source of Noise Complaints Received by Environmental Health Officers.....	282
6.5	Percentage of Noise Complaints Received by Environmental Health Officers Which are Confirmed as Nuisances.....	284
6.6	Proportion of Noise Nuisances Confirmed by Environmental Health Officers Which are (A) Remedied Informally (B) Remedied Formally.....	286
6.7	Procedures for a New Domestic Noise Complaint.....	300

APPENDIX 2

A	Parameters of a Sound Wave.....	419
B	Some Typical Sound Pressure Waveforms.....	422

C Sound Pressure Levels of Some Commonly Encountered Noises..... 424
D Range of Audible Frequencies..... 425
E The Fletcher-Munson Equal Loudness Level Contours..... 427

CHAPTER 1

INTRODUCTION

1.1 GENERAL AIMS AND BACKGROUND

In the pollution field, the tendency of recent years has been towards the increasing incorporation of scientific and technical terms and criteria within the text of British regulatory legislation. Not only are environmental monitoring and assessment increasing in technical sophistication, but, for reasons explored in this thesis, pollution control legislation is also tending to become more technically explicit.

The extent to which legislation makes use of scientific and technical terms and criteria is referred to in this thesis as 'technical specificity'. The thesis considers the origins of the trend towards technical specificity in pollution legislation, its effects on enforcement, and its implications for the future of pollution regulation, through the use of a detailed, interdisciplinary study of a small area of pollution control policy. The area chosen for study is neighbourhood noise policy, which is defined as the intentions and actions of Government, both at national and local level, directed towards controlling the negative effects of neighbourhood noise.

In principle, the implementation of pollution control policies can be achieved via legal controls, economic instruments or even voluntary measures. In practice, however, the favoured method has been to rely on legal standards, backed by negative sanctions as the means of ensuring compliance (Richardson, 1982). The sanctions are most commonly a combination of criminal offences, leading to fines or prison sentences; and what may be called administrative sanctions, such as the power to issue a pollution abatement notice or to grant or remove an operating licence (Macrory, 1986a). Failure to comply with

administrative sanctions usually leads eventually to the imposition of criminal sanctions.

Pollution legislation is generally enforced not by the police, but by specific public agencies or inspectorates, which are responsible for the imposition of both criminal and administrative sanctions.

Enforcement - to compel observance of the law - implies an active role of inspection to determine whether statutory requirements imposed on others are being complied with; and to take appropriate measures, such as the imposition of sanctions, if they are not. The term 'enforcement process' is used in this thesis to cover both the behaviour of the enforcement agency, and also the behaviour of the courts in deciding cases which are ultimately brought to trial.

The enforcement function is only one of several responsibilities vested in pollution agencies. As statutory bodies, pollution agencies must also comply with various other legal requirements imposed directly on them by the legislature. These responsibilities may include advisory and educational functions, and pollution monitoring and assessment. A recent review by the Cabinet Office described the role of pollution control agencies in the following terms:

> "Government sets standards to balance safety and pollution consequences against the desire to encourage economic activity. Inspectors ensure compliance with standards by giving guidance, advice and information to industry and where necessary by applying formal sanctions. They also give advice to policy makers and help formulate standards" (HMSO, 1986a).

In common with the British administrative tradition of devolved responsibility, much enforcement work in relation to pollution legislation has been undertaken by local authorities and regional water authorities (HMSO, 1986a). The "lower tier" of local authorities - the district or London borough councils - is responsible for the enforcement of legislation relating to neighbourhood noise, statutory nuisance, air pollution from domestic and many industrial premises, and the collection of waste. The "upper tier" - the county councils -

enforces provisions controlling the disposal of waste on land. (In Wales, waste collection and disposal are both the responsibility of district councils). Until recently, the water authorities were responsible for water pollution and trade effluent control. These responsibilities now fall to a new regulatory agency - the National Rivers Authority (NRA).

Where the regulation of particular pollutants is technically complex, politically sensitive, or else of such a scale that only national or international control arrangements make administrative sense, Central Government generally retains control (Macrory, 1986a). For instance, Central Government has direct enforcement powers over air pollution from the larger or more complex industrial processes (the Industrial Air Pollution Inspectorate), and over the holding and disposal of radioactive materials and the authorisation of radioactive discharges (the Radiochemicals Inspectorate). Since April 1987, these two inspectorates have formed part of 'Her Majesty's Inspectorate of Pollution' (HMIP), presently part of the Department of the Environment. HMIP also comprises the Controlled Waste Inspectorate (which monitors local authority controls over waste disposal to land) and the Water Directorate (which until recently handled appeals against water authorities, and controlled water authorities' own discharges from sewage treatment works - these function have now been taken on by the NRA). The Controlled Waste Inspectorate and the Water Directorate currently have no direct enforcement capabilities: their remit is to supervise the enforcement work of other agencies (HMSO, 1986a).

In recent years policy analysts have begun to appreciate that in addition to the traditional preoccupation with policy formation, an understanding of the processes of policy implementation is vital to the successful study of policy systems (for example, Levitt, 1980; Jackson, 1985). The importance of examining the difference between policy in principle and policy in practice is beginning to influence academic thinking on this subject.

Studies of a broad spectrum of enforcement agencies (including the police, pollution agencies, and other non-police agencies) have acknowledged that, whatever the level of resources assigned to the enforcement function, it remains a practical impossibility for agents to detect and sanction every breach of the law (Laurie, 1970; Cranston, 1979; Steer, 1980; Richardson, 1982; Hutter, 1984). As a consequence, the nature and extent of actual enforcement practice is determined both by the form of the legal controls and by the behaviour of the enforcement agents and ultimately the courts.

It has never been the rule in Britain that suspected criminal offences must automatically be the subject of prosecution. Even when breaches of the law are detected, the police and other enforcement agencies effectively have total discretion as to whether or not to prosecute in a particular case (Sanders, 1985a). As a consequence, agents possess considerable discretion both in relation to the procedures employed for detecting breaches of the law, and in relation to the manner in which breaches are sanctioned. Enforcement discretion - the room for decisional manoeuvre possessed by enforcement agents (adapted from Jowell, 1973) - therefore frequently becomes a central concern of studies which have examined the practice of law enforcement (for example, Skolnick, 1966; Reiss, 1971; Cranston, 1979; Richardson, 1982; Hawkins, 1984a; Hutter, 1984).

A further element of enforcement discretion is identified in these studies. This is the discretion involved in deciding what constitutes a breach of the law. On the face of it, this discretion rests with the legislature, but in practice the legal provisions frequently leave a degree of interpretational latitude. In some instances, this latitude is the result of the legislature explicitly delegating responsibility for determining specific standards to the enforcement agency. In other instances, the legislative definition of a breach may be broadly-drawn, implicitly leaving the agency with the responsibility of determining what standards in practice must be met. Examples of such broad terms used in pollution legislation include 'nuisance'; 'best practicable means'; 'reasonable' and 'environmental hazard'.

In addition, Bennion (1980) argues that however precisely-drawn a legal provision may be, some interpretative discretion always remains as a result of the ambiguous, vague and general nature of language. Many classifying words have a core of established meaning and a 'penumbra' where their meaning is indeterminate. Hart (1961) used the term 'open-textured' to describe such words.

The manner in which the legislative controls are expressed therefore influences the discretion available to enforcement agents. Although a residual level of discretion will always remain, in general the more precisely controls are defined, the less discretion will be available to enforcement agents to determine whether or not there has been a breach of the law. For instance, legislation specifying a clear intention to protect the environment may be interpreted more stringently than a statute that attempts in more ambiguous terms to define the public interest by balancing the objectives of environmental protection and economic progress (Hawkins and Thomas, 1984).

Some studies of the nature and extent of discretion in administrative agencies have suggested that an appropriate compromise must be sought between a mandate consisting of precise, detailed rules and one consisting of broadly defined, general guidelines (Nonet, 1969; Jowell, 1973 and 1975; Kagan, 1978). Both have their relative merits: rules being associated with certainty, guidelines with flexibility. This is discussed in more detail in Chapter 2.

The study of pollution control agencies, based on the premise that the behaviour of the enforcement agency is a significant determinant of the manner in which pollution control laws are implemented, is a small - albeit growing - academic field. Such studies have often adopted a sociological or socio-legal perspective, and have considered enforcement discretion as a central concern. These investigations have used the enforcement of pollution legislation primarily as case studies to illustrate the form which Government

regulation of economic activity frequently takes (for example, Richardson, 1982; Hawkins, 1984a). These studies are also considered in more depth in Chapter 2.

These studies, however, have not considered what effect, if any, a change in legislative content and style would have on enforcement practice. As pollution legislation is currently tending to become more technically explicit, it is important that the implications of this trend on the process of enforcement are examined. The broad objective of the thesis is to explore this aspect of the subject. Within this overall aim, the origins and future implications of the trend towards a more technically explicit style of pollution legislation are considered.

In particular, as the inclusion of scientific and technical criteria tend to make the legal provisions more rule-bound, the inference that can be drawn from the studies of administrative discretion is that an appropriate compromise may need to be reached in the legislative provisions between scientific certainty and administrative expediency. The thesis therefore examines the premise that the level of technical specification in pollution control legislation should be suited to the operational requirements of the enforcement process. The thesis considers whether this 'appropriate' level of technical specificity has been met by the present legislative arrangements for neighbourhood noise control, and contemplates possible implications for the future.

The approach adopted in the thesis, and the more specific objectives arising from it, are described in Sections 1.3 to 1.6 below. The reasons for using the control of neighbourhood noise as the focal study (Section 1.3), the use of the concept of enforcement discretion as a unifying theme (Section 1.4) and the rationale behind the interdisciplinary approach to the study (Section 1.5) are covered in more depth in these Sections. The Chapter concludes with an outline of the contents of the thesis (Section 1.6).

Prior to this, Section 1.2 examines the points of interaction between the disciplines of science and law, in order that the thesis may be set in a broader context.

1.2 INTERACTIONS BETWEEN SCIENCE AND LAW

The legal process may come into conjunction with scientific disciplines in at least four important areas (based on Macrory, 1986b):

(i) New scientific findings may reveal omissions or weaknesses in current legal controls and doctrines, and demand either the implementation of new laws or the reappraisal of existing ones.

(ii) New scientific developments may themselves demand some form of response from government, and this may take the form of legal controls.

(iii) Legal controls, both in the scientific and non-scientific fields, may make use, either explicitly or implicitly, of scientific terms and criteria.

(iv) In the courts or in other forms of legal tribunal or quasi-legal setting, scientific "expert" evidence may play a vital role in the judicial process.

For the purposes of this thesis, science and technology are considered to be synonymous as, in the context of the interaction of science and law, 'science' is implicitly 'applied science' and, to all intents and purposes, applied science is 'technology'.

Some elaboration of the four areas identified above is helpful. Looking at the first area, an example of a scientific finding which led to new legal provisions is provided by research in the late 1970s suggesting that the release of chlorofluorocarbons (CFCs) - used, amongst other things, as propellants in aerosols - could damage the

stratospheric ozone layer. This research led to the introduction of precautionary legal measures limiting the total production of CFC within the European Community (eg. 80/372/EEC (OJ L90 3/4/80) Decision concerning chlorofluorocarbons in the environment). The discovery of a "hole" in the ozone layer over the Antarctic resulted in an international convention for the protection of the ozone layer, held in Montreal in September 1987. The protocol to the convention, signed by 27 nations, called for a three-stage reduction plan for CFC production (IEEP, 1987).

An example of research demanding a reassessment of existing controls was the finding that the risk of developing fatal cancers from exposure to radiation was two or three times higher than was previously thought. As a consequence, the National Radiological Protection Board recommended that occupational dose limits should be reduced from 50 to 15 millisieverts per year (New Scientist, 1987; Guardian, 1987).

Where the second area is concerned, by generating ethical issues or risks to society or both, scientific advances may themselves require some form of legal control. The development of in vitro fertilisation techniques, for example, raises complex moral and social issues. There are risks attached to the use of nuclear power. The release of genetically engineered organisms into the environment poses risks and ethical issues.

Turning to the third area, the formulation of appropriate legal controls may well require the use of scientific terms or criteria. These may be incorporated directly into legislation, so that "a scientific way of looking at things actually, or at least apparently, becomes the law" (Macrory, 1986b). This is what is meant by the 'explicit' use of scientific criteria in law.

Alternatively, the external expression of legislation may be couched in completely unscientific terms. But the practical application of such legislation may mean that these qualitative criteria are

converted into precise - and 'scientific' - operating standards, by reference to codes of practice, World Health Organisation standards, British Standards, or guidelines developed by the enforcement agency itself. This is what is meant by the 'implicit' use of scientific criteria in law.

The last thirty years in particular have seen the development of a substantial body of environmental legislation, some of which incorporated explicit scientific standards from the outset. In addition, a more recent trend in pollution legislation is towards the replacement of implicit with explicit scientific criteria. These trends are examined in more detail in Chapter 2.

Considering the fourth aspect, scientific "expert" evidence plays a particularly important role in the resolution of several types of legal and quasi-legal conflict. For example, pollution cases, both in the civil and in the criminal courts, may involve the presentation of technical evidence and the use of expert witnesses. Forensic science, forensic medicine and forensic psychiatry are disciplines whose primary objective is the application of these respective bodies of knowledge for legal purposes, particularly for eliciting and interpreting facts which may be of significance in legal inquiries. Civil litigation may require the assessment of complex scientific and technical evidence, in relation to claims in negligence concerning industrial injuries and engineering failures, for instance, in addition to actions in nuisance or negligence concerning environmental pollution. Inspectors at public inquiries or tribunals of inquiry may have to determine the significance of similarly esoteric technical data. Patent law may also involve the evaluation of technical matters in judicial or quasi-judicial settings. Even in the routine processing of traffic offences, the courts may need to assess technical evidence: drink-driving cases, for example, where the concentration of alcohol in the defendant's breath is measured automatically using an 'intoximeter', or where alcohol levels have been determined from blood or urine samples.

The four major areas outlined above are not independent of one another. For instance, an appropriate policy response to a new scientific finding or development may be the framing of legislation where controls are expressed in terms of scientific standards. Pollution offences may be defined by reference to scientific criteria, and, on coming to court, may involve both the presentation of technical evidence and the use of expert witnesses.

The resolution of scientific and technological conflicts by the courts is a problem particularly pertinent to the constitutional style of the United States, where the federal courts may review decisions made by administrative agencies or establish the legitimacy of innovative research practices (Jasanoff and Nelkin, 1982). In Britain, the courts do not intervene in policy matters to the same extent and, in particular, they have been, and still are, reluctant to interfere in decisions based on scientific and technical expertise (Guruswamy and Tromans, 1986). Consequently the problems raised by the interaction of scientific and legal disciplines have received more attention in the United States than in Britain (Wynne, 1982).

Nevertheless, the two disciplines are increasingly tending to come into contact in this country (Wynne, 1982), but their interaction has not been well documented (Wynne, 1982; Macrory, 1986b). In particular, except for a conference paper by Macrory (1986b), the contribution of science to the formulation of legal controls and the use of scientific and technical terms and criteria in legislation appear to have been little studied in this country, at least in published material.

1.3 THE FOCAL STUDY

Noise has been defined as "unwanted sound" (for example, Open University, 1972) or "sound which is undesired by the recipient" (Committee on the Problem of Noise, 1963). More recently the Organisation for Economic Cooperation and Development (OECD) defined noise as "any acoustical phenomenon producing a sensation perceived as

disagreeable or disturbing by an individual or group" (OECD, 1985). All these definitions identify noise as a physical signal (sound) which produces a negative subjective evaluation in the hearer (unwanted, undesired, disagreeable or disturbing).

Sources of noise are commonly classified in terms of four categories: road traffic, aircraft, neighbourhood and occupational (for example, the Noise Advisory Council, 1974a). The first three comprise sources of 'environmental' noise. Environmental noise is recognised by the Government as a form of environmental pollution (for example, Denis Howell, Minister of State at the Department of the Environment, 1974), although other parties (eg. the Royal Commission on Environmental Pollution, 1984) have declared that the particular characteristics of environmental noise set it apart from other pollutants. Occupational noise is dealt with as a matter relating to health and safety at work. Control policies treat each of these four major sources separately.

The subject of this thesis - neighbourhood noise - is a blanket term basically covering noise from stationary sources. The term was first used by the Noise Advisory Council to refer to a wide variety of noise from stationary sources "which may - and frequently do - cause disturbance and annoyance to the general public in their homes and going about their lawful occasions" (Noise Advisory Council, 1971). As such the term encompasses factory noise; noise from demolition, construction and roadworks; noise from ventilation and air-conditioning plant in all types of buildings; noise from sports, entertainment and advertising; noise from domestic animals; and human noise arising from lack of consideration for others (for example, amplified music, noisy parties, shouting and DIY activities).

Noise levels encountered in the workplace may be so high as to lead to permanent hearing-loss and eventual deafness after many years' noise exposure. The primary concern of occupational noise control is thus to prevent noise-induced hearing loss. Research has established a direct correlation between permanent hearing impairment and long-term noise exposure (Burns and Robinson, 1970), so enabling the

setting of exposure criteria based on judgements of acceptable risk (for example, EEC Directive on the protection of workers from the risks related to exposure to noise at work, 86/188/EEC (OJ L137 24/5/86)).

Whilst noise at levels encountered in the environment does not usually pose a risk to hearing, it can impair the intelligibility of communication, the ability to concentrate and the quality of sleep; and it can engender feelings of irritation and annoyance in those subjected to it. In addition, it can elicit physiological responses which may constitute contributory stress factors in disorders of the cardiovascular and digestive systems (OECD, 1985). Unlike noise at occupational levels, however, there is not as yet any unequivocal evidence that noise at environmental levels causes any general adverse effects on health in the commonly accepted sense of the word (Flindell, 1988). As a consequence, for regulatory purposes, exposure to noise at environmental levels is primarily considered as a source of annoyance, rather than a direct threat to health. Control measures therefore aim to reduce the incidence of community annoyance to acceptable levels. Noise-induced annoyance, however, is a complex, subjective, emotional response which may be influenced both by the physical characteristics of the noise and by a wide range of psychological, social and economic factors.

Although reasonably good correlations have been found between the physical characteristics of particular sources of noise and average community annoyance, the correlations between physical parameters and individual annoyance have tended to be very poor indeed (Schultz, 1982). In addition, there is as yet no scientific consensus concerning a unified index of noise exposure which relates to subjective annoyance in all circumstances and for all sources of environmental noise. The measurement and evaluation of the effects of noise are considered in more detail in Chapter 5.

Surveys and opinion polls undertaken in several OECD countries have found that the disturbance most frequently cited by respondents is

noise in the home (OECD, 1980). According to a report on social attitudes, "levels of concern about noise, fumes and other forms of pollution were so high as to suggest a potential political force of some strength" (Jowell and Witherspoon, 1985).

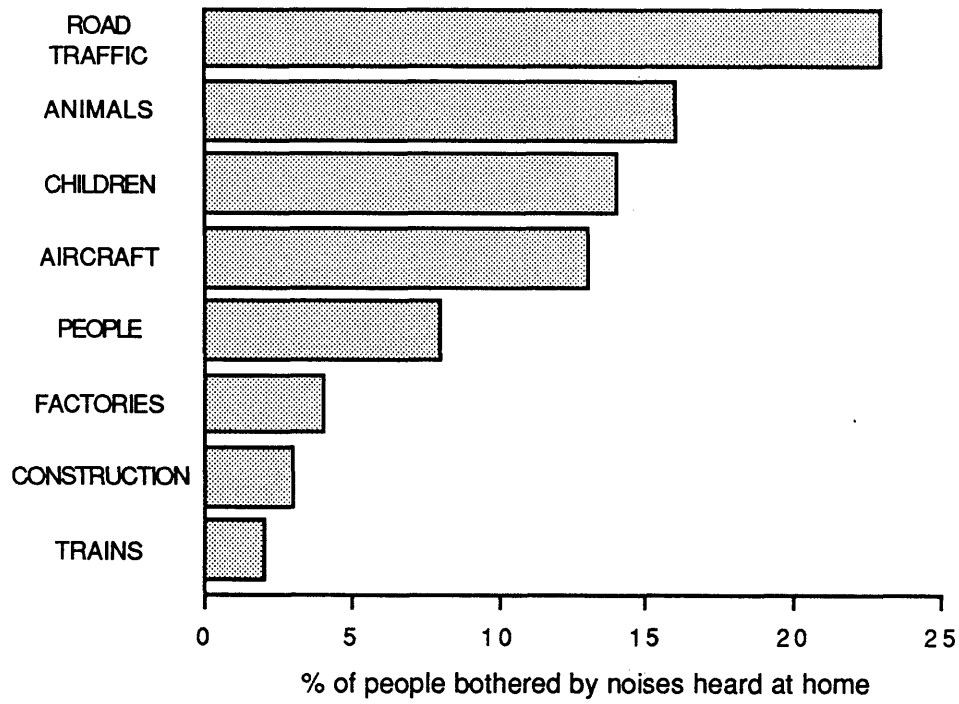
In terms of the number of people disturbed, road traffic is generally considered to be the major source of annoyance, followed by neighbourhood noise and then aircraft noise (OECD, 1985). Figure 1.1 (from Clegg and Whittaker, 1986) shows the percentage of respondents bothered by various sources of noise heard in the home. These data are based on the results of a national survey in England, directed at examining attitudes to and effects of road traffic noise, which was commissioned by the Department of the Environment in 1971. Recent data obtained by the Building Research Establishment, however, indicate that the proportion of people bothered by traffic noise has decreased to the extent that neighbourhood noise may now be the most widespread source of noise disturbance in the home (Utley and Buller, 1987).

There were several reasons for using neighbourhood noise policy as the focal study. Most importantly, the legal controls provide a good example of a piece of regulatory law currently expressing a spectrum of technical specificity, from qualitative guidelines in the form of statutuory nuisance provisions, to quantitative criteria effectively setting noise emission limits for specified premises in noise abatement zones. This spectrum provides the basis for examining the effect of technical specificity on the process of enforcement. Neighbourhood noise legislation is largely contained in Part III of the Control of Pollution Act 1974 (COPA), and is a discrete and reasonably succinct body of law suitable for detailed interdisciplinary study.

Enforcement of the controls is the responsibility of the district or London borough councils, usually through their Environmental Health Department (EHD). Central Government plays no direct part in the enforcement of neighbourhood noise controls. The Department of the

FIGURE 1.1
PERCENTAGE OF PEOPLE BOTHERED BY NOISES HEARD AT HOME

**(From Clegg and Whittaker (1986)
using data from Social and Community Planning Research (1978)
"Road Traffic and the Environment")**



Environment's role is primarily concerned with the formation of neighbourhood noise policy, including developing and promoting legislation, holding administrative appeals, conducting international negotiations, commissioning research and producing technical and policy material.

EHDs are easily accessible from a researcher's point of view: the officials (Environmental Health Officers (EHOs)) are used to dealing with the public and can cope with the presence and questions of a research student. No previous study has examined the enforcement of neighbourhood noise legislation in such depth, although Hutter (1984) examined the procedures used by EHOs to enforce their whole suite of statutory responsibilities, including matters relating to food and drugs, housing, pollution control and health and safety.

As a type of pollution, neighbourhood noise is even more worthy of study since it is a growing cause of complaint - it currently constitutes the major source of complaints to EHDs (Royal Commission on Environmental Pollution, 1984) - and a growing cause for concern amongst EHOs (Battersby, pers. comm.).

Its use as a focal study also shows up in sharp relief the problems encountered when the response to an environmental pollutant cannot be quantified satisfactorily, with consequent difficulties for determining acceptability criteria.

1.4 THE UNIFYING THEME

Enforcement discretion - the room for decisional manouevre possessed by enforcement agents - is a recurring theme throughout the thesis. The literature on administrative discretion is vast (for example, see Salem, 1983). It has been regarded as an 'issue' for different reasons by many different disciplines (Richardson, 1982).

In a seminal work on the subject of discretion in public administration, Davis (1969) defined discretion in the following manner:

> "A public officer has discretion whenever the effective limits on his power leave him free to make a choice between possible courses of action or inaction."

Davis emphasises two main points arising from his definition. Firstly, discretion includes the choice to do nothing, or to do nothing now, as well as the choice to make a decision involving action of some sort. Secondly, discretion does not have to be limited only by what is legal, but includes all that is within the 'effective limits' of an official's power. These effective limits may be set by factors such as resource constraints, time limits, and organisational 'norms' as well as by legal rules and guidelines. The discretion given to a decision maker lies on a spectrum. Discretion is a relative concept: as Jowell (1973) stated, it is "...rarely absolute and rarely absent. It is a matter of degree, and ranges along a continuum from high to low".

Writers on enforcement discretion usually consider that there are two aspects to the concept: firstly, the discretion involved in interpreting what constitutes a contravention of the law, and, secondly, the discretion involved in deciding whether a contravention of the law merits prosecution (for example, Richardson, 1982). Hawkins (1984b) identified these two aspects as firstly a matter of whether to act, and secondly how to act.

For the purposes of this thesis, a third aspect - goal discretion - has been added to the two identified above, so that enforcement discretion is considered to be composed of the following:

(i) GOAL DISCRETION

The discretion involved in interpreting what is the perceived aim or intention of the legislation. Enforcement strategies may vary, depending on what the objective of the legal controls is considered to

be, or on how explicitly that objective is explained in any legal text.

(ii) DISCRETION TO DETERMINE UNLAWFUL BEHAVIOUR
The discretion involved in determining what constitutes a contravention of the law.

(iii) SANCTIONING DISCRETION
The discretion involved in deciding whether a contravention of the law merits formal action. 'Formal action' is a term used by EHOs themselves to mean the imposition of administrative or criminal sanctions.

1.5 THE INTERDISCIPLINARY APPROACH

Many problems of an applied or operational nature are not capable of being systematically explained on the basis of a single discipline. Environmental policy is one such area, where scientific, legal, economic, administrative, social and political inputs are drawn together and integrated in the decision-making process. It is asserted that any analysis of environmental policy "must be handled with sensitivity so as to identify and integrate the contributions made by each distinctive approach, without loss of authenticity to the various disciplines and interests involved" (Peachey and Macrory, 1983). The basic principles and ground-rules of each particular discipline must be adhered to, in order that authenticity may be maintained.

The concern of this thesis - science in legislation and its enforcement - encompasses distinctive strands of scientific, legal and administrative thinking. Each of these strands is considered initially within the context of its own distinctive viewpoint and ground-rules. The strands are then brought together to examine their interaction in the policy process. This is what is meant by the 'interdisciplinary approach' as used in this thesis.

The words 'multidisciplinary' and 'interdisciplinary' are often used synonymously, but in the context of this thesis there is a distinct difference between them. A 'multidisciplinary' study is taken to mean one which simply encompasses more than one discipline. An 'interdisciplinary' study, however, builds on top of a multidisciplinary study by considering all the composite disciplines as open boxes, and by then focusing on the interfaces between the composite disciplines.

In order to structure the study of each of the different strands of thinking identified above and to facilitate their integration, use is made of conceptual models. Three conceptual models are used in the thesis: a Legal Model, an Operational Model and a Technical Model. These are described below. 'Model' is used here in the sense of a simplified aspect or abstraction of reality, enabling the analytical schema to be simplified by picking out certain elements which appear more relevant or significant than others. Otherwise the analytical process becomes swamped with facts. As Finnegan (1972) asserts, a model in this sense is merely a logical extension on paper of the cognitive processes used by everyone to make sense of a complex world. It amounts to the imposition of intellectual order on what might otherwise appear confused or chaotic.

The development of the models means that salient aspects are emphasised and developed into themes for further analysis. Which aspects appear 'salient', however, depends on the perspective or viewpoint taken - in other words on the particular model being used. So the use of a model predisposes the analytical schema towards concentration on, and development of, certain perspectives and themes. Each model in its own right only provides a partial picture of the policy process: a complete picture can only be gained by considering all three models and their areas of overlap and interaction with one another.

The intention of integrating the Legal, Technical and Operational Models is to yield novel insights into, and recommendations for, the

use of technical terms and criteria in neighbourhood noise legislation and in its enforcement, which cannot be gained from single discipline studies, or from multidisciplinary studies where the interactions between disciplines are not examined. This interdisciplinary approach was developed for this thesis and, certainly in the field of UK pollution studies, has not been used in quite this way before.

The main research tools used in the thesis consisted of literature reviews, an interview and questionnaire survey of a sample of Environmental Health Departments, and interviews with relevant parties in central government, research institutions, non-government organisations and industry.

A. THE LEGAL MODEL

In this model the organising concept is the formal structure of the law. The Legal Model embodies the traditional legal viewpoint in which the process of law enforcement, the behaviour of law enforcement agents and, as a consequence, enforcement discretion, are considered to be determined solely by the form of the legal mandate. By 'legal mandate' is meant the remit originating from the legislature and from judicial interpretations, with additional advice from Central Government in the form of codes of practice, circulars, and memoranda. The term also includes local Acts and byelaws, Directives of the European Economic Community (EEC), and operational guidelines and criteria contained in British Standards.

Basically the Legal Model adheres to Weber's ideal of bureaucracy as a legalistic purity, where officials are subject to strict systematic control and enforce the law "without hatred or passion and hence without affection or enthusiasm" (Weber, 1947).

From the perspective of the Legal Model, the enforcement agency is a black-box with the legal mandate as an input producing an output of enforcement actions entirely predictable from the form of the mandate, and unperturbed by any constraints or variables hidden in the black-

box. As implementation is considered unproblematic, the Legal Model is therefore predisposed towards concentrating on the processes of formation of law, rather than on the processes of implementation of law.

B. THE OPERATIONAL MODEL

The Operational Model evolved out of the realisation that the gap between the law as written (the legal mandate) and its practical expression is extensive. Law and jurisprudence have traditionally been more concerned with the processes of formation of law than with the behaviour of those agents whose remit is its enforcement. It is only comparatively recently that the practical expression of laws has been studied and, as mentioned in Section 1.1, a body of literature has grown up concerned with the behaviour of enforcement agencies.

The Operational Model borrows from these studies by effectively opening the black-box, which in the Legal Model is the enforcement agency, and examining the administrative, social and political constraints which influence the enforcement process. From the perspective of the Operational Model, enforcement discretion is circumscribed both by these 'operational constraints' and by legal constraints.

C. THE TECHNICAL MODEL

The fundamental aims of pollution control policies in Britain have been to prevent harm to people and the environment, or to prevent people being subjected to 'unacceptable' levels of nuisance or disamenity (Macrory, 1986a). The basic ideology behind these aims is one of controlling pollution to acceptable levels - however 'acceptable' may be defined - rather than one of necessarily seeking to minimise all pollutant emissions, regardless of perceived risk or disamenity (Holdgate, 1983).

In order that limits of acceptability may be determined, control policies require data regarding 'dose-effect' relationships: in other words, scientific data quantifying the relationship between a pollutant and its potential or actual impact on people or the environment. One of the seven principles of the British Government's so-called 'environmental charter' is to "base decisions on the best available scientific foundation" (Department of the Environment, 1988a). The danger or unwanted effects of a pollutant depend on its harmfulness or - where environmental noise or litter are concerned, for example - its intrusiveness; the circumstances of its release; the likelihood that it will reach a susceptible 'target' and the impact it may have on the target whether immediate or long-term. Once a causal correlation can be established between pollutant levels and effects, the hazard or disamenity can be evaluated and control strategies developed.

The Technical Model examines the key characteristics which underlie the scientific process of attempting to quantify dose-effect relationships. These include the development of technology for the detection, measurement and monitoring of environmental pollutants; the acquisition of scientific evidence to establish cause-and-effect relationships; and the use and efficacy of scientific standards in pollution control legislation.

1.6. OUTLINE OF THE THESIS

The structure of the thesis is based on the three conceptual models, applied to neighbourhood noise policy.

Chapter 2 provides the broad context of the thesis, by examining the characteristic features of the British approach to the regulation of pollution and, in particular, the trend towards increasing technical specificity in British pollution control legislation, identified in Section 1.1. The issues raised by the use of legal standards, enforced by specific agencies and ultimately backed by criminal sanctions, as the preferred method of implementing pollution control policies, are

considered. Previous studies of enforcement agencies, in particular those dealing with pollution control, receive a critical review.

Chapter 3 comprises the first part of the Legal Model. It examines the history of neighbourhood noise legislation and associated policy, in order to identify the factors underlying the development of the legal mandate, and how these shape its resulting substance and style. More specifically, the Chapter examines the premise that the legal mandate for neighbourhood noise has become more technically defined in recent years. It aims to identify the origins of this trend and those factors, if any, which have encouraged the incorporation of scientific and technical terms and criteria into the legal mandate. An unpublished doctoral thesis by Gearty (1986), which considered the role of the courts in the control of environmental pollution, looked briefly at the history of neighbourhood noise legislation. The present study, however, investigates the historical background in substantially more depth than Gearty's work.

Chapter 4 comprises the second part of the Legal Model. It analyses the substantive provisions of the legal mandate for neighbourhood noise in terms of the extent to which they constrain enforcement discretion.

Chapter 5 comprises the Technical Model. The development of technology to measure environmental noise and of methods for the determination of dose-effect relationships for neighbourhood noise are examined from a historical perspective as a means of evaluating the scientific basis of the legal mandate. Likely further developments are considered in the context of their impact on enforcement and on the design of legislation. The development of instrumentation to measure noise, and noise assessment have been broadly reviewed by Meij (1971) and Tempest and Bryan (1976). Schultz (1982) provided a comprehensive review of methods for determining dose-effect relationships - or 'noise rating' - for all sources of environmental noise. The present study considers both the historical development of noise measurement instrumentation and the development of

neighbourhood noise ratings, and adds original material to the body of information outlined above.

Chapter 6 comprises the Operational Model. Operational constraints on the enforcement of neighbourhood noise laws are identified from semi-structured interviews and conversations with officers from 18 EHDs, and from the results of a real-time survey of the procedures used by a sample of 8 departments to enforce their legal mandate with respect to neighbourhood noise. The Chapter considers the extent to which noise measuring equipment is used in the enforcement process.

In Chapter 7 the major conclusions and recommendations from the three conceptual models are integrated. Interdisciplinary themes and recommendations are developed by considering the areas of overlap - or 'interfaces' - of the three models. The Chapter examines the question of 'appropriate' levels of technical specification in neighbourhood noise legislation, introduced in Section 1.1. The Chapter also considers the extent to which the interdisciplinary approach has succeeded in uncovering novel insights into the policy process, which cannot be addressed by either single disciplinary studies, or by multidisciplinary studies where the interactions between disciplines are not examined. The applicability of this approach to other areas of pollution regulation is considered.

CHAPTER 2

THE REGULATION OF POLLUTION

2.1 INTRODUCTION

This Chapter begins by examining the characteristic features of the British approach to pollution control policy, and then considers the supranational and national policy influences which are currently producing marked changes in the traditional approach, in particular the increasing technical specificity of pollution control legislation. The issues raised by the use of legal standards, enforced by specific public agencies and ultimately backed by criminal sanctions, as the preferred method of implementing pollution control policies, are considered. Previous studies of enforcement agencies, in particular those dealing with pollution control, receive a critical review.

2.2 GOVERNMENT REGULATION

The criminal sanction is not the only method by which Government may seek to control private behaviour. Alternative methods include fiscal or monetary instruments (such as taxes or grants and subsidies); voluntary agreements between government and industry; restrictive contracts (licensing) and civil penalties.

In the broad sense all these control methods involve Government 'regulation' of private activities. However, the term is used in a more restrictive sense in this thesis. Although there is no universally accepted meaning of 'regulation' (Ogus and Veljanovski, 1984), the definition adopted in this thesis is: 'the control of private behaviour, usually but not necessarily that conducted for economic gain, by means of direct legal orders primarily enforced by a public institution, often an administrative agency created for that specific purpose' (adapted form Kagan, 1978). In keeping with the academic literature on regulation and regulatory agencies,

'traditional' crimes enforced by the police (such as burglary, theft and assault) are considered not to be included within the ambit of this definition.

2.3 BRITISH POLLUTION CONTROL POLICY

Pollution is a difficult term to define since it means different things to different people, but a popular definition is the following, which is used by the Royal Commission on Environmental Pollution (1984):

> "The introduction by man into the environment of substances or energy liable to cause hazards to human health, harm to living resources and ecological systems, damage to structures or amenity, or interference with legitimate uses of the environment (Holdgate, 1979).

Pollutants are considered to originate from a source and move through pathways in the environment until they reach a receptor or 'target' (Holdgate, 1979). Targets can be humans, fauna, flora or inanimate objects (for example, buildings). Pollution can give rise to two kinds of consequence (Burrows, 1982). Firstly, the immediate victims of pollution can suffer physical harm (death or illness) or financial loss (such as a decrease in the productivity of a business or a decrease in property prices). Secondly, pollution can result in a misallocation of resources from the point of view of society as a whole (such as reduced levels of productivity due to employees being ill, destruction of the environment and amenity, decrease in the quality of life and increased costs for the Health Service).

Control strategies can impose limits on the amount of permissible pollution of the environment - that is, pollution control 'standards' - at various points in the pollutant pathway (Holdgate, 1979), as outlined below. In the legal sense, standards are often contrasted with 'objectives': the former considered to be legally binding, the latter considered to be guidelines or ideal goals to work towards. However, this distinction has become somewhat blurred, as some EEC Directives refer to 'objectives' which are, in effect, legal

obligations (Haigh, 1984).

(i) Biological standard
Prescribes the maximum concentration of a pollutant that is permitted to accumulate in a living target.

(ii) Exposure or primary protection standard
Prescribes the maximum allowable exposure or dose for a particular target.

(iii) Product standard
Limits the composition of a product or specifies properties or design characteristics in order to limit the level of pollution arising from the use of a product.

(iv) Operating/Process standard
Specifies the way in which a product is to be used or a manufacturing process operated.

(v) Emission standard
Limits the maximum concentration of a pollutant in a discharge to the environment over a particular period of time.

(vi) Environmental quality standard
Prescribes the maximum concentration over a period of time of a pollutant in a given medium or geographical area, regardless of the number of emission sources entering the medium or in the area.

The common law, with its basis in rights in property, has traditionally provided a means of controlling pollution, by providing compensation for damage to persons or their property or by injunctive relief. It proved ineffectual, however, in controlling the worst excesses of the industrial revolution, especially pollution of the air and water (Brenner, 1974). According to Brenner, the difficulties lay in attributing blame when the pollution emanated from a multiplicity of sources, and also in the reluctance of the courts of the time to

impose injunctions on industrial undertakings.

The earliest legislation to control such pollution took the form of local, piecemeal provisions, to be followed at a later date by legislation of national application (Holdgate, 1983). As the world's first industrial nation, Britain has the world's oldest system of pollution control and the oldest pollution inspectorate (the Alkali Inspectorate, now contained within HMIP) (Vogel, 1986). Although currently undergoing major changes, present legislation to control air and water pollution has its roots in Victorian provisions: the origins of legislation controlling water pollution derive from the Public Health Acts 1848 and 1875 and the Rivers Pollution Prevention Act 1876, while those for industrial air pollution derive from the Alkali Acts 1863 to 1906.

The 1950s saw the passing of the Clean Air Act 1956, which sought to control smoke emissions from domestic premises, and thereby prevent a repetition of the smog of the winter of 1952 which led to 4,000 extra deaths in London (Ashby and Anderson, 1981). By the late 1960s and early 1970s environmental issues provoked considerable concern at an international level, as evidenced by the United Nations Conference on the Human Environment in Stockholm and by the inauguration of the environmental policy of the EEC, both in 1972. This concern was reflected in national policy developments, outlined in more detail in Chapter 3 (Section 3.6.1) and culminating in legislation such as the Deposit of Poisonous Waste Act 1972, the Water Act 1973, the Control of Pollution Act 1974 (COPA) and the Health and Safety at Work, Etc., Act 1974.

2.3.1 Traditional Characteristics of British Pollution Control Policy

Whilst it is difficult, and possibly even misleading, to generalise about the prevailing character of any sector of policy, some characteristics of the traditional British approach to pollution control can be discerned. The British regulatory approach has tended to be flexible, informal, decentralised and conciliatory, in contrast

to the approaches prevailing in the United States and West Germany which permit significantly less enforcement discretion and are more rigid, explicit and adversarial (Vogel, 1986; von Moltke, 1988). British pollution control legislation has tended to make little reference to explicit scientific criteria within the text of the provisions themselves. Traditional attributes of British pollution control policy include the following:

(i) An approach which is essentially pragmatic and gradualist. Environmental problems have been dealt with as they manifest themselves, in a piecemeal, reactive, ad hoc manner: "....as new hazards were recognised, industrial processes improved and public awareness sharpened, so new controls were introduced and existing controls tightened" (Shore, 1977). In contrast to countries such as West Germany, there are no explicit constitutional principles concerning the protection of the environment, nor is there anything approaching an organic law on pollution (in contrast to the United States' National Environmental Policy Act 1969). The result is a complex array of laws and administrative policies which do not present a coherent framework or overall scheme, but which reflect, rather, their historical background (Macrory, 1986a).

(ii) There has been considerable reliance - more so in the past than now - on voluntary control arrangements between Government and industry. For example, prior to the implementation of the Food and Environment Protection Act 1985, the marketing and use of pesticides were controlled in this way under the non-statutory Pesticides Safety Precautions Scheme (Gilbert, 1987).

(iii) In keeping with the administrative tradition of devolved responsibility, many duties in pollution control are delegated to local authorities and - until privatisation - were also delegated to the regional water authorities. Pollution control has consequently tended to be decentralised and policies have been minimalistic and flexible, permitting a high degree of enforcement discretion (Haigh, 1984).

(iv) As mentioned in Chapter 1 in relation to the Technical Model, pollution control policies in Britain have aimed to keep damage within acceptable limits (however 'acceptable' may be defined), rather than seeking to minimise all pollutant emissions, regardless of the perceived risk or disamenity. This approach requires that pollution agencies should take account of the assimilative capacity of the local environment, and should have the flexibility to set standards which vary in the light of local circumstances. Such standards may therefore be expressed more appropriately in codes of practice or agency operating procedures, rather than in national legislation.

(v) There has been a marked reluctance to make use of explicit or quantitative standards in pollution control legislation. Instead, legislators have exhibited a preference for the use of qualitative terms such as 'dark smoke'; 'nuisance'; 'wholesome water' and 'environmental hazard'. General guidelines such as these may be translated into explicit rules at the operational level by the use of agency procedures, codes of practice, WHO standards or British Standards (in other words, the 'implicit' use of scientific criteria in legislation (Chapter 1, Section 1.2)). Although the legislation leaves a broad enforcement discretion, operating procedures often result in more standardised approaches prevailing in practice (for example, Richardson, 1982).

(vi) Legislation tends to elaborate decision-making procedures in more detail than substantive provisions (Macrory, 1986b).

(vii) A preference for using criminal sanctions - as opposed to some form of civil penalty - as the ultimate means of gaining compliance with legislative requirements. The higher evidential standard of 'beyond all reasonable doubt' is required by the criminal court system, in contrast to the requirement of the civil courts that cases must be proved 'on the balance of probabilities'.

(viii) It is unusual for the overall goal of any policy to be expressed explicitly in the legislation (ibid.). Enforcement agents therefore have considerable goal discretion.

(ix) One of the major tenets of the British approach to pollution control is the concept of 'best practicable means' (BPM), which has a statutory history going back to the Alkali Act 1874, although a local Act applying to Leeds in 1842 first used the expression (Holdgate, 1983). According to the Department of the Environment (1978), "Authorities, both central and local, are expected to operate on the philosophy that standards should be reasonably practicable (or best practicable)", meaning that standards for pollution control should be set with regard among other things to local conditions and circumstances, to the current state of scientific and technical knowledge and to the financial implications (Department of the Environment, 1977). The control of industrial air pollution is currently based on the principle that the larger or more complex industrial processes (the so-called 'scheduled processes') are required to use the BPM to abate atmospheric emissions. In practice HMIP sets 'presumptive' emission limits, meaning that if these limits are adhered to, the presumption is that the BPM are being used. The concept of BPM also provides the implicit basis for many other pollution standards.

(x) Pollution control policies have been 'sectoral', treating discharges to air, land and water as if they were separate and unrelated media.

(xi) Policies adhere to the 'polluter pays principle', meaning that those responsible for the pollution should bear the costs of controlling or abating it. Ultimately this means that abatement costs are often passed on to consumers, however.

(xii) Pollution control policies have traditionally provided little scope for the disclosure to the public of data on hazards or on emissions from individual plants and factories (Wilson, 1984) and, in

contrast to the opportunities for public participation afforded by provisions relating to land-use planning, public accountability has been low.

(xiii) Pollution control agencies tend to adopt a conciliatory approach to enforcement and work as far as possible in co-operation with industry. A Cabinet Office review, referring to Central Government inspectorates, commented that "....resort to formal enforcement is rare, accounting at most for only a few per cent of field enforcement time" (HMSO, 1986a). The result is a paucity of reported case law, and little opportunity for judicial interpretation of legislation.

(xiv) Policies have not made any use as yet of fiscal or economic measures. More use may be made of economic measures in future since the European Commission intends to consider them as a possible means of implementing pollution control policies (Commission of the European Communities, 1986).

2.3.2 Pressures for Change

The increasing technological sophistication of environmental monitoring and assessment has meant that the substantive input to environmental policy is more scientific than it used to be (Holdgate, 1983). This is considered in some depth in the Technical Model (Chapter 5), in relation to neighbourhood noise. It is not dealt with further here, other than to note that contemporary pollution issues focus not so much on acute, local problems as on more complex (both scientifically and politically speaking) global problems such as acid rain, the ozone layer, and the 'greenhouse effect'.

This Section, however, is more concerned with policy style than with policy substance. The style of British pollution policy is currently experiencing strong pressures for change: "....the trend in the future is likely to be a far more explicit setting of policy objectives and standards by Central Government than has been the custom to date. The

goals of environmental policies, especially in the field of pollution control, will be made increasingly more explicit, whether in the form of legal emission or environmental quality standards or clearer policy making" (Macrory, 1986a). Given the scientific and technical nature of pollution control, increasing precision and explicitness in legislative style will manifest itself as increasing technical specificity, both in terms of the incorporation of technical criteria from new and in terms of raising technical specificity from an implicit to an explicit level.

The specific influences at work where the technical specificity of the legal mandate for neighbourhood noise is concerned are examined in Chapter 3. This Section provides an overview of the major influences responsible for increasing the technical specificity of pollution control legislation in general.

The main impetus for this trend has been the incorporation into national legislation of over two hundred EEC Directives concerned with the environment (Department of the Environment, 1988b). Britain acceded to the Community on 1 January 1973 and, according to Haigh (1984), "With the benefit of hindsight it can now be seen that the passing by the British Parliament of the European Communities Act 1972 was the significant step that has changed the way an important part of British environmental policy is now thought about, is enunciated and ultimately is even put into practice".

Up to now, the European Commission's favoured means of implementing environmental policies have been legal standards (although, as mentioned above, there are indications that the Commission may consider the use of economic measures in future). Unlike the agricultural sector, there is only a tiny Community environment fund (Haigh, 1984). The style of Community legislation differs markedly from the traditional British approach. Community legislation enunciates guiding principles to a greater extent than British legislation has tended to (ibid.), and favours the inclusion of explicit numerical pollution standards within the text of Directives.

As the task of securing compliance with Directives falls to Central Government - although local authorities and other agencies may well be the 'competent authorities' where enforcement is concerned - this results in a more centralised approach, and a decrease in devolved responsibility. It is likely that more attention will be paid to the implementation of EEC Directives in future (Commission of the European Communities, 1986).

There are numerous instances where the incorporation of Community legislation into national provisions has resulted in increasing technical specificity. For example, air quality limit values for smoke, sulphur dioxide, lead and nitrogen oxides specified in a series of Directives, are the first mandatory air quality standards to be laid down in Britain, and Regulations giving them statutory backing have recently been published (The Air Quality Standards Regulations 1989, SI. 1989 No. 317). A consultation document published in 1986 (Department of the Environment, 1986a) proposed that the Secretary of State for the Environment should be empowered to set statutory emission standards for specified atmospheric emissions or in relation to specified industrial processes, in order to implement an EEC Directive on the combating of air pollution from industrial plants (84/360/EEC, 28 June 1984 OJ L188/20). This will give statutory force to the current system of presumptive limits. Directives concerned with the control of water pollution have forced Britain to adopt explicit water quality standards and objectives.

In addition to the supranational influence of EEC environmental policy, several national influences can be discerned which will also have the effect of increasing the technical specificity of pollution control legislation. These include the privatisation of the water authorities. As a result of privatisation, water quality objectives, water quality standards and drinking water standards have been raised to statutory level and are to be enforced by the NRA (Department of the Environment, 1987).

The Government's recent upgrading of environmental issues towards the top of its agenda (Guardian, 1988a; The Independent, 1988a) will most likely lead to new policy initiatives, in the form of the proposed 'Green Bill'. Two consultation documents which were published in the summer of 1988, with further details being released in the first half of 1989, describe some possible future policy developments.

The first concerns discharges to water of chemicals considered to constitute a major environmental hazard: the so-called "Red List" substances (Department of the Environment, 1988b) which have been selected using strict scientific criteria. Discharges of these substances to the aquatic environment will be controlled via a system of centrally prescribed emission standards, based not on BPM but on the "best available technology not entailing excessive cost" (BATNEEC) (a concept used in EEC documents). Due to uncertainty about the effects of these substances, a precautionary approach, which aims to minimise discharges to the aquatic environment, will be taken. This marks a significant departure from the traditional British approach of aiming to keep damage within acceptable limits and making use of the assimilative capacity of the environment. It bears some relationship to the 'Vorsorgeprinzip' in West German environmental policy, which translates as the principle of precaution or foresight (von Moltke, 1988). It implies that emissions to the environment are to be avoided wherever possible, even when no environmental effects are immediately discernible.

The second concerns the development of an integrated system of pollution control (Department of the Environment, 1988c), in line with the movement away from a sectoral approach towards viewing pollution problems in the round and following on from the establishment of HMIP as a unified central inspectorate. An integrated approach was first mentioned in the fifth report of the Royal Commission on Environmental Pollution (1976) in terms of the best practicable environmental option (BPEO) and the best practicable environmental timetable (BPET). These concepts were further developed in the Commission's twelfth report (Royal Commission on Environmental Pollution, 1988). The strategy of

BPEO seeks to control pollutant discharges in such a way that their overall adverse effects on all three environmental media (land, air and water) are minimised.

The consultation document recommends a system of integrated pollution control to be enforced by HMIP, for certain types of industrial processes giving rise to significant quantities of pollutant discharges - including 'Red List' substances - or generating significant quantities of hazardous waste. The proposal is based on the present system operated by HMIP for air pollution from scheduled processes. However, instead of operating according to BPM, processes will have to use BATNEEC to comply with specific - and in some cases, statutory - emission standards and environmental quality standards.

A further factor encouraging increasing technical specificity in pollution legislation is the move towards increasing public participation in the regulatory process, resulting in a need to explain more explicitly the rationale behind decisions permitting specific discharges from industrial plants (Macrory, 1986b). S.41 of COPA, for example, established public registers providing details of discharge consent conditions imposed by water authorities on industrial discharges to watercourses.

Broadly accepting recommendations concerning the need for greater public access to information contained in the tenth report of the Royal Commission on Environmental Pollution (1984), the Government stated that "the presumption must be in favour of openness in environmental matters (Department of the Environment, 1984). As a result, the Government set up an interdepartmental working party to consider how best to implement a regime to encourage greater public access to information (Department of the Environment, 1986b). A Private Member's Bill was passed in 1988 - the Environment and Safety Information Act - which will require the establishment of a public register of some enforcement notices served under environmental

legislation (including those served by HMIP in respect of industrial air pollution under the Health and Safety at Work, Etc., Act 1974).

The consultation document on integrated pollution control (Department of the Environment, 1988c), recommends taking the s.41 COPA procedure as a model for public access to information concerning all discharges (including those to air and land as well as to water) from scheduled processes operating under the integrated approach. The implementation in July 1988 of the Directive on environmental impact assessment (85/337/EEC, Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment) will also lead to more public consultation over pollution matters by bringing them within the frame of planning (Haigh, 1987a).

The combined effect of these policy influences will be to increase the technical specificity of pollution control legislation, to reduce devolved responsibility and enforcement discretion (both goal discretion and discretion to determine unlawful behaviour), to make more information available to regulators, the regulated and the public, and to make policy more centralised and more strategic.

2.4 THE CRIMINAL SANCTION

The use of the criminal sanction for regulatory purposes has given rise to a body of literature around what Kadish (1963) termed "the problem of moral neutrality". In essence, this is the problem of applying the criminal law to deal with behaviour which may not be considered a 'crime' in the traditional sense of the word, since society may not attach any moral opprobrium to the act which the law deems to be criminal. Kadish (1963) defined such behaviour as "morally neutral", meaning conduct to which "the stigma of moral reprehensibility does not naturally associate itself" because "it is not criminal under traditional categories of crime and, apart from the regulatory prescription, closely resembles acceptable aggressive business behaviour". Criminal law theory has for a long time distinguished between actions which are immoral in their own right -

mala per se - and actions which are illegal merely because they are prohibited by law - mala quia prohibita - but the boundaries are somewhat blurred (Andenaes, 1966).

A study by Rossi et al. (1974), attempted to find some empirical evidence for the problem of moral neutrality. A sample of 200 adults was asked to rate 140 different crimes in terms of their relative seriousness. The respondents largely agreed on the relative ordering of the crimes, with the seriousness of 'regulatory' crimes and victimless crimes (such as prostitution) not considered to be high.

The utility of applying the criminal law to morally neutral behaviour has been queried on two counts (Richardson, 1982). Firstly, that it is unfair to brand someone a criminal in the legal sense, when society's consensus of opinion is that the individual in question has not been guilty of a 'crime' in the moral sense. Secondly, due to this perceived 'unfairness' in the law, the strength and purpose of the criminal law may be debased, since enforcement agencies may be disinclined to prosecute and juries to convict for behaviour they subjectively consider to be socially acceptable (Kadish, 1963). "When it becomes respectable to be convicted, then the vitality of the criminal law has been sapped" (Williams, 1961).

Kadish (1963) proposed two methods of overcoming the 'problem' of moral neutrality. Firstly, there should be more vigorous enforcement of regulatory laws. Secondly, feelings of moral disapproval for regulatory offences should be inculcated in the community. However, there is an element of circularity in this argument, as noted by Richardson (1982) who quotes from Sutherland (1945):

> "The relation between the law and the mores tends to be circular. The mores are crystallized in the law, and each act of enforcement of the laws tends to reinforce the mores".

It could be that the moral neutrality of many regulatory offences is a result of their comparative youth, and in time the community may come to accept them as crimes in the traditional sense. An example may be

provided by drink-driving offences, which in recent years have come to carry more of a social stigma than in the past. Andenaes (1966) remarked on the radical difference prevailing in the 1960s between social attitudes towards drink-driving in the United States and Norway. He believed that the much tougher Norwegian sanctions had been instrumental in forming or sustaining a stronger conviction of the immorality of drinking and driving in Norway than in the United States.

Kadish limited his discussion to the use of the criminal sanction in the enforcement of regulatory laws which "impose restrictions upon the conduct of business as part of a considered economic policy" (Kadish, 1963). He specifically excluded "regulations directly affecting business conduct which are founded on interests other than economic ones". The exclusion of pollution and health and safety legislation from this debate, which arguably are more likely to be viewed by the public as carrying some token of moral opprobrium, means that his arguments are not so forceful when applied to the concerns of this thesis. Some writers have found no difficulty in attaching moral opprobrium to pollution offences. Gunningham (1974), for example, stated that Bugler (1972) maintained that the environment is a public property immeasurably more valuable and irreplaceable than an individual's possessions.

Aside from the direct issue of moral neutrality, some regulatory laws control complex activities with long-range or indirectly damaging effects. If cause and effect are separated by time or distance, it is harder for the public to appreciate the seriousness of such activities, without having either a detailed knowledge of the activities in question or of their implications (Aubert, 1952).

2.5 STRICT LIABILITY

The traditional requirement for liability in criminal offences is that the defendant should possess "mens rea", meaning literally "guilty mind". It is a term of art referring to whatever specific state of

mind the courts require the defendant to possess for a finding of guilt on a particular charge. As a rule, either intention or recklessness is required (Walker, 1980). However, throughout the twentieth century there has been a steady growth of statutory provisions, both for regulatory purposes and to curb minor crimes (such as some driving offences), for which no proof of intention or recklessness is required. These are termed 'strict liability' offences.

The advantages of strict liability offences have been summarised by Smith and Pearson (1969) and Richardson (1982). The first argument in favour of strict liability is an economic one: enforcement agents and the courts do not need to spend time and money investigating culpability, enabling more rapid processing of cases. Secondly, strict liability gets round the problem of apportioning blame to a company or corporate body. Thirdly, strict liability in theory enables potential offenders to know the precise legal implications of their behaviour.

The literature, however, is full of references to the so-called "moral dilemma" (Richardson, 1982) posed by the increasing use by the legislature of strict liability. This dilemma, in its simplest terms, derives from the belief that criminal liability should not be imposed in the absence of culpability. The problem of strict liability is analogous to that of the criminalisation of morally neutral behaviour mentioned above. The argument against the use of strict liability maintains that the prosecution of defendants who have no mens rea is pointless and harmful (Smith and Pearson, 1969). Pointless, since if there has been no fault, the law cannot act as a meaningful incentive towards taking greater care in future (although the other side to this argument is that potential offenders will be encouraged by the imposition of strict liability to take extreme care). Harmful, since it brings blameless people - and hence the criminal law - into disrepute.

Inherent in the notion of criminal sanctions as a means of controlling regulatory offences is the notion that the law seeks not to punish offenders, so much as to gain a general, acceptable level of compliance (Sayre, 1933; Kadish, 1963; Ball and Friedman, 1965). Sayre (1933) looked for a way round the moral dilemma posed by strict liability, by differentiating between 'traditional' criminal offences (such as burglary, murder and rape) created primarily for punishing wrongdoers - although conformity with the law is a consequence of this - and those regulatory offences which are created primarily to gain the compliance of the majority of the population who could conceivably come within the ambit of the provisions. He considered that mens rea should be maintained as a necessary and important safeguard in all criminal proceedings which fell in the first category, since without culpability punishment can never be justified, but that it was reasonable to maintain strict liability for regulatory offences which were aimed at general compliance.

An article by Sayre (1933) traces the origins of strict liability offences in England and the United States. According to Sayre, the growth of a distinct group of offences punishable without regard to any notions of culpability dates from about the mid-nineteenth century in England. Prior to this, convictions for offences without proof of mens rea are to be found only very occasionally, chiefly among common law nuisance cases.

The turning point in the evolution of strict liability offences came in 1846, with the case of Regina v Woodrow. The Court of Exchequer held the respondent, a tobacco dealer, liable for selling adulterated tobacco, even though the dealer was able to prove that he had every reason to believe the tobacco in his possession was pure. This case was followed by an increasing number of similar decisions under statutes prohibiting the sale of impure or adulterated food. In 1873 the High Court suddenly reinterpreted the Food and Drink Act 1860, deciding that the doctrine of mens rea did not apply and that traders could be convicted of selling impure food even when they could prove they had not intended to do so (Paulus, 1974).

The rationale behind these judgements was that the risk to the public from the consumption of unfit food (illness or possible death from food poisoning) outweighed the disadvantage to the purveyors of such food from being found guilty of acts which they had not intended to commit. The doctrine of strict liability, initiated in adulterated food and nuisance cases, soon spread to other fields of the criminal law, and convictions for violations of petty crimes and regulatory offences without proof of mens rea became increasingly common.

Sayre observes that a similar legal movement occurred in the United States during much the same period, although it seems to have been initiated quite independently of the English movement. As this movement occurred simultaneously on both sides of the Atlantic, it suggests that it was more than historical accident. Sayre's interpretation is that the development was the result of two forces. One was the gradual shift in emphasis of the criminal law, from the protection of individual interests to the protection of public and social interests. The other was the growing use of the criminal sanction to regulate external costs, requiring the provision of enforcement powers on an extended scale. The removal of mens rea helped to facilitate the rapid processing of these cases by the courts.

Strict liability is now commonplace for regulatory offences and for minor crimes. However, the harshness of strict liability is frequently mitigated by the provision of statutory defences and grounds for appeal which effectively provide 'escape routes' or 'loopholes' for the morally innocent (Carson, 1970a). These often have the overall effect of producing an element of culpability before guilt can be proved (Richardson, 1982). The use of administrative sanctions - such as statutory notices - prior to the imposition of criminal sanctions also softens the blow of strict liability offences. Administrative sanctions mean that enforcement is a step-wise process, a notice effectively providing a warning before an offence is committed.

2.6 EXPRESSION OF LEGAL CONTROLS

One of the major debates in the literature on administrative discretion concerns the extent to which the decision-making behaviour of officials should be bound by rules. The debate is often viewed in terms of identifying the appropriate compromise between uncontrolled discretion and legalism. 'Legalism' in its basic sense means strict adherence to the word of the law, but is often interpreted as implying a mechanistic application of rules without regard to their purpose. For instance, Kagan (1978) defined legalism as the "literal application of a legal rule when the policy that gave rise to the rule would justify an exception or when commonsense notions of fairness and social utility would suggest a departure from the rule."

Pound (1959) defined a legal rule as "a legal precept attaching a definite detailed legal consequence to a definite detailed state of fact". The alternative to expressing legal controls in terms of rules is to make use of "general criteria of social choice" (Ehrlich and Posner, 1974), ie., more general instructions or legal guidelines.

2.6.1 Benefits of Rules

Adherents to the "extravagant version of the rule of law" (Davis, 1969) maintain that administrative behaviour should be closely bounded by predetermined rules, since it is considered constitutionally unacceptable for decision-makers to have free rein if they are not directly accountable to the electorate: at least the process of parliamentary rule-making is part of the democratic process. However, this argument does not consider the substantive efficacy of bounding administrative action by strict rules. Jowell (1975) notes that nowhere does the extravagant version require that rules should be good rules.

With respect to the substantive benefits of rules, Ehrlich and Posner (1974) identify two audiences to whom rules should be addressed:

(i) Potential violators of the rules;
(ii) Participants in the process of determining whether or not a violation has occurred (for example, enforcement agents, lawyers and judges).

A fundamental principle of the criminal law is that criminal provisions should be clear and certain, to give fair warning of what conduct is liable to be penalised (Walker, 1980). Rules provide more information to potential violators to help them comply with the law. General guidelines may be so vague that they leave potential violators uncertain whether their behaviour is legal or illegal. According to Ehrlich and Posner (1974), "The chilling of socially valuable behaviour by an uncertain law is a potentially serious problem".

With respect to participants in the enforcement process, rules have several advantages. According to Jowell (1975) and Richardson (1982), decision-making according to strict rules:

(i) Makes corruption in the process easier to detect. Law enforcement is inevitably a selective process, since it is a practical impossibility to sanction all breaches of the law. However, if improper criteria are used in the selective enforcement of a law, then those enforcement decisions are corrupt;

(ii) Tends to decrease local variation in enforcement procedures, and so leads to a universally more equitable approach;

(iii) Should speed up the processing of cases by the courts since there are fewer points where disputes can arise, so the outcome of a legal dispute should be easier to predict;

(iv) Enables enforcement procedures to be rationalised and streamlined, as like cases can be processed alike without the need to

consider each case afresh;

(v) Shields decision-makers from criticism both from their superiors and the public, since if the rules have been correctly applied, then decision-makers cannot be blamed personally for any decision that is made.

(vi) Increases the accountability of administrative behaviour.

2.6.2 Defects of Rules

(i) Rules may permit legalism if rigorously enforced;

(ii) Rules tend to be inflexible, both spatially and temporally. Spatially, because they may not permit an enforcement agency to modify its approach in response to the needs and pressures of differing local environments. Temporally, because they will not readily allow an enforcement agency to modify its procedures in response to changes in the system that it attempts to control. If they are to be of use, precise rules must be updated regularly to keep pace with technological and social change. Broad guidelines, however, being relatively unaffected by such changes, do not become out-dated so rapidly.

(iii) It is difficult to apply rules to heterogeneous behaviour which defies precise definition. Due to the limitations of language, and the difficulty of forseeing all circumstances to which a rule might apply, problems of under- or over-inclusion of certain types of behaviour in the legal provisions may arise. Strict rules are unresponsive to the variable nature of human behaviour and are not primarily tailored to individual circumstances.

2.6.3 Rules or Guidelines?

What conclusions can be drawn from this debate concerning the relative merits of rules versus guidelines as a means of expressing legal

controls?

If discretion is located along a continuum, guidelines and wide discretion tend to be at one end, with precise rules and restricted discretion at the other end. Athough discretion is usually associated with guidelines, Richardson and Ogus (1979) point out that "specific rules and discretion are not mutually exclusive: for instance, a precise rule may exist defining the unlawful conduct, but the extent of its enforcement depends on the discretion of the enforcement agency". However, a decision not to impose sanctions in the event of a clear-cut breach of a precise rule is more visible - and possibly harder to justify - than a similar decision made in the event of a breach of a broad guideline. Consequently, defining unlawful behaviour in terms of precise rules may possibly lead to a stricter, or more 'sanctioning' approach to enforcement.

Pepinsky (1976) argues, however, that instead of decreasing discretion, rule-making actually increases the scope for discretionary interpretation, because the number of terms and phrases requiring interpretation increases as the provisions of the law are further specified.

Although followers of the extravagant version of the rule of law would like to see administrative discretion shaved down to the minimum conducive to efficient administration, Jowell (1975) draws attention to the fact that there are limitations to what precise rules may achieve in practice. He maintains that there are costs and benefits attached to the use of both rules and guidelines, and that these must be weighed up each time the form of legal controls is being considered. What is gained in uniformity may be lost in flexibility, rules to prevent corrupt decisions may encourage legalistic ones, rules which enable the routinisation of enforcement behaviour may offend the potential violator who wants individually tailored justice. "An understanding of the necessary role of discretion in relation to the task to be performed....should result in an admission that law cannot be "fashioned" to solve all social problems or to control all

administrative decisions" (Jowell, 1975).

Although legal controls may be expressed in terms of broad guidelines, their practical expression may be rendered much more specific by means of codes of practice, British Standards or agency operating procedures. Legislation may either implicitly or explicitly delegate rule-making powers to agencies. As Friedman (1967) states:

> "As a general proposition, there is a strong tendency in the legal system toward the framing of non-discretionary rules at some level and....this is strongest where it is socially important to have mass, routine handling of transactions, which are channelled through some agency of the legal system, or where relative certainty of legal expectation is important".

Thus the rules versus guidelines debate can also be seen as one concerning the location of discretion in the legal system. Legal guidelines which delegate rule-making powers shift much discretion into the hands of the enforcement agency and/or the courts. On the other hand, precise rules leave most discretion in the hands of the legislature.

2.6.4 Types of Specificity in Pollution Control Legislation

So far reference has been made only to 'technical' specificity in legislation, but as Table 2.1 indicates, specificity in pollution control legislation can take a variety of forms, covering both substantive and procedural provisions. The list is not exhaustive, but serves to illustrate the point. Pollution legislation has tended to elaborate procedural aspects in more detail than substantive policy. Technical specificity is generally associated with substantive aspects such as pollution control standards and the measurement and monitoring of pollutants, but it can also appear in procedural provisions, such as grounds for appeal or statutory defences.

TABLE 2.1

TYPES OF SPECIFICITY IN POLLUTION CONTROL LEGISLATION

SUBSTANTIVE

(i) Legislative aims and objectives

(ii) Application (mandatory or discretionary)

(iii) Type of control (for example, prohibition, limitation or consent)

(iv) Definition of unlawful behaviour;

* Source details
* Time limitations
* Pollution control standards;
  - biological standard
  - exposure standard
  - product standard
  - operating standard
  - emission standard
  - environmental quality standard

(v) Measurement methodology

(vi) Monitoring requirements

PROCEDURAL

(i) Machinery for service of abatement notices, licences, consents etc.

(ii) "Due process" provisions, for example;

- grounds for appeal
- statutory defences

(iii) Machinery for establishing, for example, smoke control areas, noise abatement zones; hazardous waste notification systems

(iv) Sentencing

(v) Default powers of Secretary of State

(vi) Adjudicatory procedures

2.7 ENFORCEMENT AGENCIES

Chapter 1 mentioned that responsibility for the enforcement of pollution legislation is usually vested in specific public agencies or inspectorates, rather than the police.

Although in some instances the effects of pollution may be all too obvious, detecting breaches of pollution laws frequently requires specific skills and training. The legislation itself is often complex, the presence of some pollutants (such as radiation or pesticide residues in food, for example) may only be detected via the use of monitoring devices, and the detection of a breach may hinge on the results of a technically-complex monitoring exercise. Enforcement agents also require expertise to fulfil their educational role by keeping industry up to date with general legal requirements, and to provide offenders with suggestions for remedial works and abatement measures in order that future breaches may be prevented.

The level and nature of the specific skills required by the enforcement agency depend on the characteristics of the regulated industry and on the nature of the pollutant emissions. The more specialised enforcement agencies tend to be found in central government; the more generalised, multi-purpose agencies in local government (Rhodes, 1981). For example, inspectors within HMIP who deal with air pollution from the larger or more complex industrial processes, are recruited from chemical engineers with longstanding industrial experience. Local authority Environmental Health Departments (EHDs) provide an example of a more generalised agency. Environmental Health Officers (EHOs) undergo four years' training which covers a very broad range of matters. Since their inception under the Public Health Act 1848, as the original Inspectors of Nuisances, the EHOs' remit has widened so that, in addition to enforcing the Public Health Acts, they now have responsibilities in such diverse areas as housing; standards of accommodation on camping and caravan sites; inspection of food and food hygiene in shops and restaurants; meat inspection; infectious diseases; health and safety

in shops and offices; pest control, water quality in swimming pools; and the licensing of pet shops, kennels and riding establishments, in addition to responsibilities in pollution control (Institution of Environmental Health Officers, 1982). It is becoming increasingly common, however, to find specialist sections, concentrating on matters such as pollution control or housing, within the generalist EHD. EHOs may gain specialist qualifications in subjects such as these, after their basic training has been completed.

Moving outside the field of pollution control, the range of contemporary regulatory enforcement activity can be illustrated by reference to some of the areas of public administration where specific enforcement agencies have been created. These include health and safety in factories and industrial premises, mines and quarries, nuclear installations and agriculture; trading standards and consumer protection; building control; safety standards in civil aviation; planning control and tax inspection. A comprehensive list is provided by Rhodes (1981). Many enforcement agencies were established in the period 1830-1860 (ibid), at a time when the emphasis of government concern was shifting from the protection of private interests towards the protection of public and social interests. Rhodes (1981) recounts that enforcement agencies were set up to regulate new industrial activities, such as the employment of large numbers of workers in factories, or to regulate those operating on a much larger scale than before, such as coal-mining. New problems, particularly those concerning the health and safety of people exposed to the results of a level of industrialisation never experienced before, necessitated some form of control. When regulatory legislation was imposed on industry, the legislature at the same time usually provided for the appointment of enforcement agents to see that those responsibilities were carried out.

Since 1945, new enforcement agencies have been established for agricultural health and safety, nuclear installations and oil pipelines, amongst others (ibid). As technological developments transform the face of industry - nuclear power; North Sea oil;

increasing capital inputs to agriculture, for instance - new risks and hazards associated with these technologies become apparent. Government intervention to mitigate the worst effects of these external costs has commonly taken a regulatory approach, with the creation of specific enforcement agencies or inspectorates (Richardson, 1982).

Enforcement agencies are statutory bodies: their powers and duties are defined by statute. In general their powers are specific: their rights of entry into premises are often greater than those of the police and, in theory at least, the criminal sanctions available to them are strong. In England and Wales, central government inspectors are usually empowered to institute their own legal proceedings for breaches of the law. For local government agents, the right to institute prosecution proceedings usually rests with the authority and not with the individual agent.

2.7.1 Studies of Enforcement Agencies

Organisation theory predicts that individuals at the upper end of the organisational hierarchy will typically be able to use more discretion in their decision-making than will the lower echelons (Salem, 1983). The staff of enforcement agencies provide an interesting exception to this general maxim since the 'field staff', who are responsible for the bulk of inspection work and who provide the major link between the enforcement agency and the regulated population, are generally at the lower end of the hierarchy of the organisation. These field staff usually work unsupervised when they are out of the office, and exercise considerable discretion in determining unlawful behaviour and in deciding whether or not to institute sanctions against offenders. The majority of sociological and socio-legal work on the behaviour of enforcement agents and on the nature of enforcement discretion has accordingly concentrated on field-level personnel.

The police have been the subject of most of these studies of enforcement discretion (Kagan, 1984). A variety of sociological studies of policing practices (for example, Banton, 1964; Piliavin and

Briar, 1964; Skolnick, 1966; Bittner, 1967; Black, 1971; Reiss, 1971; and Davis, 1975) have demonstrated the significance of operational constraints in controlling and structuring enforcement discretion. The studies revealed the influence on enforcement behaviour of variables relating to the environment and context in which decisions were made, as well as those relating to the process of enforcement and to the individual personalities of police officers. The sociological literature on police discretion, however, has tended to have an almost total disregard of the legal constraints acting on police officers in the performance of their job (Steer, 1980). The socio-legal school of thought has tried to redress this imbalance by accommodating both legal and sociological approaches, such that studies of the 'law in action' do not ignore the effects of the 'law in books'.

Alongside the extensive literature on police discretion exists a much smaller body of literature concerning the behaviour of non-police agencies responsible for enforcing 'regulatory' legislation. Although there is a growing body of work specific to the British situation, most of the research interest is still concentrated in the United States. In the United States the exercise of discretion by enforcement agents is usually perceived as a 'problem' to be controlled, whereas the traditional administrative ethos in Britain considers discretion to be an essential part of the regulatory system and an important individualising agent in law enforcement (Veljanovski, 1984). As mentioned in Chapter 1, a small number of studies have specifically considered the enforcement of British pollution legislation. These are considered in more detail in Section 2.7.2.

The earliest research on the enforcement of 'regulatory' laws consisted of sociological studies of what was commonly referred to as 'white-collar crime', a term coined by Sutherland (1940) meaning "...a crime committed by a person of respectability and high social status in the course of his occupation". A definition which is more appropriate to regulatory control is provided by Hartung (1950) as "....a violation of law regulating business which is committed for a

firm by the firm or its agents in the conduct of its business". Sutherland (1940 and 1945) saw no reason to differentiate between white-collar crime and traditional crime on moral grounds: he considered both were "real crime". He maintained that the preference for administrative sanctions and the low level of prosecution for white-collar offences, in contrast with the vigorous enforcement by the police of 'traditional' crimes, were a result of the inherent class bias of the criminal justice system, an explanation sometimes also favoured by contemporary legal theorists (for example, Sanders, 1985b). Sutherland's work provoked a heated debate on the nature of crime and the issue of moral neutrality, with some writers - like Sutherland - favouring a definition of crime as any illegal act (for example, Tappan, 1947 and Hartung, 1950) while others favoured a moral definition (for example, Burgess, 1950). This semantic debate has still not been satisfactorily resolved.

Contemporary studies of the day to day decision-making behaviour of 'regulatory' agents encompass a variety of disciplines, including sociology, law, political science, organisation theory and the economics of decision-making (Hawkins and Thomas, 1984). Like Sutherland's seminal work on white-collar crime, many of these studies have commented on, and proffered explanations for, the predominantly conciliatory style of enforcement adopted by these agencies in comparison with the penal, or 'sanctioning', style of the police: "In the enforcement of regulation, a distinct aversion is noticeable to sanctioning rule-breaking with punishment" (Hawkins, 1984a). Studies of British non-police enforcement agencies have included those which have examined the enforcement of legislation relating to occupational health and safety by the Factory Inspectorate (Carson, 1970a and 1970b); local authority enforcement of provisions concerning consumer protection and trading standards (Cranston, 1979 and 1984), education and child welfare (Dickens, 1970), and development control (Jowell and Millichap, 1983 and 1986), as well as the pollution studies described below.

Although the studies varied in terms of disciplinary perspective, breadth and depth, all commented on the low prosecution rates of these agencies. Generally less than 10% and often as few as 1-2% of known contraventions are proceeded against by non-police agencies (Lidstone et al., 1980), in contrast to the police who prosecute approximately 80-90% of known contraventions, with the exception of motoring offences (for example, Central Statistical Office, 1985). According to the statistics provided by the Central Statistical Office (1985), the police initiate prosecution proceedings against only 20-30% of motoring offences, since between 60-75% are dealt with by the service of fixed penalty notices - a sanction which is not available for other summary offences.

Table 2.2 provides a summary of the typical characteristics of sanctioning and compliance enforcement strategies. These rather idealised polar opposites are in practice more like shifting points on a continuum (Hawkins, 1984a). Although most non-police enforcement agencies tend towards the conciliatory end of the spectrum, while the police tend towards the sanctioning end of the spectrum, in practice agencies will use a variety of strategies depending on the needs and circumstances of a particular case. For instance, the police have been observed to adopt a conciliatory approach in their dealings with states of affairs such as vagrancy and prostitution (Bittner, 1967).

Various arguments have been proposed as to why non-police agencies prefer in the main a conciliatory approach to enforcement. These include the following:

(i) A widespread assumption that the offences concerned are not 'real crimes' (the problem of moral neutrality) (Lidstone et al., 1980);

(ii) Agencies would prosecute more if only they could afford the time and personnel (for example, Cranston, 1979);

(iii) The ethos of British public administration whereby importance is attached to negotiation and compromise (although many studies of

TABLE 2.2
SANCTIONING AND COMLPIANCE STYLES OF ENFORCEMENT
(from Hawkins, 1984a and Reiss, 1984)

SANCTIONING STRATEGY	COMPLIANCE STRATEGY
The primary aim of enforcement is to punish rule-breaking: a "just desserts" approach.	The aim of enforcement is not to punish, but to achieve compliance with legal requirements.
Recourse to prosecution is an automatic response to witnessing rule-breaking.	Recourse to prosecution is a last resort and may be seen as a failure, since compliance could not be achieved by conciliation.
To attain compliance with the law, it is often sufficient for the offender to refrain from acting.	To achieve compliance, some positive action is often required by the offender.
The enforcement process is accusatory and adversarial, frequently involving lawyers and the courts, in addition to the enforcement agent and a member of the public.	The enforcement process involves negotiation and bargaining, usually carried out in private between an enforcement agent and a member of the public.
The offence is often a one-off event which is punished in order to prevent a recurrence in future.	The offence is often a state of affairs or a continuous problem which agents try to remedy in order to prevent future breaches.
Emphasis given to detection and punishment. Efficiency means a good clearance rate.	Emphasis given to conciliation and negotiation since it is considered to be the most efficient in terms of attaining compliance at least cost to the enforcement agency.
Enforcement decisions tend to be abrupt and compressed, allowing little possibility for a relationship to develop between enforcer and offender (except in the case of persistent offenders).	Enforcement decisions tend to be gradual and incremental, allowing the development of a relationship between enforcer and offender.
Blame can be associated with the conduct being punished.	Conduct may be illegal, but not "blameworthy" in any popularly accepted moral sense.
Personal harm to a victim prompts a sanctioning approach.	The victim may not be a specific, readily identifiable individual.
Often a potentially unlimited population of potential offenders.	Often a limited population of potential offenders.

American regulatory agencies have also identified a conciliatory approach) (Rhodes, 1981);

(iv) Identification of agency personnel with the interests of those they are regulating. Under the general heading of 'Capture Theory', this has been one of the most frequent explanations (Hawkins, 1984a). The enforcement agency is seen as incorporating the interests of those it seeks to regulate into its decision making, in the interests of stability and self-preservation (for example, Selznick, 1966, as reported in Hawkins, 1984a). Regulation in the health and safety and pollution spheres may be less susceptible to capture since a large number of industries with diverse interests are subject to control (Veljanovski, 1983);

(v) A reluctance to prosecute offenders of high social status (for example, Sanders, 1985b, following in the white-collar crime tradition of Sutherland, 1940);

(vi) Non-police agencies are not engaged in criminal law enforcement as a primary function, but rather fulfil a specialist enforcement role as one means of fulfilling other primary functions (Lidstone, et al., 1980). Consequently the major concern of regulatory enforcement is to achieve compliance with legal requirements, rather than to punish contraventions of the law and this, it is argued, can be achieved more economically by the use of a conciliatory strategy (Veljanovski, 1983).

(vii) Uncertainty in the legal mandate and in its enforcement due to political ambivalence, resulting from the trade-off between industrial lobbies and lobbies seeking to minimise external costs (for example, the environmental lobby) (Hawkins and Thomas, 1984).

2.7.2 Studies of Pollution Agencies

The small body of research studies on the enforcement of pollution control legislation in Britain has predominantly concentrated on providing explanations for the conciliatory approach adopted by enforcement agents when confronted with unlawful behaviour.

One study, which took industrial air pollution legislation as its focus, concluded that the conciliatory approach was the result of weak or under-enforced laws (Gunningham, 1974). Gunningham considered that laws regulating pollution were weak because of in-built formal obstacles to their effective enforcement (such as BPM). He maintained that attempts to secure adequate controls and effective enforcement had foundered due to the opposition posed by the powerful industrial lobby which wielded a disproportionate measure of political power.

A study of the Alkali Inspectorate (now part of HMIP) undertaken by the public interest group 'Social Audit', considered that the agency had been 'captured' by the industry it was supposed to regulate, identifying with industrial interests for the sake of preserving the status quo (Frankel, 1974). Frankel considered that the Inspectorate had an "overriding concern for the economic consequences of its requirements", to the possible detriment of the public interest.

Macrory and Withers (1985) undertook a study of the enforcement of hazardous waste legislation as the British contribution to a research project initiated by the European Commission to survey the application and effectiveness of regulatory controls in the field of toxic and hazardous wastes within the EEC. Macrory and Withers considered that the primary role of waste disposal authorities was to develop and apply effective waste management strategies, a role that included but was not solely concerned with law enforcement. The results of their interview and questionnaire survey of waste disposal authorities in England revealed that prosecution was usually seen as a last resort by waste disposal officers, but that there was a wide range of internal procedures concerning the decision to prosecute, and variations in the

propensity to prosecute, between different authorities. Although the variability of the authorities made generalisation difficult, the authors noted a general reluctance to undertake prosecutions without a near certainty of success, owing to the expense and resources involved in preparing a case for prosecution.

Empirical studies from the Centre for Socio-Legal Studies at Oxford were the first to look in depth at the day to day decision-making procedures used by pollution control agencies to implement and enforce their legal mandate. Two studies examined the regulation of water pollution by the regional water authorities: Richardson (1982) adopted a socio-legal approach for her study of the control of trade effluents (industrial discharges to sewer), while Hawkins (1983 and 1984a) examined the control of direct discharges to watercourses from a more sociological perspective. As mentioned in Chapter 1, a study by Hutter (1984) examined the procedures used by EHOs to enforce their whole suite of statutory responsibilities, including duties in pollution control.

Instead of focusing on the 'problems' of non-enforcement or selective enforcement of the law (as Gunningham and Frankel had done), these studies from the Centre for Socio-Legal Studies emphasised the question of compliance, and the use of law as a resource to achieve compliance. In Hawkins' (1984a) words: "Viewed from this perspective, highly selective use of the formal processes of law enforcement emerges more clearly as a valuable resource for enforcement staff and their agencies".

All three studies reported that prosecution was a rare event and was almost invariably limited to those cases where some element of intention was believed to be present. Most offenders were seen by enforcement agents as honest people in need of advice rather than a criminal sanction: only those offenders who aligned themselves with traditional notions of criminality (such as blatant or intentional disregard of the law, or violent or hostile actions) were treated to formal enforcement procedures. Hawkins (1983) emphasised the use by

water authority officers of bargaining and bluffing as tools for gaining compliance: the criminal sanction was considered to be vital to the adoption of the conciliatory stance since it provided the background against which bargaining could take place.

Hawkin's and Hutter's broad conclusions were that the regulation of pollution took place in a predominantly social, rather than a legal or technological, context. They considered that the conciliatory approach to enforcement was adopted as a result of agents using their sanctioning discretion to adopt procedural notions of mens rea, which softened the blow of strict liability criminal sanctions, and made their job more acceptable to themselves in terms of what they considered to be popular notions of culpability. Hawkins (1984a) stated that:

> "Regulation may be contemplated by the law as the dispassionate sanctioning of misconduct by the even-handed application of a criminal law unconcerned for the niceties of mens rea, but regulation in practice, mediated as it is by a bureaucracy in which people have to exercise their discretion in making judgements about their fellows, is founded upon notions of justice. Pollution control is done in a moral, not a technological, world".

Neither Hawkins nor Hutter found any evidence of agency capture or of deference to social status (both water authority officers and EHOs dealt with offenders from a wide range of social backgrounds). Hawkins accepted that resource limitations imposed the ultimate constraint on what an enforcement agency could do, but he did not consider it was the limiting factor where the enforcement of legislation regulating direct discharges was concerned. He maintained that the moral component was of overriding significance.

Richardson maintained that in the abstract, officers believed there could not be criminality without some sort of culpability. But in practice, she considered that officers were usually more concerned with the preventive effects of prosecution, rather than with punishing a reckless breach. Richardson noted that as many as 30% of all sampled effluents were technically criminal (in excess of consent conditions),

but very few prosecutions were mounted. She maintained that a technical breach alone was not sufficient grounds for prosecution: there was also a need for some threatened or actual harm to result from the breach and/or for a moral intent, such as a flagrant or deliberate breach. "The intention and attitude of the trader were extremely influential on a number of different levels" (Richardson, 1982).

Hutter found that EHOs utilised the criminal sanction more frequently than did water authority officers, but that their approach to enforcement was still fundamentally conciliatory. Hutter's thesis highlighted variations in the conciliatory strategy between authorities, reflecting - as did Macrory and Withers (1985) - the diverse nature of local authorities.

These studies have made an important contribution towards understanding the process of pollution policy implementation, by examining the day to day behaviour of pollution agencies and the exercise of discretion by enforcement agents. But, as mentioned in Chapter 1, they have not considered what effect, if any, a change in legislative content and style - in particular the increasing technical specificity of pollution control legislation - would have on enforcement practice. Hawkins (1984a) admitted that the process of enforcement was changing subtly in the water authorities, resulting in a slight shift away from the conciliatory approach. He attributed this to the reorganisation of the water industry in 1974 as a result of the Water Act 1973, but he failed to consider the implications for enforcement of the changing face of environmental policy or of a more specific legal mandate. In fairness, however, it should be pointed out that both Hawkins' and Richardson's field research was undertaken before most of the EEC water Directives were implemented, and at least a decade before it was suggested that water quality objectives and standards be given statutory force as a result of the privatisation of the water authorities.

CHAPTER THREE

THE LEGAL MODEL I - THE HISTORY OF NEIGHBOURHOOD NOISE LEGISLATION

3.1 INTRODUCTION

As mentioned in Chapter 1, neighbourhood noise policy provides a body of law that is discrete and reasonably succinct for detailed interdisciplinary study, and one that currently provides a spectrum of technical specificity.

This Chapter comprises the first part of the Legal Model. It considers the historical development of neighbourhood noise legislation and associated policy. Its broad objective is to examine the influences underlying the development of the legal mandate, and how these shape its resulting substance and style. More specifically, the Chapter examines the premise that the legal mandate for neighbourhood noise has become more technically defined in recent years. It aims to identify those factors, if any, which have encouraged the incorporation of technical terms and criteria into the legal mandate. Although some factors may be the same as those identified in Chapter 2 in relation to pollution control in general, the Chapter aims to uncover the specific influences at work where neighbourhood noise is concerned.

The organising concept in the Legal Model is the formal structure of the law. The model embodies the traditional legal viewpoint, where the process of law enforcement and the behaviour of enforcement agents are considered to be determined solely by the form of the legal mandate. The model therefore suggests that in order to study the process of law enforcement, it is sufficient to look at the law which directs the actions of enforcement agents. From the perspective of this model,

factors which determine the form of the mandate are important, since they also determine the enforcement process itself.

'Legal mandate' was defined in Chapter 1 to mean the remit originating from the legislature and from judicial interpretations, with additional advice from Central Government in the form of codes of practice, circulars and memoranda. The term also includes local Acts and byelaws, EEC Directives, and operational guidelines and criteria contained in British Standards.

The focus for the study is neighbourhood noise policy. This was defined in Chapter 1 as the intentions and actions of Government, both at national and local level, directed towards controlling the negative effects of neighbourhood noise. Where it is pertinent to the argument concerning technical specificity, the present Chapter also touches to some extent on Government policy concerning traffic and aircraft noise.

The main body of the Chapter provides a detailed historical analysis of neighbourhood noise legislation. The Conclusion draws out factors which have had a significant bearing on the development of the legal mandate. In particular, it discusses the premise outlined above, that there has been an increase in the technical specificity of the legal mandate for neighbourhood noise in recent years.

3.2 THE COMMON LAW

Although actions in nuisance are not exclusively concerned with environmental protection, it is nevertheless that branch of the common law most closely associated with environmental matters (Winfield and Jolowicz, 1979). The common law of nuisance was the earliest remedy of general application to noise. It has been dealing with problems caused by neighbourhood noise since at least 1725 (Gearty, 1986, who cites the case of R v. Smith (1725) 2 Str.704, where it was held that noise from a 'speaking trumpet' was a public nuisance when used at night). Remedies available in the civil courts include both

compensatory damages and injunctions, the latter providing a means of abating noise problems.

The concept of nuisance does not imply any absolute standards: rather it is one where the standard will vary in time and place, each case effectively being decided on its own merits. Although numerous principles have been established by precedent, which set bounds to what can be considered a nuisance at law, within those bounds a high level of judicial discretion still remains.

Civil action in nuisance may take the form of either a public or a private nuisance. Private nuisance is the most common form (Macrory, 1982), and was defined by Scott, C J (adopting Winfield) as "an unlawful interference with a person's use or enjoyment of land, or of some right over or in connection with it" (Read v Lyons (1945) K.B.216). It is apparent from this definition that private nuisance is essentially concerned with the protection of private rights in the use and enjoyment of land: an action may only be brought by an occupier of land affected by the nuisance.

A public nuisance can be either a common law crime or a tort, and has been defined as an act or omission which materially affects "the reasonable comfort and convenience of life of a class of Her Majesty's subjects" (Attorney General v PYA Quarries Ltd (1957) 1 All ER 894). As to the question of what number of people is sufficient to constitute a class, Denning, LJ. proposed that a public nuisance is one which is so widespread in its range, or so indiscriminate in its effect, that it would not be reasonable to expect one person to take proceedings at his or her own expense to put a stop to it, but that action should be taken at the expense of the community at large (Attorney-General v PYA Quarries Ltd (1957) 1 All ER 894).

Although actions in private nuisance require rights over property to have been affected, this limitation does not apply to public nuisance. Irrespective of whether they have any interests in land, members of the public can sue for public nuisance, but only if they

can show they have suffered particular damage over and above other members of the community. As a common law crime, action in public nuisance may be taken only by the Attorney General or a local authority acting on behalf of its residents.

A substantial case law has built up concerning noise nuisance actions at common law. Specifically in relation to noise, a nuisance has been defined as any noise sufficient to cause "a substantial interference with health, comfort or convenience" (Vanderpant v Mayfair Hotel Co Ltd (1930) 1 Ch. 138). Reported cases of civil liability for noise nuisance are given in every textbook dealing with the law on noise, and include the following: use of a printing press at night (Rushmer v Polsue and Alfieri Ltd (1907) 51 Sol. Jol. 324 HL), noise arising from a hotel kitchen (Vanderpant v Mayfair Hotel Co Ltd (1930) 1 Ch. 138), pile driving at night (De Keysers Royal Hotel Ltd v Spicer Bros Ltd and Minter (1914) 30 T.L.R. 257), noise and vibration from the use of large pestles and mortars (Sturges v Bridgman (1879) 11 Ch.D 852) and the malicious firing of guns by a neighbour, scaring foxes during the breeding season (Hollywood Silver Fox Farm Ltd v Emmett (1936) 2 K B 468).

3.3 EARLY NOISE LEGISLATION

Tempest and Bryan (1976) point out that the ancient Greeks and Romans passed legislation for the control of neighbourhood noise. In Sybaris, a Greek city founded in Southern Italy in 720 BC, the authorities prohibited industrial noises in residential areas and provided for zoning of the city. In Pompeii, the magistrates were authorised to prevent people making a noise in the streets.

In Mediaeval England, concern about noise resulted in several towns enacting laws prohibiting noisy trades from starting work early in the morning. In thirteenth century London, noisy or unsavoury trades - such as tanners, butchers and smiths - were restricted to specific areas of the city (Tempest and Bryan, 1976).

By the nineteenth century a few Acts of national application had been passed which, amongst other things, made provision for the control of specific noise problems (Gearty, 1986): for example, the Steam Whistles Act 1872 (prohibiting the use of steam whistles for summoning or dismissing workmen, unless permission was obtained from the local sanitary authority), the Explosives Act 1875 (controlling noise from fireworks) and the Locomotives Act 1865 (controlling the whistle of "road locomotives").

Several local Acts enforced by the police created minor street offences, some of which sought to control particular noise problems. The Metropolitan Police Act 1839, for example, created various offences in London punishable by fines of up to 40 shillings. These included using threatening, abusive or insulting words or behaviour, with intent to provoke a breach of the peace (s.54(13)); blowing a horn or using a noisy instrument for drawing a crowd together, or for making announcements, advertising, selling or collecting money (s.54(14)); wantonly disturbing householders by ringing doorbells or knocking at doors (s.54(16)); or annoying people by discharging firearms near dwellings (s.55). S.171 of the Public Health Act 1875, by incorporating certain provisions of s.28 of the Town Police Clauses Act 1847, created similar minor street offences outside London (Strauss, 1935). The breach of the peace provisions in s.54(13) of the Metropolitan Police Act 1839 were later replaced by s.5 of the Public Order Act 1936, retaining almost identical wording.

Byelaws provided another means of controlling noises which interfered with the use and enjoyment of public places. Strauss (1935) mentions that the London County Council, county councils and borough councils outside London had power to make byelaws within their area for good rule and government, and for the prevention and suppression of nuisances, under s.23 of the Municipal Corporations Act 1882 (as applied by s.16 of the Local Government Act 1888). The London borough councils obtained the same powers in 1899 (s.5 London Government Act 1899), subject to the condition that any byelaws made must not be inconsistent with those of the London County Council. These

provisions were subsequently amended by s.249 of the Local Government Act 1933 (outside London) and s.146 of the London Government Act 1939 (inside London).

London County Council byelaws covered matters such as noisy animals, street shouting, whistling for cabs and ringing of alarm bells. Several London boroughs made byelaws dealing with shouting and making noise in streets at night, noisy hawking, music near public buildings and hospitals, and - later - wireless loudspeakers and gramophones (Strauss, 1935). Byelaws were usually enforced by the police, although action could also be taken by the local authority. There was considerable uniformity in the form of byelaws, despite their local nature, owing to the fact that the Home Office issued model byelaws which local authorities then adopted.

When the corpus of existing public health legislation was laid down in the Public Health Act of 1875 (which itself consolidated an earlier enactment of 1848), noise was not included in the Act's list of statutory nuisances. Prompted by the sanitary reform movement, Government was more concerned with acute problems of health, such as waterborne diseases, slum dwellings and disposal of sewage, rather than problems of amenity (Ogus, 1982), such as the nuisance of noise.

By 1932 there was sufficient interest in the problems of noise to merit the founding of the first anti-noise pressure group: this was the Anti-Noise League (Law Times, 1959). No particular information was obtained on the antecedents to the League. However, it could well have been that by the 1930s the increased ownership and use of motor vehicles had led to growing concern about traffic noise, and this in turn heightened public perceptions about noise in general. There were in addition more sources of noise in the home, such as vacuum cleaners, gramophones and the wireless.

Certainly the Government took traffic noise sufficiently seriously to appoint a "Committee on Noise in the Operation of Mechanically Propelled Vehicles" in 1934 which produced two reports, published in

1935 and 1936 respectively (Department of the Environment, 1981). Although the advisory committee recommended the introduction of vehicle noise limits, based on commissioned research which had made substantial progress towards resolving the technical problems associated with vehicle noise measurement, no legislation was forthcoming (Robinson, 1962).

In 1935 the Anti-Noise League staged a Noise Abatement Exhibition at the Science Museum, London, whose object was to heighten the awareness, both of the public and of manufacturers, designers, engineers and transport managers, to the problem of noise and to show what measures could be taken to control and abate it (Anti-Noise League, 1935). Viewed from a 1980s' perspective, the Chairman of the League took a very over-optimistic stance in an article for the conference programme:

> "In a few years' time the needless noise-maker will be an outlaw from sober and intelligent society: a rude uncouth creature who will find it to his interest to mend his ways. We may predict that in a few years' time the delicate fabric of our bodies and minds will no longer be menaced and mutilated by the brutality of unnecessary noise" (Lord Horder, 1935).

3.3.1 Private Local Acts

It was also during the 1930s that local authorities began to pass private local Acts of Parliament in order to avail themselves of powers to control noise nuisances in general, as opposed to the piecemeal provisions described above. The first of these powers were granted to Newport, Bootle and Stockton-on-Tees Corporations and Middlesex County Council in 1930 (Sanitary Journal, 1930). There is nothing in Hansard to suggest why these local authorities decided to obtain these powers at this particular time (HC Debates, 1930; HL Debates, 1930).

Despite being local Acts, their wording was generally comparable throughout the country, since local authorities made use of model clauses issued by Government. Once again, noise was not included in

the provisions of the Public Health Act 1936, which consolidated and expanded the 1875 enactment. The local Acts, however, achieved for the implementing authorities what the Public Health Act had failed to do: they made noise amenable to statutory nuisance procedure. The provisions were enforced by the local authorities' Sanitary Inspectors (who were renamed Public Health Inspectors in 1956).

The relevant clause in the first of these local Acts granted to Newport, Bootle and Stockton-on-Tees Corporations and Middlesex County Council was of standard wording (Forster, 1959):

> "Grants to the local authority all the powers with regard to noise nuisance which a local authority has with reference to a nuisance under the Public Health Act 1875, a noise nuisance being deemed to exist where any person makes or causes to be made any excessive or unreasonable or unnecessary noise and where such noise:
> (a) is injurious or dangerous to health, and
> (b) is capable of being prevented or mitigated having due regard to all the circumstances of the case."

Unlike the earlier public order enactments and byelaw provisions, which sought to control various noises if they were potentially damaging to amenity, this clause concentrated on noises which had a detrimental effect on health. As there was no precedent for this health limitation in the earlier provisions described above, it is conceivable that this restriction in the clause was the result of its connection with the Public Health Act. In both the 1875 and 1936 Public Health Acts, matters are defined as statutory nuisances if it can be proved that they are "prejudicial to health or a nuisance" (for example, the provisions in s.92(1) of the 1936 enactment).

It is unlikely that more than about twenty prosecutions in total were taken under the private Act provisions (Duerden, 1970), since local authorities preferred to proceed in a conciliatory fashion (Forster, 1959). In order to prove that a noise was "injurious or dangerous to health", medical opinion was required (Duerden, 1970). Duerden, himself a Public Health Inspector, maintained that it was difficult to prove, beyond reasonable doubt, that a given noise had

had an adverse effect on health. However, other opinion was at variance: according to Forster (1959), the town clerk of a London borough, a doctor's evidence that a plaintiff's sleep had been disrupted was sufficient proof.

By 1960 approximately 400 local authorities in England and Wales had passed private local Acts to enable them to make use of these powers. Some twenty local authorities had in addition obtained local Act powers to control the use of loudspeakers in streets, a provision most frequently used against ice-cream van chimes, and which dated back to the 1930s (Committee on the Problem of Noise, 1963). The majority of local authorities in England and Wales had also made some byelaws about noise: the byelaws most commonly adopted were the models, and many authorities had adopted most of these (ibid.).

3.4 THE NOISE ABATEMENT ACT 1960

> "An Act to make new provisions in respect of the control of noise and vibration with a view to their abatement" (long heading of the Noise Abatement Act 1960).

The Noise Abatement Act 1960 (NAA) was the first law of national application to concern itself specifically with the problem of neighbourhood noise. It provides a good example of a piece of pollution control legislation which reached the statute book mainly due to the influence of a pressure group: this being the Noise Abatement Society. The Act was the result of a Private Member's Bill, and in a way it pre-empted mainstream Government policy since the Committee on the Problem of Noise (the "Wilson Committee") was established, with a broad remit to investigate the problem of noise, while the Bill was making its passage through Parliament. In the words of Lord Taylor, speaking in the House of Lords during the second reading of the Bill, "In a sense it is a "gun-jumping" Bill, because the Government are making a thorough investigation of this difficult problem of noise" (HL Debates, 1960a).

3.4.1 Antecedents to the Noise Abatement Act

Noise was not a priority issue in the years both during and immediately after the Second World War:

> "Since the outbreak of war, the subject has receded somewhat into the background...." (Turner, 1940).

The Anti-Noise League was disbanded in 1939 (Gearty, 1986), presumably as a result of the onset of war. Towards the end of the 1950s, however, concern about noise began to grow (Robinson, 1962). One focus for concern was provided by the beginnings of pressure to limit noise in the workplace. Another was provided by the growing commercial use of jet aircraft, such as the Boeing 707 (Robinson, pers. comm.).

In 1957 the European Productivity Agency, set up under the Organisation for European Economic Co-operation (the precursor of the Organisation for Economic Co-operation and Development), held an international seminar at Stockholm on health and safety at work: occupational noise featured on the agenda (Law Times, 1959; Robinson, pers. comm.). It had been known for over a hundred years that the very loud noise levels associated with some industrial processes caused workers to become deaf. At the Stockholm seminar, however, it became clear that Italy appeared to be the sole European country having legislation (for a few industries) which aimed to protect the worker from occupational noise (Law Times, 1959). In Britain, a "Noise in Industry" conference, held at Earls Court in 1959, considered the effects and control of industrial noise both inside and outside the workplace (Insulation, 1959).

People living near sites of heavy industry had suffered from industrial noise for years, but the growth of civil aviation in the 1950s caused noise problems to spread to sectors of the community previously unaffected. The introduction of the larger turbo-jet engined aircraft in 1958 caused the number of complaints about aircraft noise to increase sharply (Committee on the Problem of Noise, 1963). It is possible that this was the trigger which prompted public

opinion about environmental noise in general to reach a level, by the end of the 1950s, at which political action was stimulated or, in Ashby's words, to reach the "ignition stage" (Ashby, 1977). Even though the Noise Abatement Bill made no attempt to include aircraft noise within its ambit, frequent mention was nevertheless made of aircraft noise during the second reading of the Bill in the House of Commons (HC Debates, 1960a), where one MP went so far as to assert that:

> " We owe a very great debt to the Boeing and the TU 104, which by their almost cynical disregard of the comfort of whole populations have made possible even this modest advance today. We should make no mistake about it: without the Boeing the Bill would not be before the House today with any real prospect of success" (Ronald Bell, ibid: col. 1583).

In May 1959 the Paris Prefecture organised a "Week of Silence", in an attempt to increase public awareness of noise and of the means of reducing it, and this received coverage by the British press (eg. The Times, 1959a). Later that summer, in response to a letter to a selection of national newspapers, inquiring whether people were bothered by noise, the founder member of the Noise Abatement Society received over 4000 affirmative replies (John Connell, pers. comm.). On the basis of such a positive response, the Noise Abatement Society was founded in September 1959, "with the sole purpose of eliminating excessive and unnecessary noise from all sources" (Noise Abatement Society, 1984).

3.4.2 The Noise Abatement Bill

From the start of the 1959/60 Parliamentary session, there had been pressure on the Government, particularly from their own backbenchers, for action to combat noise nuisance (The Times, 1959b). The Noise Abatement Society's first objective was to press for national noise control legislation (John Connell, pers. comm.). When that session's ballot for Private Members' Bills was drawn, and the fourth member on the list had not committed himself to any particular course of action, the Noise Abatement Society pressed him to adopt their cause. The MP

was Rupert Speir (Member of Parliament for Hexham), who had previously sponsored the Litter Act 1958 (HC Debates, 1960b). He agreed to introduce a Noise Abatement Bill into the House of Commons, provided the Noise Abatement Society took responsibility for its drafting (John Connell, pers. comm.).

The Bill was introduced in the House of Commons on November 11 1959 (HC Debates, 1959) and subsequently received Royal Assent on 27 October 1960 (HL Debates, 1960b). Welcomed by the Government of the day "as a useful though necessarily limited measure" (HL Debates, 1960c), it was largely based on the private Act provisions. Its scope had been restricted after an announcement in the House of Commons that the Government would shortly appoint an advisory committee to inquire into the problem of noise (The Times, 1959c): this being the Wilson Committee.

The Noise Abatement Bill nevertheless made two useful amendments to the private Act provisions. For one thing, the first clause made vibration, in addition to noise, amenable to statutory control under the provisions of the Public Health Act 1936. Secondly it substituted the words "which is a nuisance" for the more demanding "noise which is injurious or dangerous to health" (HL Debates, 1960d), so bringing the emphasis back to a concern for amenity rather than a concern for health as such. Hansard does not provide any explanation as to why these amendments were made. At the stage of the second reading in the Commons, vibration had been omitted, and a statutory noise nuisance was defined, in terms similar to other statutory nuisances under the Public Health Act 1936, as:

> "Excessive or unreasonable or unnecessary noise which is prejudicial to health or a nuisance or an annoyance" (HC Debates, 1960c).

No reference is made to either of these points during the report in the Commons of the committee stage or the third reading of the Bill (HC Debates, 1960d). By the time the Bill was debated in the Lords, however, the two amendments had appeared (HL Debates, 1960e).

Noise and vibration caused by aircraft and by statutory undertakers were exempt from the provisions of the Bill. S.s 40/41 of the Civil Aviation Act 1949 (dating from the Air Navigation Act 1920) had already prohibited actions for nuisance arising from civil aircraft in flight and at aerodromes. This prohibition had been introduced as it was feared that the development of aviation would be hindered if actions in nuisance were permissible (Committee on the Problem of Noise, 1963).

Local Acts had exempted noise caused by railway workers from their provisions, and it was felt logical to extend this to all statutory undertakings (ibid.). Where a noise nuisance was caused in the course of a trade or business, the Bill provided a defence if it could be proved that "the best practicable means" had been used "for preventing, and for counteracting the effect of, the noise or vibration" (clause 1(3)). The basis for this limitation can again be found in the old local Acts (Forster, 1959; Hopper, 1961), and in some provisions of the Public Health Acts 1875 and 1936.

The second clause of the Bill was also based on a model clause for inclusion in local Acts, limiting the use of loudspeakers in streets (Committee on the Problem of Noise, 1963). It prohibited their use for any purpose between 9 pm and 8 am, and provided a total ban on using them for advertising any entertainment, trade or business at any other time of the day. Some exemptions to this blanket prohibition were provided, however, for the emergency services, for transport undertakings to make passenger announcements, for use within vehicles or as part of a horn, and for fairgrounds. A further exemption allowed travelling vendors of perishable foodstuffs, in the main ice-cream vans, to use loudspeakers for advertising their trade between noon and 7 pm, but only if their chimes were operated so "as not to give rise to reasonable cause for annoyance to persons in the vicinity".

3.4.3 Lack of Technical Specificity

Nowhere in the Bill was any reference made to technical terms or criteria, or to methods of measuring a "noise nuisance". Scant attention was paid to this aspect in the debates, despite the following point made during the second reading in the Commons:

> ".....there is nothing in the Bill....which provides for any method of measuring unnecessary or unreasonable noise. I believe that there are instruments by which this can be done. We have been able to find a method of measuring what is black smoke and what is not [using a device known as the "Ringelmann chart"], and I understand that there are instruments for measuring noise. I suggest that this point might well be considered as the Bill progresses" (John Hynd, HC Debates, 1960e).

It may well have been that the Bill's sponsors considered it most appropriate to leave technical matters such as these to the deliberations of the Wilson Committee.

3.4.4 The Ice-Cream Vendors' Exemption

The first clause of the Bill made a smooth passage through Parliament, but the second clause provoked considerable debate in both Houses (HC Debates, 1960f; HL Debates, 1960f/1960g). Rupert Speir commented that:

> "Ice cream, although it is not specifically mentioned at all in the Bill, came very near to wrecking the whole Bill" (HC Debates, 1960g).

The clause had initially been drafted with a total ban on the use of ice-cream chimes, but the ice-cream lobby protested that this would drastically reduce their income (John Connell, pers. comm.). Ultimately a compromise was reached "between complete prohibition and unfettered freedom" (Committee on the Problem of Noise, 1963, para. 472), allowing the chimes between noon and 7 pm, as fears were being expressed that this bone of contention might hinder the passage of the entire Bill. A morning prohibition was retained for the sake of sleeping night-shift workers, while 7 pm was considered to be the time that many children went to bed (HC Debates, 1960g).

It is interesting that a seemingly trivial matter concerning ice cream had the potential to take up a substantial proportion of the Parliamentary time allocated to the Bill. However, in the early years of the NAA, most prosecutions under the Act were for the mis-use of ice-cream vendors' chimes, with proceedings being taken in a much higher proportion of these cases than for other types of noise nuisance (Committee on the Problem of Noise, 1963). Ice cream chimes demonstrably had the capacity to give rise to community annoyance.

3.4.5 The Statutory Nuisance Procedure

The first clause of the Bill effectively provided a new means of dealing with a long-established civil wrong. In the words of Lord Conesford during the second reading of the Bill in the House of Lords:

> ".....if a noise or vibration is a nuisance at common law, the first clause of this Bill makes it a statutory nuisance subject to Part III of the Public Health Act 1936" (HL Debates, 1960d).

'Nuisance' is not defined in statute, but Circular 58/60, issued by the Ministry of Housing and Local Government in relation to the NAA, reiterated Lord Conesford's point. Although not directly binding on noise nuisance, case law relating to statutory nuisance under the Public Health Act 1936 (NCB v Thorne (1976) 74 LGR 429) suggests that a statutory nuisance may be either a private or public nuisance at common law. (See Chapter 4 where the principles of nuisance are considered further).

In bringing noise within the statutory nuisance procedure, the first section of the NAA made any noise or vibration, which amounted to a statutory nuisance, subject to the controls under s.s 91-100 of the Public Health Act 1936 (except in London, where the Public Health Act did not apply: instead the London County Council (General Powers) Act 1937 was used to control nuisances, and the NAA made special provision for noise to be also included within the ambit of these powers).

The similarities between the procedural provisions of the Public Health Act 1936 and its predecessor, the Public Health Act 1875, are striking. The procedural provisions of the 1936 enactment described below, relating to local authority powers to serve notices for the abatement of matters designated as statutory nuisances, are also to be found in the earlier Act.

S.91 placed a mandatory requirement on local authority Public Health Inspectors to inspect their district "from time to time" for the detection of statutory nuisances.

S.93 enabled Public Health Inspectors to serve abatement notices on people causing a statutory nuisance, or on the owners or occupiers of premises from which the nuisance originated. The notice required the abatement of the nuisance, and stipulated the method by which this was to be achieved, including details of any work that would be necessary, and the time period within which this was to be accomplished. If the terms of the abatement notice were not complied with, or if it was suspected that a nuisance, although abated since the service of the notice, was likely to recur on the same premises, the local authority was given powers to make a complaint to the local magistrates, who could then issue a summons against those named in the abatement notice (s.94).

Alternatively, the NAA enabled private action to be taken by at least three individuals who, as owners or occupiers of premises, were "aggrieved" by a noise nuisance (s.1(2)(a)). This differed slightly from the terms of the Public Health Act 1936 where one individual aggrieved by a statutory nuisance could take a private action (s.99). The precedent for having at least three people annoyed by the noise originated from the local Acts and byelaws. By requiring at least three separate complainants, it was thought that this would reduce the risk of vexatious proceedings amongst neighbours, which was considered more probable with noise than with other statutory nuisances, since noise was "so much a matter of personal reaction and temperament" (Committee on the Problem of

Noise, 1963, para. 66). The procedure for private action required the individuals to make a complaint to the local magistrates' court. If the magistrates were satisfied that a prima facie case existed, they would serve a summons on the nuisance-maker or on the owner or occupier of the premises from which the nuisance arose.

The ensuing enforcement procedure for local authority-initiated action and for private action was identical. If the magistrates upheld the complaints at the court hearing, they would serve a nuisance order requiring the abatement of the nuisance, or prohibiting its recurrence, and specifying any work that would have to be undertaken to achieve this. In addition they also had the discretion to impose a fine. There was right of appeal against the terms of a nuisance order to the Quarter Sessions (now the Crown Court) (s.301, Public Health Act 1936). Failure to comply with the terms of a nuisance order, "without reasonable excuse", was a criminal offence, punishable by a fine (s.95). In 1960 the maximum fine which could be imposed was £5, with a further fine of not more than forty shillings per day for each day on which the offence continued after conviction. The local authority themselves had powers to carry out any remedial works specified in the nuisance order and claim reasonable costs from the offender (s.95).

S.1(3) of the NAA stated that the defence of best practicable means (BPM) was available for any proceedings taken in respect of noise caused in the course of a trade or business. This section was read in conjunction with s.110 of the Public Health Act 1936, which provided that in deciding whether the BPM had been taken for preventing or counteracting the effect of a nuisance, "a Court shall have regard to cost and to local conditions and circumstances".

If a local authority considered the noise problem to be so great that summary proceedings were inadequate to secure its abatement, then action in the High Court could be taken to obtain an injunction (s.100).

3.5 THE COMMITTEE ON THE PROBLEM OF NOISE: "THE WILSON COMMITTEE"

One way of developing a frame of reference for an emergent issue is to establish an ad hoc committee, such as the advisory committees of the departments of state (Solesbury, 1976). As mentioned above, there had been pressure on the Government from the start of the 1959/60 Parliamentary session for some form of action against noise, and a motion tabled early in the session called on the Government to set up an inquiry into ways of reducing noise (The Times, 1959b).

On December 14 1959, a month after the Noise Abatement Bill had received its first reading in the Commons, the Government announced that it was going to appoint an advisory committee to investigate noise problems (The Times, 1959c). The thirteen members of the "Committee on the Problem of Noise", under the chairmanship of Sir Alan Wilson, were subsequently appointed in April 1960 by Lord Hailsham, Minister of Science, with a remit as follows:

> "to examine the nature, sources and effects of the problem of noise and to advise what further measures can be taken to mitigate it" (Foreword: Committee on the Problem of Noise, 1963).

The final report of the Committee on the Problem of Noise, published in 1963, covered sources, effects and methods for control (both technically and legally speaking) of neighbourhood noise, noise from aircraft and surface transport and, to a more limited extent, occupational noise. It remains the most detailed and comprehensive Government text on noise in the United Kingdom, although it is now out of date (House of Lords Select Committee on Science and Technology, 1985).

For the most part, the Committee members had no personal specialist knowledge of the subject, but made use of assessors and called on expert evidence as required. The Committee comprised seven scientists and six non-scientists. The chairman, Sir Alan Wilson, was recognised as an eminent scientist, being a Fellow of the Royal Society (HC Debates, 1960h).

3.5.1 Emphasis on Noise Standards

The Committee decided that one of its major objectives was to define, wherever possible, quantitative levels of noise which would be suitable for adoption as statutory standards, or as guidelines, since:

> "People's reactions to noise vary greatly, and in the past this has prevented the framing of rules for its control except in qualitative terms, with consequent difficulties for administration" (Foreword: Committee on the Problem of Noise, 1963).

The emphasis was again on problems of amenity rather than health. The Committee admitted that, although noise at levels encountered in the environment could affect peoples' well-being by interfering with sleep and communication, inducing stress and reducing working efficiency, they had been unable to find any evidence that it produced a direct and measurable physiological effect on the average person. Consequently, in common with the majority of other efforts to quantify the effects of environmental noise (see Chapter 5), they were led to consider "those reactions to irritating or disturbing noise which are called, for brevity, "annoyance"" (ibid., para. 33). The aim was to define levels above which a noise could be considered a community annoyance. They recognised that this was particularly difficult to do, since annoyance depended not only on the loudness of a noise, but also on many other factors including the personality of the recipient.

The Committee commissioned a substantial amount of original research, which dealt in the main with assessing and quantifying the degree of annoyance caused by environmental noise, in particular noise from aircraft and traffic. The Central Office of Information and the Ministry of Aviation were commissioned to carry out a noise survey around London (Heathrow) Airport. This led to the development of the Noise and Number Index (NNI), which has since been used in this country for the assessment of community annoyance caused by aircraft noise. The Committee recommended that grants towards the cost of providing acoustic insulation against aircraft noise should be made

available to residents in the area around Heathrow Airport where noise exposure was in excess of 50/60 NNI. This recommendation was subsequently implemented by the Government (s.15, Airports Authority Act 1965, under which noise insulation schemes for Heathrow and Gatwick airports were made).

The interim results of an independent survey of noise levels in London, carried out by the Building Research Establishment, the London County Council and the Central Office of Information in 1961-62 (Parkin et al., 1968), were also used by the Committee. The survey had been commissioned by the London County Council who at the time were concerned about the potential impact of planned helicopter stations on ambient noise levels in London (ibid.). Noise levels were monitored and public reactions to noise were determined at 540 points equally spaced over 36 square miles of London. Traffic noise was found to be the predominant noise source at these points. From the interim results of the survey, the Committee proposed tentative levels of acceptability - in A-weighted decibels, or 'dB(A)'(explained in more detail in Appendix 2) - for noise within dwellings. These were based mainly on public response to traffic noise as this was the predominant noise source in the survey. Following the noise rating adopted by Parkin et al., they were expressed in terms of the level exceeded for 10% of the time (L10) (see Chapter 5), as follows (Committee on the Problem of Noise, 1963, para.117):

Situation	Day	Night
Country areas.....	40 dBA	30 dBA
Suburban areas, away from main traffic routes.....	45 dBA	35 dBA
Busy urban areas.....	50 dBA	35 dBA

The standards for busy urban areas were adopted by the Greater London Council in 1966, as desirable standards for all new housing schemes (Gilbert, pers. comm.). Although the standards were not explicitly referred to in any Government text, they probably inspired some of the

noise guidelines quoted in a Department of the Environment circular on "Planning and Noise" (Circular 10/73) (see Section 3.6.3).

The Wilson Committee also recommended statutory limits in decibels for vehicle noise, both in terms of construction standards which manufacturers would have to comply with, and in terms of limits for vehicles in use to be enforced by the police in roadside tests. These recommendations were eventually translated into law in 1969 by the Motor Vehicles (Construction and Use) Regulations, although the actual legal limits were based mainly on standards proposed by the United Nations Economic Commission for Europe (Noise Advisory Council, 1972). These limits subsequently had to be brought in line with the harmonised standards applying within the EEC when the United Kingdom acceded to the Community in 1973.

3.5.1.1 Standards for Neighbourhood Noise

The Committee made six recommendations for setting standards for sources of neighbourhood noise, which are outlined below. Although none of these were directly responsible for legislative changes, some were adopted in codes of practice and others were eventually given effect by legislation which came about as the result of other policy influences such as the Noise Advisory Council and the EEC.

A. A Procedure for Assessing Reaction to Industrial Noise in Mixed Residential and Industrial Areas

Where noise nuisance was concerned, the Committee admitted that:

> "The factors which govern whether or not a noise is a nuisance are so many and so subtle that it is possible in only a few instances to attempt to fix a quantitative limit to noise. Where it is practicable with present knowledge we have recommended such limits" (Committee on the Problem of Noise, 1963, para. 74).

In spite of this difficulty, one area of neighbourhood noise where the Committee had some success in determining a quantitative standard of acceptability was noise from industrial premises. The Committee

commissioned the Building Research Establishment, in co-operation with a number of local authorities, to develop a simple, quantitative method for assessing the likelihood of complaints about noise from industrial premises located in mixed residential/industrial areas.

The resulting procedure (ibid., Appendix XV) was derived from methods developed by noise control consultants in the United States (Stevens, Rosenblith and Bolt, 1955) and Holland (Kosten and Van Os, 1962), and from a number of case histories of industrial noise provided by local authorities. It was deliberately made as simple as possible, so that it could be used by Public Health Inspectors who had:

> "....neither the training, experience and equipment nor, probably, the time...." to perform more complicated analyses (Committee on the Problem of Noise, 1963, para. 383).

The procedure was later amended by a small committee at the British Standards Institution (Williams and Robinson, 1985). The Government's response to the Wilson Report (Circular 22/67) mentioned that "a simplified procedure to give a reasonably reliable guide to the probable public reaction to industrial noise" had been drawn up as a British Standard, and would shortly be published. The resulting standard - BS 4142 - was published in 1967 and subsequently amended in 1975, 1980 and 1982 (see Chapter 5 for background to, technical details and critique of BS 4142).

Unlike standards setting maximum permissible noise levels in absolute terms, BS 4142 refers to a maximum permissible relative level. The rationale is that the propensity of a noise to cause complaint depends primarily on the amount by which the noise level, after appropriate allowances have been made for its character and duration (this is referred to as the 'Corrected Noise Level' (CNL)), exceeds the pre-existing background level. The standard predicts that complaints may be expected if the CNL exceeds the background level by 10 dB(A) or more. Differences of 5 dB(A) are considered to be of marginal significance.

Its purpose is two-fold: firstly, as a guide to the determination of whether or not a complaint about noise from existing industrial premises is justified, and that a reduction in level should be sought, and, secondly, as a guide in planning applications in deciding whether or not noise from a new factory could be a potential problem, provoking complaints from local inhabitants. The Wilson Committee recognised:

> "That rules of this sort would help local authorities and others in this country, and also that their use would tend to produce a greater consistency of decision than is possible from purely personal opinions" (Committee on the Problem of Noise, 1963, para. 380).

BS 4142 is the first and only procedure to have been incorporated into the legal mandate, which goes some way towards quantifying neighbourhood noise nuisance. 'Legal mandate' is used here in its broadest sense, however, for although the standard has now assumed a quasi-legal status after frequent use in noise nuisance cases and planning inquiries, it remains an informal code of practice. Its use for noise nuisance assessments has never been formally recommended by Government, although Circular 10/73 recommends its use for planning purposes. It must also be emphasised that BS 4142 is not intended to provide unequivocal proof of the existence of a nuisance. Whilst the standard is a useful guide, it should not be relied on totally as noise nuisance can undoubtedly exist without BS 4142 predicting complaints (Penn, 1979; Taylor, 1981).

B. Statutory Limits for Noise from Construction Plant

The Wilson Committee recommended, in principle, setting statutory limits for noise emitted by powered plant used on construction and demolition sites. This suggestion relied for its implementation on the development of accurate, standardised methods of measuring the sound power output of such equipment, which at that time had yet to be formulated to the satisfaction of the British Standards Institution.

A decade later, following a recommendation from the Scott Committee of the Noise Advisory Council (Noise Advisory Council, 1971), the Control of Pollution Act 1974 (COPA) included an enabling provision for the Secretary of State to make regulations limiting noise emitted by industrial machinery and construction plant (s.68). No regulations giving effect to this section have yet been made. However, legislation from the European Community which sets product standards for noise emitted by certain types of construction equipment is now in force. These provisions have been implemented by regulations made under s.2(2) of the European Communities Act 1972, and not s.68 of COPA (see Section 3.6.2.3).

C. Limits for Noise from Construction Sites

Another recommendation made by the Committee was that between the hours of 7 am and 7 pm the noise level immediately outside the nearest building at the window of the occupied room closest to the construction site boundary should not exceed:

(i) 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise;

(ii) 75 dB(A) in urban areas near main roads and heavy industrial areas.

The Committee considered these limits would best be used as a desirable code of practice for the construction industry, and as a guide to local authorities in deciding whether or not to take proceedings under the NAA or the common law. They thought it premature to give the limits legal force until enough experience of their use had been obtained to establish their validity. The rationale behind these noise emission standards was that an external level of 70-75 dB(A), attenuated by 15-20 dB(A) by closed windows, gave a noise level indoors of 50-55 dB(A). At this level conversations could be held, the telephone used, and business conducted without undue difficulty.

By 1975, BS 5228 (Code of Practice for Noise Control on Construction and Demolition Sites), designated as an approved code for s.s 60/61 of COPA (by the Control of Noise (Code of Practice for Construction Sites) Order 1975, SI.1975 No.2115), suggested that it should be possible to achieve a 12 hour equivalent continuous noise level, Leq (see Chapter 5), of 75 dB(A) at the site boundary. However, the revised version of BS 5228, published in 1984 (Noise Control on Construction and Open Sites) makes no mention of desirable noise emission standards for construction or demolition sites, leaving it to the discretion of the local authority as to what noise levels at the boundary of a site, if any, should be set.

D. Noise Limits for Lawn-Mowers

The Committee recommended that the British Standards Institution should develop a method for testing the noise output from motor lawn-mowers, with the ultimate objective of introducing legislation fixing maximum noise limits for new machines. Although this suggestion was not followed up in national legislation, an EEC Directive setting maximum levels for the sound power output of lawn-mowers (84/538/EEC Permissible Sound Power Level of Lawn-mowers, OJ L 300, 19.11.84) has now been implemented in Britain (under s.2(2) European Communities Act 1972).

E. Code of Practice for Ice Cream Chimes

The Wilson Committee reported that ice cream vendors' chimes were found to be a continuing source of annoyance, despite the provisions of s.2 of the NAA, and a code of practice issued by a representative body of ice cream manufacturers. The Committee recommended giving statutory force to such a code, limiting the duration, frequency and loudness of chimes and prohibiting their use in places where they would be exceptionally disturbing, such as near hospitals, schools and churches.

COPA includes an enabling provision (s.71) for the Secretary of State to make or approve codes of practice giving guidance on methods for reducing noise, and in 1982 the Department of the Environment published three such codes, including a "Code of Practice on Noise from Ice-Cream Van Chimes Etc" (Department of the Environment, 1982a) (see Section 3.6.2.7). This contained some specific limitations concerning the duration, frequency and loudness of chimes. Failure to comply with the code is not an offence as such, but can be used as evidence of a contravention under the Act.

F. Objective Measurements of Noise from Household Appliances

After receiving evidence from various women's organisations concerning the noisiness of domestic appliances, such as vacuum cleaners, the Committee recommended that:

> "Objective measurements of the noise produced by domestic tools, using a standard procedure would enable customers to compare the noisiness of different models of machines" (Committee on the Problem of Noise, 1963, para. 589).

Nothing more was heard of this proposal in the national policy arena, but over twenty years later an EEC Directive (86/594/EEC (OJ L344 6.12.86)) was finalised, which aims to introduce a common system of labelling the noise emitted by various household appliances (see Section 3.7.4).

3.5.1.2 Training in Noise Control

When the NAA was enacted, very few Public Health Inspectors had any knowledge of acoustics:

> "It is no exaggeration to say that there were many inspectors who, at that time, were unable to operate a sound level meter, and that there were inspectors who had never even seen a sound level meter" (Duerden, 1970).

This was hardly surprising since Public Health Inspectors' enforcement responsibilities for noise at that time neither explicitly

mentioned, nor necessarily required the use of, sound measuring equipment.

In accordance with their emphasis on technical standards for noise control, the Committee recommended that training in techniques of noise measurement and control should be made available to all local authority officers who had to deal with noise problems in their work. They considered that knowledge of this sort was especially important for advising factory owners on noise abatement measures, and in deciding whether the BPM were being used "for preventing, and for counteracting the effect of, the noise or vibration" (NAA s.1(3)). Although the onus lay with the owner of the trade or business premises to prove that the BPM were being employed, the local authority had to form their own opinion before taking proceedings.

The Government, in its response to the Wilson Committee, confirmed that training in noise control was needed and suggested that public health inspectors should have access to short part-time courses at technical institutions, preferably ones where courses for the Diploma of the Public Health Inspector's Education Board were already in existence (Circular 22/67). The Scott Committee (Noise Advisory Committee, 1971) subsequently reported that those local authorities with major noise problems were acting on this recommendation.

3.5.2 General Recommendations for Neighbourhood Noise

Apart from attempting to determine quantitative standards to limit annoyance due to noise, the Committee made several recommendations of a more general nature concerning neighbourhood noise. Many of these were ultimately adopted in new legislation or other policy instruments. Their more important recommendations concerning

neighbourhood noise were as follows:

3.5.2.1 The Noise Abatement Act

A. Recurring Noise Nuisances

The Wilson Committee saw a loophole in the provisions of the NAA: there was a need for Public Health Inspectors to be able to serve noise abatement notices where a nuisance had occurred, temporarily ceased, but showed a strong likelihood of recurring (para. 77). The Public Health (Recurring Nuisances) Act 1969 eventually gave effect to this recommendation for all categories of statutory nuisance. It enabled inspectors to serve prohibition notices where they were satisfied that a statutory nuisance had occurred and was likely to recur on the same premises, regardless of whether or not the nuisance existed at the time of service of the notice and whether or not an abatement notice had been served.

B. Speed of Nuisance Proceedings

The processing of noise nuisance cases was thought to be too slow. The Government agreed with this recommendation and urged local authorities and courts to deal with such cases as quickly as possible (Circular 22/67), albeit without amending the enforcement procedure.

C. Fines

The Wilson Committee considered the penalties for contravening the NAA to be "quite inadequate", especially for substantial industrial firms, "which may stand to gain more from ignoring notices by the local authority and orders by the Court, than the amount of the fines" (Committee on the Problem of Noise, 1963, para.80). Substantial increases in the penalties were recommended. Although the Government's response (Circular 22/67) made no mention of the adequacy or otherwise of the penalties, the Criminal Justice Act 1967 raised the level of fines to maxima of £20 for failure to comply with an abatement or

prohibition notice, and £50 (plus a daily fine not exceeding £5) for failure to comply with a nuisance order.

3.5.2.2 Construction Noise

The Committee recommended that local authorities should have statutory powers to impose conditions of operation on particularly noisy construction or demolition processes, such as pile driving. Local authorities should be able to restrict the hours of operation of especially noisy processes, and to obtain information about whether quieter processes might be practical alternatives. The provisions of s.60 of COPA, based on the recommendations of the Scott Committee (Noise Advisory Committee, 1971) provide local authorities with equivalent powers.

The use of mufflers or acoustic enclosures to limit noise from pneumatic drills, and a statutory requirement for efficient exhaust silencers on all internal combustion engines used as prime movers on construction sites, along the lines of some local Act powers, were further recommendations made by the Committee. The Government responded by publishing an advisory booklet (Ministry of Public Building and Works, 1968), providing information on methods of noise reduction on building sites. Circular 59/68, sent to local authorities with copies of the advisory booklet, suggested that local authorities might consider taking action under the NAA against firms using concrete breakers without effective silencers (as this would mean that the BPM were not being used).

S.68 of COPA (following Scott Committee recommendations (Noise Advisory Council, 1971)) creates an enabling power for the Secretary of State to make regulations requiring the use of noise limiting devices on plant and machinery, in addition to the power to set noise emission standards mentioned above. But again no such regulations have been made.

3.5.2.3 Industrial Noise

A. Liaison Between Planning and Public Health Departments

The Committee advised that local authority Planning Departments should consult with their Public Health Departments about potential noise from proposed industrial developments. This advice was reiterated by the Scott Committee (Noise Advisory Council, 1971) and given formal recognition by the Government (Circular 10/73). No statutory consultative procedure has been established, however, but all the Environmental Health Departments visited as part of the survey undertaken for the thesis nevertheless had such arrangements with their respective Planning Departments (see Chapter 6).

B. A Central Noise Inspectorate

A recommendation by the Committee that was not adopted by the Government concerned the establishment of a central Noise Inspectorate to regulate especially noisy industrial processes, such as drop-forging and boiler-making. A system analogous to that used by the Alkali Inspectorate (now HMIP) was envisaged, whereby noisy processes would be registered and required to use the BPM to prevent and counteract the effect of the noise. The use of BPM would be enforced by a 'Noise Inspectorate', whose inspectors would provide expert advice to industry on methods of noise control. Once the system was fully operational, registered premises would then be exempt from statutory noise nuisance proceedings, but liable to prosecution if BPM were not being used.

The proposal for a Noise Inspectorate, however, was not supported by Government (Circular 22/67), as they considered it would tend to duplicate work already being done by the Factory Inspectorate, who had a remit to control occupational noise. They argued that if noise was a nuisance to the neighbourhood, it was likely to be also a problem to employees. Additionally, as noise was more of a local problem than air pollution, responsibility for its control was more suited to local

authorities than Central Government. The central/local control issue raised its head again when the Scott Committee considered neighbourhood noise (Noise Advisory Council, 1971): a memorandum from the Confederation of British Industry also advised the establishment of a Central Government inspectorate. The Scott Committee, however, favoured local control, reiterating the arguments put forward by the Government in its response to the Wilson Committee.

C. The Exemption for Statutory Undertakers

The Wilson Committee argued that if statutory undertakers' noisiest processes were controlled by a Noise Inspectorate, they would no longer require a blanket exemption from statutory nuisance proceedings: their noisiest processes would be registered and therefore exempt in any case, whilst quieter processes could be included within the ambit of the NAA.

The recommendation to remove the exemption for statutory undertakers was finally implemented by COPA, following a recommendation by the Scott Committee (Noise Advisory Council, 1971) although the requirement to use BPM applies "only so far as compatible with the duties imposed on them in their capacity of statutory undertakers" (s.72(4)).

D. The Defence of Best Practicable Means

Although the Committee could see no alternative to the defence of BPM for trade and industry in the short-term, they considered it to be "undesirable" in the long-term, because:

> "Many local authorities consider that they have serious difficulty in abating noise nuisance from trade and industry if the occupier of the premises from which the noise is coming claims that he is using the best practicable means of preventing it. The local authority cannot readily confirm or deny this, and, therefore, hesitate to take proceedings" (Committee on the Problem of Noise, 1963, para. 398).

They considered that once the noisiest processes were registered and in any case required to use BPM, other sources of noise should not have recourse to this defence. Along with the proposal for a Noise Inspectorate, this recommendation was not followed up by Government and the defence of BPM for trade and industry in proceedings for statutory noise nuisance still remains.

3.6 THE NOISE ADVISORY COUNCIL

3.6.1 Pollution Issues

Pollution became a major political issue in the United Kingdom towards the end of the 1960s. The Torrey Canyon oil spillage in March 1967 had a profound effect on public awareness of pollution problems (Vogel, 1986). A number of other incidents, such as the death of thousands of birds in the Irish Sea in 1969 (attributed to polychlorinated biphenyls (PCBs)); an oil well blow-out at Santa Barbara, USA, in 1969; and mercury poisoning at Minamata, Japan, throughout the 1960s, also served to highlight the problems of environmental pollution (Haigh, 1984).

In December 1969 the Prime Minister, Harold Wilson, announced his intention of establishing a standing 'Royal Commission on Environmental Pollution' (RCEP), and also a permanent unit of civil servants - mainly of scientists - to work on pollution (the Central Scientific Unit on Pollution, located within the Ministry of Local Government and Regional Planning) (HC Debates, 1969). The RCEP began work in February 1970. In that same year the Government produced a White Paper outlining its proposals for dealing with environmental pollution (HMSO, 1970), and the Department of the Environment emerged out of the former Ministries of Housing and Local Government, Public Building and Works, and Transport (Levitt, 1980).

At the same time as the Prime Minister announced that the RCEP was to be established, he also stated that the Minister of Housing and Local

Government, Antony Crosland, was going to set up a 'Noise Advisory Council' (NAC), along the same lines as the Clean Air Council (HC Debates, 1969). The NAC started work in 1970 (Noise Advisory Council, 1974a).

The work of the NAC, combined with considerable interest in Parliament, ensured that noise problems received attention within the broader milieu of environmental issues. In May 1970 Mr Mcnair-Wilson introduced a Private Members' Bill, which aimed to restrict the noise levels of motor vehicles, motor cycles and aircraft (HC Debates, 1970). The Bill got no further than its first reading, owing to the 1970 general election which stopped all unfinished Parliamentary business. The first report of the RCEP stated that high priority should be given to dealing with noise problems (Royal Commission on Environmental Pollution, 1971). In 1973 the House of Lords held a debate on the problems of noise and noise abatement (HL Debates, 1973).

The NAC's role was to advise the Secretary of State for the newly formed Department of the Environment, who was also its chairman. Its terms of reference were:

> "To keep under review progress made generally in preventing and abating the generation of noise; to make recommendations to Ministers with responsibility in this field; and to advise on such matters as they may refer to the Council" (Department of the Environment, 1978, para. 308).

3.6.2 The "Scott Committee" Report on Neighbourhood Noise and Part III of the Control of Pollution Act

The NAC comprised 22 members, including both those with a special interest in noise and lay members. It operated through a series of working groups, which reported on aircraft, traffic and neighbourhood noise. In November 1970 a working group on the NAA was established (commonly referred to as the "Scott Committee", after its chairman), "to study further the working of the Noise Abatement Act; to formulate proposals for strengthening it; and to report"

(Noise Advisory Council, 1971, para. 42). Their subsequent report, entitled "Neighbourhood Noise" was published in 1971 (Noise Advisory Council, 1971). It was based on information gleaned from visits to, and evidence from, interested parties, and on a survey of local authorities undertaken by the Ministry of Housing and Local Government in 1969 (details given in Circular 36/69), concerning the extent and effectiveness of the measures authorities had to deal with industrial noise.

The Scott Committee pinpointed several areas in which they considered the NAA to be inadequate. Their subsequent proposals to remedy these inadequacies, reported in "Neighbourhood Noise", included an outline for a new Noise Abatement Act. Part III of COPA is based to a very large extent on the recommendations of the Scott Committee.

COPA was originally introduced in the House of Lords in November 1973, as the 'Protection of the Environment Bill'. Its passage was interrupted by the sudden general election in February 1974, which forced all unfinished Parliamentary business to be abandoned, and replaced the Conservative Government with a Labour one. In the April of that year, a new 'Control of Pollution Bill' was introduced in the Lords, containing substantially the same provisions as the earlier Bill. It made a rapid passage through Parliament, receiving Royal Assent on 31 July 1974 (Levitt, 1980). Part III of COPA came into effect in January 1976 and repealed the NAA in its entirety.

The main recommendations from the Scott Committee are outlined below (Sections 3.6.2.1 to 3.6.2.6). Their most innovative proposal, concerning noise abatement zones (Section 3.6.2.1), led to a large increase in the technical content of the legal mandate (Section 3.6.2.2). A recommendation to limit the noise output of machinery by means of product standards would also have led to an increase in technical specificity, had the resulting legislation been implemented (Section 3.6.2.3). Further proposals concerning BPM, the statutory nuisance procedure and construction noise (Sections 3.6.2.4 to 3.6.2.6) were largely adopted in Part III of COPA. However, these did

not have anything to add where technical specificity was concerned. Further amendments to the statutory nuisance procedure, which did not originate from the Scott Report, are also mentioned. A novel provision of COPA, which has no antecedents in the Scott Report, is the power to make or approve codes of practice giving guidance on methods of minimising noise from particular sources (Section 3.6.2.7). This has also led to the inclusion of more technical terms and criteria in the legal mandate.

3.6.2.1 Noise Abatement Zones

A. Limitations of the Nuisance Approach

Although the Scott Committee considered that local authorities, working within the limits of the NAA, had achieved "a substantial measure of success in abating the worst cases of noise nuisance" (Noise Advisory Council, 1971, para. 90), they saw a need to broaden these powers away from a direct dependence on statutory nuisance procedure.

The Committee argued that noise, which might not amount to a statutory nuisance, could still be a very real cause of disturbance and misery. According to statistics from the Association of Public Health Inspectors, approximately half the complaints about noise received by local authorities were not confirmed as representing statutory nuisances. The Committee doubted whether all these complaints could be "frivolous or at any rate without substantial foundation" (ibid., para. 88). It seemed likely, rather, that in some cases, owing to difficulties in attributing the nuisance to a specific source or in providing sufficient evidence to satisfy a local magistrates' court of the existence of a statutory nuisance, the authority had decided to close the file as no remedial action could be taken.

Consequently, the Scott Committee proposed a "new and somewhat more radical measure" (ibid., para.93) not based on statutory nuisance, to deal with noise problems caused by the collective output of a

multiplicity of sources, rather than by an individual output loud enough in its own right to constitute a statutory nuisance. This was the concept of the 'noise abatement zone'.

The idea of designating areas where local authorities would have special powers, totally divorced from statutory nuisance procedure, to control noise from a multiplicity of premises, and so prevent "a creeping deterioration in the overall noise climate of a neighbourhood" (ibid., para. 148) stemmed from a memorandum to the NAC from the Association of Public Health Inspectors (APHI).

B. Proposal From the Association of Public Health Inspectors

The APHI proposed that local authorities should be able to make orders (subject to confirmation by the Secretary of State) declaring "noise control areas". The basis for the idea was the concept of the "smoke control area" (contained in the Clean Air Act 1956) which, by the time the RCEP came to look at it in 1971, had proved to be a very successful provision (Ashby and Anderson, 1981). Areas where commercial, industrial and residential premises were juxtaposed, along with roads (other than main through roads) carrying fairly heavy traffic, were considered ideal targets for noise control areas. Nuisance procedure would still apply in these areas, but the local authority would have an additional power - where noise levels were problematic, although not a nuisance - to require firms to implement noise reduction measures if these were reasonable and practicable. Firms would have to give prior notice to the authority of any change in working hours or installation of new machinery. Additionally traffic management schemes could be introduced to reduce traffic noise.

C. Scott Committee Recommendations

Although the Scott Committee considered the analogy between smoke and noise control to be erroneous, they did not share the Confederation of British Industry's view (in a memorandum to the NAC) that legislation

based on the APHI proposals would "probably quickly fall into disrepute". From the point of view of making good the deficiencies of nuisance procedure, they considered that these areas of special control - or "noise abatement zones" (NAZs), as they preferred to call them - would be a useful measure to adopt.

The Committee envisaged a situation whereby a local authority could use its discretion to specify part, or all, of its area as a NAZ. Areas where there was an acute neighbourhood noise problem, which had not been amenable to effective control under the statutory nuisance procedure, would be the first to be designated. The local authority would set noise emission targets for the zone, in accordance with a method specified in regulations. Targets could vary within the zone, depending on the particular area, the type of premises, and the time of day or night.

The designation of a zone, including the intended target levels, would require approval from the Secretary of State. The local authority would then monitor noise levels within the zone, in order to identify premises where the target level was being exceeded. A statutory notice would then be served on these premises, requiring the reduction of the noise to an appropriate level, which was not less than the target level, within a reasonable time period. A NAZ programme would be implemented over a number of years, dependent on the resources available to the LA and the extensiveness of the noise problem.

D. The COPA Noise Abatement Zone

The concept of a NAZ was incorporated in s.s.63-67 and Schedule 1 of COPA, and in associated secondary legislation, in almost identical form to that originally proposed by the Scott Committee. Procedural modifications were made, but there were only two substantive amendments.

One was the subtle change in emphasis concerning the aims of the NAZ. The Scott Committee considered the purpose of a NAZ to be to "reduce (or perhaps in some cases hold steady) the ambient noise level" (Noise Advisory Council, 1971, para. 165). The Department of the Environment circular accompanying the implementation of Part III of COPA on 1 January 1976 (Circular 2/76) stated the aim to be "preventing deterioration in environmental noise levels and achieving reductions in noise level wherever practicable". The primary aim of achieving a positive reduction in noise levels had been replaced by that of preventing noise levels from increasing. The objective of securing a reduction in noise levels appeared to have shifted to a somewhat longer term goal than that implied by the Scott Committee.

The other amendment was that no provision was made in COPA to control road traffic noise within a NAZ via some sort of traffic management scheme. This point was raised when the Protection of the Environment Bill was debated in Parliament (HL Debates, 1974a). Although mention was made of the need for traffic control by the APHI, the Scott Committee was rather vague on this point. They stated that local authorities had powers under the Planning Acts to close roads, or restrict the access of traffic in order to improve the amenity of part of their area, and that "there would clearly be scope for the exercise of these powers in the furtherance of noise abatement within designated zones" (Noise Advisory Council, 1971, para. 173). No formal declaration of the possibility of using these powers in conjunction with a NAZ was ever made, however, either in COPA or in secondary legislation, circulars or codes of practice.

3.6.2.2 Technical Specificity of the Noise Abatement Zone Provisions

The successful implementation of the NAZ provisions relied on the development of an accurate and reliable method for measuring noise emitted from premises within a zone, which could be followed by Public Health Inspectors (renamed 'Environmental Health Officers' in 1972) who were not necessarily expert in noise control. Technical staff at the Building Research Station were given the task of

developing a suitable measurement method (HL Debates 1974b; Jenkins, Salvidge and Utley, 1976). The resulting method was subsequently published as a schedule to regulations made in 1976 to coincide with the implementation of Part III of COPA (The Control of Noise (Measurement and Registers) Regulations 1976 SI.1976 No.37), and was largely reiterated in Circular 2/76.

The schedule to the regulations ('Memorandum on Measurement and Calculation of Noise Levels') comprises a set of precise and detailed technical instructions which leave little room for discretionary interpretation. The procedure is described in more detail in Chapter 4, but, broadly speaking, control of noise from premises within a zone is accomplished by setting individual emission standards (in terms of the equivalent continuous noise level, Leq) for each premises. Noise levels are measured at several points along the boundary of the premises, and it is an offence to exceed these levels without the consent of the local authority. The authority can require a reduction in level, provided it is "practicable at reasonable cost and would afford a public benefit" (s.66(1)(b)).

The regulations are some of the most technically defined to be found anywhere in the field of pollution control legislation. The technical detail of the procedure is contained in secondary legislation (and in this case also in a circular), rather than in statute. This is typical of legislation in highly specialised fields (Greenwood and Wilson, 1984).

It is highly unlikely that staff with no experience of noise measurement could carry out the procedures detailed in the regulations. The regulations themselves require that the measurements should be carried out by "competent staff", but do not elaborate on what level of training equates with "competent". The question of training Environmental Health Officers in noise control is considered further in Chapter 6.

3.6.2.3 Machines: Rating and Limitation of Noise Output

As a means of controlling noise at source, the Scott Committee suggested that new legislation should be framed to provide an enabling power to make regulations requiring the sound power level of machinery offered for sale to be specified. At a later date further regulations could be made requiring manufacturers to reduce the noise output of various classes of machinery: in other words to set product standards. An additional measure, making it an offence to use certain types of construction equipment without effective silencers, was also proposed (Noise Advisory Council, 1971).

The provisions of s.68 of COPA are very similar to these recommendations. As mentioned above (Sections 3.5.1.1B and 3.5.2.2), s.68 creates enabling powers for the Secretary of State to make regulations requiring the use of silencers or mufflers on plant or machinery (s.68(1)(a)), and also "for limiting the level of noise which may be caused by any plant or machinery" used in construction work or industry (s.68(1)(b)). To reiterate, no regulations have yet been made to implement this section.

Rather than enabling product standards to be set, it seems more likely, however, that s.68 actually implies the setting of noise emission standards on site or in the factory. During the Committee stage of the Protection of the Environment Bill, it was mentioned that the Government was opposed to the introduction of national legislation setting product standards for plant or machinery, since this would create barriers to trade within the EEC, and would only require harmonisation with Community legislation at a later date (HL Debates, 1974c). In addition, regulations implementing EEC Directives, setting product standards for certain types of construction equipment (see section 3.7.2), have been made under s.2(2) of the European Communities Act 1972, and not s.68 of COPA.

3.6.2.4 The Definition of 'Best Practicable Means'

The Committee proposed that new legislation should contain "a general duty on the citizen not to impose unnecessary noise on his neighbours" (Noise Advisory Council, 1971: para. 141). This duty would be formulated as an obligation to use the BPM at all times for minimising noise. They recognised that problems of enforcement meant that using such a duty as the main pillar of new legislation was not tenable, but nevertheless thought it could be included as a way of encouraging people to consider the noise implications of their activities.

Although the general duty did not appear in COPA, the Committee provided the more detailed definition of BPM which appears in the Act. Instead of the brief statement in s.110 of the Public Health Act 1936 (see Section 3.4.5), the COPA definition of BPM (s.72(2)/(3)) states that "practicable" means "reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications". The means to be used include "the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures." This is taken verbatim from the Scott Report (ibid, para. 144).

3.6.2.5 Modifications to the Statutory Nuisance Procedure

The Committee thought the existing statutory nuisance procedure under the Noise Abatement Act was "slow and cumbersome" (ibid, para. 91), and that modifications were needed to provide quicker and more effective relief for those suffering noise nuisance. COPA retained the statutory nuisance procedure in a modified form (s.s 58/59). The following recommendations of the Scott Committee were adopted:

1. A right of appeal, within a specified period of time, against any noise abatement notice to the Magistrates' Court (ibid., para.

181). Under the NAA there was no right of appeal against a noise abatement notice; only against the terms of a noise nuisance order to the Crown Court (s.301, Public Health Act 1936). Regulations specifying the grounds for appeal against noise abatement notices under Part III of COPA were made in 1975 (The Control of Noise (Appeals) Regulations 1975 SI.1975 No.2116).

2. In some instances, at the discretion of the Magistrate, a private action in statutory noise nuisance should be allowed to proceed on the basis of only one or two aggrieved occupiers, rather than three as in the NAA. COPA went one step further and enabled private action to be initiated by a single occupier, magistrates having a mandatory duty to consider their complaint (s.59(1)).

3. Penalties for offences under the NAA should be increased. The original fines under COPA (maxima of £200 for a first offence, and £400 for a subsequent offence, plus a daily fine of up to £50 for a continuing contravention (s.74(1))) were very close to the figures proposed by the Committee as a reasonable deterrent.

4. In line with the Wilson Committee, the Scott Committee recommended the removal of the exemption from proceedings for statutory undertakers. They added the proviso that any noise control requirements imposed by the local authority or the court should not be incompatible with any duty imposed on statutory undertakers by law. This was adopted in COPA (s.72(4)).

5. In accordance with a suggestion by the APHI, Public Health Inspectors should have delegated powers to serve noise abatement notices 'on the spot' where immediate action was necessary, rather than requiring approval from the relevant council committee. Although this provision was not included in COPA, many officers do now have these powers under s.101 Local Government Act 1972.

An important change to the statutory nuisance procedure in COPA, which did not originate from the Scott Report, was the power to take action against noise nuisances which had yet to occur, in addition to nuisances which had occurred or were likely to recur (s.58(1)). This was the first time that any sort of preventive provisions had appeared in noise nuisance legislation. It provides a convenient power against noisy events such as pop concerts, but does not appear to have been used very frequently by local authorities in practice (see Chapter 6). It does not, however, apply to private actions, presumably because of concern about actions being taken on the basis of neighbour disputes rather than noise nuisance as such. COPA also simplified and streamlined the procedure for dealing with contraventions of a local authority noise abatement notice, by removing the nuisance order stage. Under COPA, failure to comply with the terms of an abatement notice is an offence (in contrast to the procedure under the NAA, where failure to comply with a nuisance order was an offence).

3.6.2.6 Noise from Construction and Demolition Sites

The Scott Committee considered the statutory nuisance procedure to be ineffective against noise from construction and demolition sites, since this problem was often of a very transient nature: before abatement measures could be enforced, it was frequently the case that the work had been completed and the site cleared. To combat this problem, they suggested a system of prior approval by the local authority of construction and demolition sites, which did not depend on the need to prove a statutory nuisance. A contractor or person wishing to tender for a contract would be able to apply to the authority, prior to work commencing. Within a given time period, the authority would serve a statutory notice on this person, specifying the requirements for minimising noise that must be observed during the execution of the work. The authority should also have the right to serve a similar notice on its own initiative, in order to control noise levels from building sites. Compliance with the terms of the notice would provide immunity from noise nuisance proceedings, but failure to comply could lead to a court order to suspend the works

until the contractor could satisfy the magistrates that compliance with the terms of the notice was being achieved.

Provisions very similar to these are contained in s.s 60/61 of COPA. The major difference, however, is that the contravention of a notice leads to a fine, and not to the suspension of the works. COPA makes provision for the suspension of construction works only if the noise is severe enough to constitute a statutory nuisance under s.58 of the Act. S.s 60/61 provide for the control of works, but not for their cessation. Compliance with notices under s.s 60/61 provides immunity from local authority nuisance proceedings, but rights in private action under s.59 still remain.

3.6.2.7 COPA Codes of Practice

Apart from the preventive power to deal with noise nuisances and the streamlined procedure for dealing with contraventions of noise abatement notices, the only other major innovation in Part III of COPA, for which there was no antecedent in the Scott Report, is the power to make or approve codes of practice for minimising noise from specific activities. S.71 of COPA gives the Secretary of State a discretionary power to prepare and issue codes of practice, or alternatively to approve codes prepared by other bodies. The Secretary of State is also required to authorise a code for construction sites (s.71(2)).

The Wilson Report had recommended giving statutory force to a code of practice to limit noise from ice cream chimes (Section 3.5.1.1), so it is possible that the inspiration for the COPA codes originated from the Committee on the Problem of Noise.

The British Standards Institution Code of Practice for Noise Control on Construction and Demolition Sites (BS 5228), was approved by the Secretary of State for use under s.71(2) in 1975, and subsequently revised in 1984. Three other codes, dealing with the control of noise from ice-cream van chimes, audible intruder alarms and model

aircraft (Department of the Environment, 1982a/b/c) have also been authorised under this section by Orders made in 1981. These codes were drawn up after consultation with industry and other interested parties.

The codes do not in themselves create offences or mandatory legal requirements (Circular 2/82). They nevertheless provide criteria which help to determine both the BPM for controlling noise from sources covered in the codes (s.72(6)), and additionally whether or not the noise constitutes a nuisance. The use of codes of practice is covered in more detail in Chapter 4.

Amongst other requirements, the codes contain some specific technical instructions for limiting noise, which have had the effect of increasing the technical content of the legal mandate for neighbourhood noise. The code for ice-cream chimes, for example, recommends that chimes should not be played louder than 80 dB(A), measured at a distance of 7.5 metres, whilst the model aircraft code specifies that no model should exceed 82 dB(A), at 7 metres, unless flying in a competition.

BS 5228 describes a method for predicting noise levels from construction sites and lists typical values for the sound power levels of site equipment and activities, which form the basis for the prediction method. Methods for monitoring the actual noise levels from sites, in terms of Leq, are also provided. As mentioned in Section 3.5.1.1, the 1975 version of BS 5228 suggested that it should be possible to limit noise levels from construction sites to 75 dB(A) (12 hour Leq) at the site boundary. The 1984 revision of BS 5228, however, made no mention of acceptable noise levels for construction sites, leaving this matter to the discretion of local authorities to set limits in accordance with local circumstances.

The Department of the Environment is also considering codes of practice on clay pigeon shooting, power-boating and water ski-ing (Department of the Environment, pers. comm.).

3.6.3 Planning and Noise

In 1973 the Department of the Environment published a Circular entitled 'Planning and Noise' (Circular 10/73) which for the first time gave formal recognition to the importance of development control in avoiding the creation of new noise problems. The Circular deals with both the siting of new development which may give rise to noise problems, and the siting of noise-sensitive development, such as houses, schools and hospitals. Most relevant to the issue of technical specificity, it provides specific noise levels for aircraft, road traffic and industry which constitute the limits of acceptability above which planning authorities are advised not to permit development (Table 3.1).

The Circular additionally lists model conditions which authorities can attach to planning consents in order to minimise problems from potentially noisy developments. These include a condition imposing maximum permissible noise levels at the boundary of a development site. Although aimed primarily at planning authorities, it also recommends close liaison between Planning Departments and Environmental Health Departments.

The Scott Committee provided the broad impetus to the Circular by recommending (Noise Advisory Council, 1971) that planning authorities should:

1. Have a duty to take account of the noise implications of proposed development.

2. Impose conditions laying down maximum permissible noise levels at the boundaries of development sites, wherever there was reason to fear the creation of a new noise problem.

3. Consult the Environmental Health Department on the noise implications of planning applications (a point also made by the

TABLE 3.1

GUIDELINES FOR RESIDENTIAL DEVELOPMENT IN CIRCULAR 10/73 - PLANNING AND NOISE

		NOISE SOURCE			
Noise Standard		**INDUSTRY**		**ROAD TRAFFIC**	**AIRCRAFT**
		Corrected noise level dB(A)		L10 (18 hour) dB(A)	
		Day	Night		
External noise level		75	65	70	40 NNI, otherwise provision of suitable sound insulation
Internal noise levels within dwellings with windows closed	Maximum noise level	55	45	50	
	'Good' standard	45	35	40	

Wilson Committee (Section 3.5.2.3)).

The background to the acceptable limits for development (Table 3.1) mentioned in the Circular is harder to trace. As described below, recommendations by the NAC undoubtedly played a part. The Wilson Report may also have been influential, although this is harder to substantiate. The Circular iself was drafted by staff within the Planning Divisions of the Department of the Environment (Utley, pers. comm.).

Where traffic noise is concerned, the Circular states that there should be a "strong presumption" against allowing residential development where the traffic noise level is already in excess of, or is expected to reach within 15 years, 70 dB(A) on the L10 (18 hour) scale (the average hourly L10 value between the hours of 6 am and midnight). This value was originally proposed by the NAC in 1971 as "the limit of the acceptable, rather than a standard of what is desirable" (Circular 10/73, para. 7; Noise Advisory Council, 1974a). The standard was based on the results of a noise survey carried out in 1968 (Building Research Station, 1968) to assess the subjective effects of traffic noise at a number of sites exposed to free flowing traffic (Penn, 1979). The survey indicated that an 18-hour L10 of 70 dB(A) represented the maximum acceptable limit of road traffic noise for the majority of people.

This limit of acceptability also provided the basis for the qualifying level for grants towards insulating dwellings against traffic noise from new or improved roads. This scheme was introduced in 1973 (Building and Buildings - the Noise Insulation Regulations 1973 SI No. 1363, made under the Land Compensation Act 1973, amended in 1975) and is administered by highway authorities. The actual qualifying level was specified as 68 dB(A) (18-hour L10), presumably because the accuracy of L10 index predictions was known to be + or - 2 dB(A) (Open University, 1975).

The level of 50 dB(A) (L10 18-hour) as a maximum internal standard for traffic noise presumably results from the assumption that building structures generally provide an attenuation of 20 dB(A) (Open University, 1975). The Wilson Committee also recommended that in busy urban areas internal day-time noise levels should not exceed 50 dB(A) (L10) (Committee on the Problem of Noise, 1963 para. 117).

The Circular provides criteria for the control of development in areas affected by aircraft noise which, broadly speaking, recommend that noise-sensitive development is undesirable at levels in excess of 40 NNI, unless suitable insulation is provided. These criteria were based on Surrey County Council planning guidelines, evolved to deal with noise from Gatwick Airport (Penn, 1979; Utley, pers. comm.).

For industrial development, the Circular recommends the use of BS 4142 to assess the acceptability of the potential noise impact. If the predicted CNL exceeds the background level by more than 10 dB(A), then "even if reasonable sound insulation is required and provided, it will hardly ever be right to give permission" (Circular 10/73, para. 27). In addition, the Circular states that "it will scarcely ever be justifiable" to permit industrial development which will raise the ambient noise level affecting residential and other noise sensitive areas above a CNL of 75 dB(A) during the day, or 65 dB(A) at night. These values are the averages of the CNLs given in Appendix XV of the Wilson Report, below which complaints would not be expected according to the rating procedure used there (which was the precursor to BS 4142). However, it can only be surmised whether this was the actual reasoning behind the values in the Circular. The acceptable internal levels again assume an attenuation of 20 dB(A) due to the building structure.

3.6.4 Noise in Public Places

The Scott Report considered that, apart from measures to control amplified noise in streets under s.2 NAA (which became s.62 of COPA), noise in public places was not suited to control under existing

statutes. Byelaw control was considered to be the best option and a comprehensive review of model byelaws, to update them to meet contemporary needs, was recommended.

Consequently another working group of the NAC was set up to examine this aspect of neighbourhood noise. Their report, "Noise in Public Places" (Noise Advisory Council, 1974b), stated, however, that a system whereby the Secretary of State was empowered to make national regulations controlling noise nuisances in public places was preferable, as it was less subject to regional variation than a byelaw system whose implementation was at the discretion of local authorities. The working group's recommendation has not been adopted by Government.

3.6.5 Promoting Public Education About Noise

The idea of promoting public education about, and encouraging public participation in, noise reduction was first raised in the Wilson Committee report. The idea was further developed by the NAC in two reports, "Noise in the Next Ten Years" and "Noise in Public Places" (Noise Advisory Council, 1974a and 1974b).

"Noise in the Next Ten Years" reviewed the likely evolution of noise problems in the short term. As far as neighbourhood noise was concerned, it recommended that legislation should be passed to implement the proposals of the Scott Committee (which were given effect by Part III of COPA), and also that a 'Quiet Town Experiment' should be established. This was envisaged as a voluntary co-operative venture between the local authority, industry and local people, to see how far the ambient noise level in a town could be reduced.

This idea was eventually put into practice at Darlington over a period of two years from September 1976 (Noise Advisory Council, 1981). It was sponsored by the NAC and funded by the Department of the Environment. The overall objective of the scheme was "to illustrate by practical example the scope for reduction of noise nuisance at home,

at work and in public places by means of education, publicity and experimental schemes". Overall the scheme was successful; publicity made people more aware of noise, and a follow-up social survey found that a substantial number of people claimed to have altered their behaviour as a result of the experiment. One disappointing feature was that local industry generally failed to use the noise advisory service offered by the local EHD, apparently because the EHD was regarded primarily as an enforcement agency.

A further attempt to inform the public about legal remedies for neighbourhood noise problems was the NAC booklet "Bothered by Noise? How the Law Can Help You", published in 1975 and available free of charge. It was later republished by the Department of the Environment in 1982 under the heading "Bothered by Noise - a Guide to Noise Complaints Procedure".

3.6.6 Disbandment of the NAC

In February 1981 the NAC was disbanded, as a result of the Government's axing of quangos and advisory bodies (Clean Air, 1981). The RCEP recorded their disappointment, stating that they considered the case for its permanent abolition to be unjustified (Royal Commission on Environmental Pollution, 1984: para. 3.41). The role of the NAC, as overall coordinator of noise control policies, was adopted by the Air and Noise Division (now the Noise Nuisance and Wastes Division) within the Department of the Environment, which also has a direct responsibility for policy on neighbourhood noise (Department of the Environment, 1981).

In 1986 an independent noise lobby was formed, in an attempt to fill the gap left by the demise of the NAC. Four professional associations - the Institution of Environmental Health Officers, the Royal Environmental Health Institute of Scotland, the Institute of Acoustics and the Institute of Occupational Safety and Health - established the 'Noise Council'. This body aims "to promote and respond to issues relating to noise and vibration and to make independent technical and

scientific expertise available to international and national agencies, central and local government, commerce and industry" (Noise Council, 1986). It seems unlikely, however, that the Noise Council will have the same influence as the NAC: for one thing, it does not have such close links with the Secretary of State for the Environment, and for another it is administratively understaffed (Battersby, pers. comm.).

The Noise Abatement Society is still in existence, but no longer has the same level of influence it achieved in its first year of operation. The National Society for Clean Air is also concerned with noise, as a pollutant spread through the medium of the air. Although both societies are routinely consulted by Government on noise matters (eg. House of Lords Select Committee on the European Communities, 1985), the National Society for Clean Air has recourse to more technical expertise and probably has more standing with Government.

3.7 EEC POLICY ON NEIGHBOURHOOD NOISE

3.7.1 Introduction

After signing the Treaty of Accession in 1972, Britain formally acceded to the EEC on 1 January 1973. Legislation from the European Community concerned with environmental noise has so far concentrated on setting product standards for noise emitted by a variety of sources, including aircraft, cars, lorries, motor cycles, tractors, construction plant and lawnmowers. A further Directive introduces a common system of labelling the noise output of a variety of household appliances.

All these noise sources comprise articles in trade between Member States. The elimination of trade barriers is an important impetus to Community involvement with noise (House of Lords Select Committee on the European Communities, 1982). The primary purpose of the noise Directives made so far has been to prevent individual Member States creating barriers to trade by setting more stringent national standards than prevail in the rest of the Community (Haigh, 1987b).

Except for the Directives concerning aircraft noise, the noise Directives are of the 'optional' type: Member States are precluded from setting stricter national standards, but may, if they wish, set more lenient national standards (House of Lords Select Committee on the European Communities, 1982).

For the majority of noise Directives, by the time they were implemented the specified limits were already being met by most manufacturers in Britain (Haigh, 1987c). Some of the Directives, however, provide two sets of noise limits, one coming into force at the same time as the Directive is implemented, with the second, more stringent, due to come into effect at a future date (for example, the construction plant Directives). Future amendments to the Directives are also proposed, leading to progressive reductions in noise limits, once any technical problems have been overcome: a so-called 'technology forcing' role. These amendments should have more bearing on the environmental protection objective, which up to now has been somewhat incidental to the primary aim of preventing barriers to trade (ENDS Report, 1982).

The Directives specify both the setting up of type-approval, examination, verification and certification procedures, and the development of standard methods for measuring the noise emissions of the products in question. The annexes to the Directives - and the implementing national legislation - contain precise technical details of mandatory measurement methods and set noise limits in terms of the sound power output of the product. Compliance is effected by agencies appointed by the Government. Local authorities have no responsibilities in this field.

Community legislation particularly relevant to neighbourhood noise includes those Directives dealing with construction plant, lawnmowers and household appliances.

3.7.2 Construction Plant

The construction plant provisions comprise a family of Directives:

(a) The framework Directive (84/532/EEC (OJ L300 19.11.84)) setting out a type-approval, examination, verification and certification procedure to ensure that all construction plant offered for sale within the Community, of the type specified in a series of daughter Directives, conforms to product standards for noise emission.

(b) A Directive specifying standard methods for measuring the sound power output of plant, both at some distance from the plant and at the operator's position (79/113/EEC (OJ L33 8.2.79) amended by 81/1051/EEC (OJ L376 30.12.81) and 85/405/EEC (OJ L233 30.8.85)).

(c) A series of daughter Directives setting permissible sound power levels for specified types of plant (84/533/EEC to 84/537/EEC (OJ L300 19.11.84)). Directives made so far cover compressors, tower cranes, welding generators, power generators and powered hand-held concrete breakers and picks.

(d) A Directive setting product standards for noise from hydraulic excavators, rope-operated excavators, dozers, loaders and excavator loaders (86/662/EEC (OJ L384 31.12.86)).

Formal compliance with the Directives listed above has been achieved in Britain by the Construction Plant and Equipment (Harmonisation of Noise Emission Standards) Regulations 1985 SI 1985 No. 1968, and 1988 SI 1988 No. 361 (made under s.2(2) European Communities Act 1972). Type-approval and certification are being administered by the Department of Trade and Industry's 'Approved Bodies for Type-Examination Scheme'. Approximately ten laboratories (comprising major building companies and noise consultancies), accredited under the National Measurement Accreditation Scheme (NAMAS), are performing the relevant type-approval and certification testing for the Department of Trade and Industry (Department of Trade

and Industry, pers. comm.).

3.7.3 Lawnmowers

A Directive setting product standards for the sound power level of lawnmowers, and setting out a type-approval, examination, verification and certification procedure, was finalised at the same time as the construction Directives (84/538/EEC (OJ L300 19.11.84)). Formal compliance was due on 1 July 1987, and was achieved by the Lawnmowers (Harmonisation of Noise Emission Standards) Regulations 1986 SI 1986 No. 1795 (made under s.2(2) European Communities Act 1972). Self certification is carried out by the manufacturers, subject to a confirmatory report from a laboratory accredited under NAMAS (Department of Trade and Industry, pers. comm.).

3.7.4 Household Appliances

The Directive on household appliances (86/594/EEC (OJ L344 6.12.86)) does not of itself lay down any noise limits. However, it does require Member States to adhere to prescribed methods of noise measurement if they decide to implement a noise labelling scheme for household appliances. By preventing Member States from developing their own idiosyncratic measurement methods, it therefore ensures that no barriers to trade within the Community are created. The secondary aim is to make the public more aware of the noise output of household appliances, such that manufacturers may eventually be driven to produce quieter equipment. Measurement methods for specific appliances will be elaborated in individual daughter Directives. The date for formal compliance is 4 December 1989. No legislation has yet been made to implement the Directive, but it will probably be under the European Communities Act 1972 (Haigh, 1987c).

3.7.5 The Action Programmes on the Environment

Until 1973 the Community had no environmental policy as such. At a Summit Meeting of the European Council in Paris in October 1972 the

need for such a policy was emphasised (House of Lords Select Committee on the European Communities, 1982). This led to the development of a Community Action Programme on the Environment, the first programme being agreed in November 1973 (OJ C112 20.12.73).

The First Action Programme did not have a chapter specifically on noise. Its proposals for noise control concentrated in the main on the harmonisation of product standards, although it did refer to the need to lay down criteria for assessing the effects of noise (in other words, noise ratings) and to standardise noise measuring methods and instruments.

The Second Action Programme, covering the years 1977 to 1981 (OJ C139 13.6.77), devoted a whole chapter to noise. Its intention was to define and implement a Community anti-noise policy, in which the European Commission would propose a general framework for a body of measures to be taken at different levels to combat noise. These included the following:

(i) Guidelines for determining quality objectives for certain areas of activity.
(ii) Noise measurement methods.
(iii) Specifications for noisy products.
(iv) Noise insulation standards.
(v) Permissible noise levels in the workplace.

In May 1980 the Commission published a report on what had been achieved under the Action Programmes on the Environment (Commission of the European Communities, 1980). The report reiterated the Commission's intention to develop an overall anti-noise policy. However by 1982, and as a result of limitations on resources, the Third Action Programme (OJ C46 17.2.83) was silent on the overall anti-noise programme: in its 1980 progress report, the Commission had admitted that "It should be stressed that there are too few staff available to carry out the programme successfully". This lack of an overall strategy led to criticism from the House of Lords Select

Committee on the European Communities, when they reviewed Community action on noise in 1982 (House of Lords Select Committee on the European Communities, 1982). Nevertheless, the Lords Committee appreciated that, due to Community legislation, recommendations made by the Wilson Committee nearly 20 years previously to impose statutory noise limits on construction plant and lawnmowers, would finally be implemented.

So far European policy actions to control noise have not progressed beyond the product-oriented approach. Policy intentions, however, are still much broader than this. The Fourth Action Programme, covering the period 1987-1992, proposes to "endeavour to make progress on a number of matters", including "....the defining of quality objectives or guidelines, setting limits to ambient noise levels, in various circumstances" (Commission of the European Communities, 1986). It continues:

> "Overall the Commission's approach will be to combine the establishment of noise emission limits for specific products with the fixing of ambient noise levels. In addition the Commission will consider the possible use of charges (or other economic instruments) aimed at discouraging noisier products and favouring more silent ones, thus creating pressure on manufacturers to develop less noisy articles. Finally the Commission will, working with the relevant standard-setting bodies (such as ISO), seek to establish the basis for evaluating noise created by traffic, industry, construction works, etc." (Commission of the European Communities, 1986).

It seems doubtful whether all these proposals will come to fruition, however, since the Directorate-General for the Environment, Consumer Protection and Nuclear Safety has both a very small staff and a very low budget and it is unlikely that either will be substantially increased (ENDS Report, 1986).

3.8 FUTURE PROSPECTS FOR NEIGHBOURHOOD NOISE CONTROL

No major new initiatives are foreseen concerning neighbourhood noise legislation in the near future at least (Department of the Environment, pers. comm.; Taylor, 1987). Any developments on the

legislative front which may occur must be set in the context of the Government's present commitment to deregulation, which has been a continuing priority since 1979 (HMSO, 1985).

In 1979 a Department of the Environment White Paper (Department of the Environment, 1979) announced the Government's intention of reducing the number of bureaucratic controls over local authorities. Many of the recommendations contained in the White Paper were implemented the following year by the Local Government, Planning and Land Act 1980. These included relaxation of the requirements for the Secretary of State to confirm a local authority order establishing a NAZ, or to give his consent to its postponement.

In 1985 a White Paper entitled "Lifting the Burden" was published, which set out Government policy for "reducing burdens imposed....by administrative and legislative regulation" on the private sector (HMSO, 1985: para. 1.1). It set out the case for "more freedom in the business sector and the need to deregulate" (para. 1.2), in particular to provide more incentive to small businesses. Amongst the proposals covering a variety of policy sectors was the intention to undertake "a review of the use and effects of the powers to control statutory nuisance, with the aim of preparing guidance and making legislative changes if appropriate" (para. 3.8).

A further White Paper published the following year ("Building Businesses...not Barriers"), however, said only that the field of environmental protection legislation was "being assessed to determine opportunities for rationalising and simplifying existing regulations" (HMSO, 1986b).

3.9 CONCLUSIONS

This concluding Section examines the influences underlying the development of the legal mandate for neighbourhood noise (Section 3.9.1) and considers the premise outlined in Section 3.1, that there has been an increase in the technical specificity of the legal mandate in recent years (Section 3.9.2). Prior to this, the history of neighbourhood noise policy is broadly compared with that of British pollution control policy, and the changing objectives of neighbourhood noise legislation over time are explored. Key events in the history of neighbourhood noise legislation are outlined in Appendix 1.

Neighbourhood noise law has developed from common law actions in nuisance, through local Acts and byelaws to legislation of national application. The earliest enactments were piecemeal provisions dealing with particular sources of noise which were considered problematic, and which were usually combined with general police regulations and public order enactments. The present legislation, contained for the most part in Part III of COPA, comprises a reasonably comprehensive set of controls containing some strategic elements, such as NAZs. These trends - from local to national laws, and from piecemeal to comprehensive, strategic provisions - are characteristic of the development of British pollution law in general (Holdgate, 1983).

However, the history of environmental noise legislation departs from that of pollution law in general in two respects. One is that, in comparison with controls over sources such as air and water pollution where the foundations of current legislation were laid during the nineteenth century, national legislation specifically tailored towards environmental noise control is a relatively recent phenomenon: the NAA being the first national enactment. It must be mentioned, however, that specialised legislative controls over sources such as hazardous wastes on land and marine pollution, for example, are also similarly recent.

The other difference between early pollution laws (such as the Public Health Act 1875) and environmental noise legislation is that whilst the former were generally directed - implicitly if not explicitly - towards problems of human health, the emphasis of environmental noise legislation has in general been on problems of amenity.

Although a concern for amenity is the hallmark of most legislation dealing with environmental noise, the specific objectives of neighbourhood noise legislation show some variation over time. The piecemeal provisions of the nineteenth century were predominantly concerned with noise in public places. Noise was just one of several amenity concerns whose aim was to keep order and control nuisances in public. The local Acts which began to be adopted in the 1930s made provision for the control of all stationary sources of noise, but only if, amongst other things, the noise was "injurious or dangerous to health". The reasons for this limitation are by no means clear. It is possible, however, that it was the result of the close connection of the local Acts with the Public Health Acts 1875 and 1936, where the definition of statutory nuisance required matters to be "prejudicial to health or a nuisance". By 1960, with the passing of the NAA, the focus for concern had shifted back to amenity values, with a statutory noise nuisance being defined on effectively the same basis as a nuisance at common law: that is, a substantial interference with health, comfort or convenience (Vanderpant v Mayfair Hotel Co. Ltd (1930) 1 Ch 138).

By concentrating on annoyance as the main response - or at least the most readily measurable response - to environmental noise, the majority of environmental noise controls introduced since the NAA all share this same concern with amenity. Implicit in the control of noise-induced annoyance, however, is an acknowledgement of the 'marginal' effects of environmental noise on health, such as interference with sleep and communication, reduction of working efficiency and induction of stress. The NAZ policy recognised that noise which might not amount to a statutory nuisance could still be a

very real cause of disturbance and misery.

Noise control legislation from the European Community was introduced to harmonise disparate product standards which were being adopted by some Member States. The objective of the legislation introduced by the Member States was to reduce the impact of these noise sources, both in terms of the annoyance caused to people in the vicinity, and, in some case, in terms of the hearing damage risk to operators. The primary aim of the EEC standards, however, has been to allow free trade in these products throughout the Community. Environmental protection is at present a secondary goal. The EEC limits are based in the first instance on technical feasibility. Stricter limits planned for future adoption, and agreed after consultation with manufacturers, will force the adoption of quieter technology. These limits will consequently have more bearing on the environmental protection objective.

3.9.1 Influences on the Development of the Legal Mandate

The history of neighbourhood noise legislation reveals the following influences which have had a significant bearing on the development of the legal mandate for neighbourhood noise:

(i) **Public Opinion**

The introduction of the larger turbo-jet engined aircraft in 1958 led to a sharp increase in the number of complaints about aircraft noise (Committee on the Problem of Noise, 1963). This may well have been the trigger which caused public concern about levels of environmental noise to reach the 'ignition stage' - Ashby's term for the level at which political action is stimulated (Ashby, 1977). Whatever the exact reasons, levels of public concern about noise were sufficient to merit the founding of the Noise Abatement Society in 1959. The Society then went on to promote the Private Members' Bill which became the NAA. Although Acts of Parliament can only be initiated and achieved by parliamentary action, the process can be influenced by outside organisations and events to a considerable degree (Levitt, 1980). The NAA provides a good example of an enactment

influenced by public opinion. The Wilson Committee was established as a result of governmental concern which itself was probably 'ignited' by public opinion about noise.

(ii) **Legislative Precedents**

The provisions of the NAA relied heavily on the legislative precedent set by the earlier local Acts, which in turn borrowed from the common law of nuisance by making noise amenable to treatment as a statutory nuisance. The defence of best practicable means for noise caused in the course of a trade or business appeared in the early local Acts and in some provisions of the Public Health Acts 1875 and 1936. Similarly, the exemption for statutory undertakers in the NAA was an expansion of the exemption for railway workers granted by the local Acts. The notice procedure for statutory nuisance - a modified version of which is contained in s.s 58/59 of COPA - is derived from the Public Health Act 1875, if not from an even earlier enactment.

The tort of nuisance has been influential in shaping the character of subsequent legislation relating to public health and noise control. Circular 58/60, issued by the Ministry of Housing and Local Government when the NAA was enacted, advised local authorities that statutory nuisance implied the same standards appropriate to a nuisance at common law. Statistics issued by the Institution of Environmental Health Officers in their annual reports, reveal that the statutory nuisance provisions are still the most frequently used powers in Part III of COPA.

(iii) **Advisory Committees**

Possibly the most influential force with respect to the development of neighbourhood noise policy has been provided by the advisory committees of the departments of state: these were the Wilson Committee and the Noise Advisory Council (particularly the working group on neighbourhood noise chaired by Sir Hilary Scott). Solesbury (1976) considered advisory committees to be one way of establishing a frame of reference for an emergent issue.

The Wilson Committee reported to Lord Hailsham, Minister of Science. Sir Alan Wilson was himself an eminent scientist. With this background, it is hardly surprising that the Committee adopted a scientific approach to the study of noise problems, and considered that one of its major objectives was to define, wherever possible, quantitative levels of noise which would be suitable for adoption as statutory standards, or as guidelines. The Wilson Committee provided the impetus for beginning to frame noise control laws in scientific and technical terms, rather than qualitative terms borrowed from the traditions of the common law. The origins of, and inspiration for, the technical input to environmental noise legislation seem generally to derive from the Wilson Committee Report of 1963.

The Noise Advisory Council was established in 1970, at a time when pollution issues featured strongly on the governmental agenda. The chairman of the NAC was the Secretary of State for the Environment. The NAC was responsible for overall coordination of noise control policies and produced numerous reports on aircraft, traffic and neighbourhood noise. Part III of COPA is based to a very large extent on the recommendations of the Scott Committee.

(iv) **Professional Associations**

The Association of Public Health Inspectors provided the inspiration for the NAZ policy implemented in Part III of COPA. The regulations giving effect to the policy are some of the most technically specific yet drafted for neighbourhood noise control. NAZs provide an example of the 'bottom-up' style of policy-making, where the original policy was proposed by those ultimately responsible for its enforcement.

(v) **EEC Policy on Neighbourhood Noise**

The final influence identified in this Chapter has been the implementation in Britain of EEC noise control legislation. So far the primary motivation for EEC noise Directives has been the elimination of non-tariff trade barriers. Future amendments to the Directives, however, will lead to progressive reductions in noise limits, which may well be of more significance where environmental protection is

concerned. So far, the EEC has had a fairly minor impact on British neighbourhod noise policy. However, as mentioned in Chapter 2, its influence on other sectors of pollution law - such as air and water - has been much more profound.

3.9.2 Increase in Technical Specificity?

The historical analysis of neighbourhood noise legislation undertaken in this Chapter has confirmed the premise that the legal mandate for neighbourhood noise has become more technically specific over time. The historical development of the legal mandate shows a distinct trend from the use of qualitative criteria, such as nuisance, to the quantitative, such as noise emission limits for premises in NAZs, and product standards originating from the EEC. As discussed in Chapter 2, a similar trend is observed in other areas of pollution law.

Several influences tending to encourage the incorporation of technical terms and criteria into the legal mandate for neighbourhood noise can be discerned from this Chapter. Opposing influences, effectively discouraging the incorporation of technical terms and criteria, can also be identified. Both these sets of influences are described below. Chapter 2 mentioned that there are several types of specificity in legislation, both substantive and procedural. The technical basis of pollution control means that factors encouraging substantive specificity in legislative provisions will tend also to encourage technical specificity.

3.9.2.1 Factors Encouraging Technical Specificity

(i) **Fairness for Criminal Offences**

Chapter 2 mentioned that a fundamental principle of the criminal law is that criminal provisions should be clear and unambiguous to give fair warning of what conduct is liable to be penalised (Walker, 1980). Specific rules adhere more closely to this principle than do guidelines which are open to discretionary interpretation. For instance, the offence of failing to comply with a noise emission

limit for a premises within a NAZ leaves less scope for personalised interpretation than does noise nuisance.

(ii) **Consistency in Application**

The Wilson Committee recognised that the precursor to BS 4142 (the procedure for assessing reaction to industrial noise in mixed residential and industrial areas) should lead to greater consistency of decision amongst local authorities than was possible from purely personal opinions. A technical procedure such as BS 4142 would be expected to decrease local variation in enforcement practice, and so would lead to more equitable treatment of cases between different officers and different local authorities.

(iii) **Administrative Simplicity**

Concerning the relative advantages and disadvantages of legal rules and guidelines, Chapter 2 mentioned that rules should aid the rationalisation and streamlining of enforcement procedures. Rules should speed up the processing of cases by enforcement agents and the courts since there are fewer points in the process where disputes can occur. Consequently the outcome of legal disputes should be easier to predict. Chapter 2, however, also mentioned Pepinsky's (1976) hypothesis that further elaboration of rules would effectively produce the opposite outcome. He maintained that as the provisions of the criminal law are further specified, the number of terms requiring interpretation actually increases.

Nevertheless the expected increase in administrative simplicity resulting from the use of quantitative, rather than qualitative, standards for noise was one of the Wilson Committee's main motivations:

> "People's reactions to noise vary greatly and in the past this has prevented the framing of rules for its control except in qualitative terms, with consequent difficulties for administration" (Foreword, Committee on the Problem of Noise, 1963).

(iv) **Developments in Acoustic Science**

Developments in acoustic science, in relation to research on the effects of noise, noise measurement and abatement, and noise ratings, constitute the source material for technical specificity in noise legislation. This aspect is not considered further in this Chapter, but provides a pointer forward to Chapter 5 (the Technical Model) and Chapter 7, where this subject is considered in more depth.

(v) **Free Trade in Products**

The EEC noise Directives, whose primary objective so far has been to prevent non-tariff barriers to trade by harmonising disparate national standards, have provided another source of technical specificity for the legal mandate for neighbourhood noise.

3.9.2.2 Factors Discouraging Technical Specificty

(i) **Legislative Precedent**

Legislative precedent was identified above as a factor which has had a significant influence on the development of the legal mandate for neighbourhood noise. For example, the statutory nuisance procedure in s.s 58/59 of COPA has its origins in the Public Health Act of 1875, if not from an even earlier enactment. The defence of BPM in the COPA noise provisions can also be traced directly back to the 1875 Act, although the Alkali Act 1874 was the first national pollution enactment to make use of the term. This tendency to rely on established legal terms and procedures may well provide a source of inertia towards the adoption of legislation containing unfamiliar concepts such as technical controls and standards.

(ii) **Flexibility in Application**

The need for flexibility in the application of legal provisions may tend to discourage too great a use of technical criteria. Chapter 2 mentioned possible drawbacks to the use of legal rules. For instance, rules are difficult to apply to heterogeneous behaviour or to unusual and unpredictable circumstances. This leads on to point (iii) below, concerning the subjective nature of the response to noise. Rules

require updating more frequently than guidelines. The observed tendency to incorporate technical terms and criteria in secondary legislation and codes of practice means that the provisions can be updated more readily than if they were contained in primary legislation, however.

(iii) **Subjective Nature of the Response to Noise**

The extent to which a strategic, or planned, approach has been adopted in neighbourhood noise legislation has been limited by the subjectivity of the response to noise and the concomitant uncertainty surrounding any evaluation of the acceptability of a noise. As a consequence, despite strategic controls such as planning laws and provisions relating to NAZs, there is still a need for a reactive strategy such as that enshrined in the nuisance approach. According to statistics provided by the annual reports of the Institution of Environmental Health Officers, of the provisions contained in Part III of COPA, those relating to statutory nuisance remain the most frequently used.

'Nuisance' is a concept which is directed at the target of the pollution. In Holdgate's (1979) terms, nuisance is an 'exposure standard', rather than a standard directed at the source of the pollution (an 'emission standard') or at some point in the pollutant pathway (an 'environmental quality standard'). According to Ogus (1982), a theoretical shift in emphasis from exposure standards (such as nuisance) to emission standards (such as noise limits for premises in NAZs) or environmental quality standards can only occur once scientific investigation has convinced policy makers of the causal connection between the pollutant and the harm done or interference caused.

The next Chapter analyses the legal mandate for neighbourhood noise in terms of the extent to which enforcement discretion (as defined in Chapter 1) is constrained by the specificity - in particular the technical specificity - of the provisions.

CHAPTER 4

THE LEGAL MODEL II - THE LEGAL CONTROL OF ENFORCEMENT DISCRETION IN PART III OF COPA

4.1 INTRODUCTION

The previous Chapter showed how the legal mandate for neighbourhood noise has become more technically specific over time. This has resulted in a situation where the legal mandate presently contains a spectrum of technical specificity: from noise nuisance at the non-technical end, to the regulations for measuring noise emissions in NAZs (The Control of Noise (Measurement and Registers) Regulations 1976, SI 1976 No.37) at the more technical end of the spectrum.

By the very fact of their quantitative nature, the incorporation of scientific and technical criteria into the substantive law means that the expression of unlawful behaviour becomes more precisely defined, and hence less open to discretionary interpretation. The use of scientific and technical criteria in law means that legal guidelines tend to be replaced by legal rules.

Legal control of enforcement discretion (as opposed to operational control (Section 1.5)) can be achieved through the processes of legalisation and judicialisation, a distinction attributable to Jowell (1973). Legalisation is defined as "the process of subjecting official decision to the governance of predetermined rules"; judicialisation as "the process of submitting official decision to adjudicative procedures".

The purpose of this Chapter is to provide an analysis of the provisions of Part III of COPA in terms of the extent to which they constrain the discretion of those authorities or individuals responsible for enforcing the controls. It can be surmised that the

explicit or implicit use of technical criteria in legislation will inhibit enforcement discretion mainly through legalisation, rather than judicialisation. The former process therefore forms the main focus of the Legal Model, although the provision and effect of adjudicatory procedures are considered in less detail for the sake of completeness.

Unlike Chapter 3, this Chapter considers only those parts of the legal mandate for neighbourhood noise which are enforced by local authorities. Consequently EEC noise Directives are not dealt with here. Neither is s.68 of COPA, as no regulations to implement this section have been made. While the analysis concentrates on the substantive aspects of Part III of COPA, it is impossible to draw a neat division between the substantive and procedural provisions, since the latter frequently influence the former. For example, if the procedural requirements concerning service of a statutory noise abatement notice are not followed correctly, then the recipient of the notice has a valid ground for appeal (under the Control of Noise (Appeals) Regulations 1975 SI 1975 No.2116), regardless of whether the substantive aspect - that the noise amounts to a nuisance at law - has been fulfilled.

Before analysing Part III of COPA, it is important to expand on the definition of 'legal mandate' provided in Chapter 1 and to describe in more detail the concepts and definitions which the Legal Model utilises.

4.2 THE LEGAL MODEL

4.2.1 The Legal Mandate

The term 'legal mandate' means more than just legislation as such. The core meaning of the term includes those statutes, statutory instruments, formal codes of practice, local Acts and byelaws, judicial precedents and EEC Directives which provide the legal framework for an enforcement agent's actions. However, the term is

also used in this thesis to include various forms of back-up advice which, while carrying no strict legal status, provide more detailed guidance on how the legislation could be implemented, and hence may be very influential from an operational point of view. This back-up advice or 'penumbra' of the term consists of the following:

1. All forms of advice from Central Government, such as circulars, letters and memoranda. These are devices through which Government departments express instructions, information or request action from other agencies (Levitt, 1980). In the context of this thesis, they often provide useful explanations in readily comprehensible language of how the rather terse language of legal instruments can be put into practice. Strictly speaking, the information contained in circulars, memoranda and letters is not legally binding, but from an operational perspective may be given as much weight as legal instruments (see Chapter 6).

2. Any codes of practice or British Standards which are commonly used as tools in the enforcement process, but unlike 'formal' codes of practice their use is purely voluntary, since they have not been referred to in any legal instrument (for example, BS 4142). They may commonly be used as reference standards in the determination of unlawful behaviour.

3. Compliance with EEC Directives relating to neighbourhood noise control has been achieved via legislative means, that is Regulations made under s.2(2) of the European Communities Act 1972. However, compliance with some Directives concerned with other areas of environmental policy has been achieved administratively via the use of circulars or letters. Haigh (1984) makes the point that reliance on administrative means has been used only when existing legislative provisions give the appropriate authorities sufficiently broad powers to fulfil the obligations of the Directive. The relationship between Central Government and the competent authorities is such that Central Government can generally rely on the authorities to comply with

its informal instructions. A recent trend, however, has been the upgrading of compliance with some environmental Directives from an administrative to a statutory level.

The term 'legal mandate' bears some similarity to Levitt's 'written instruments for policy' (Levitt, 1980). Unlike Levitt's concept, however, it does not include consultative documents which, as tentative statements of policy intention, may or may not be adopted in practice. In addition Levitt's inclusion of emission standards, quality objectives and best practicable means in her list of written instruments does not fit in with the concept of legal mandate. These are pollution control concepts, rather than written instructions for implementing policy as such; for instance, an instruction to use the best practicable means for controlling pollution may be incorporated in a statute, statutory instrument or in any other written instrument of the legal mandate.

4.2.2. Discretion in the Legal Mandate

The inclusion of scientific and technical criteria in the legal mandate increases the precision of the controls and tends to decrease enforcement discretion. In Chapter 1 three aspects of enforcement discretion were identified. These were 'goal discretion', 'discretion to determine unlawful behaviour' and 'sanctioning discretion'.

(i) GOAL DISCRETION
The discretion involved in interpreting what is the perceived aim or intention of the legal mandate.

(ii) DISCRETION TO DETERMINE UNLAWFUL BEHAVIOUR
The discretion involved in determining what constitutes a contravention of the law.

(iii) SANCTIONING DISCRETION
The discretion involved in deciding whether a contravention of the law merits formal action, which in terms of Part III of COPA means the

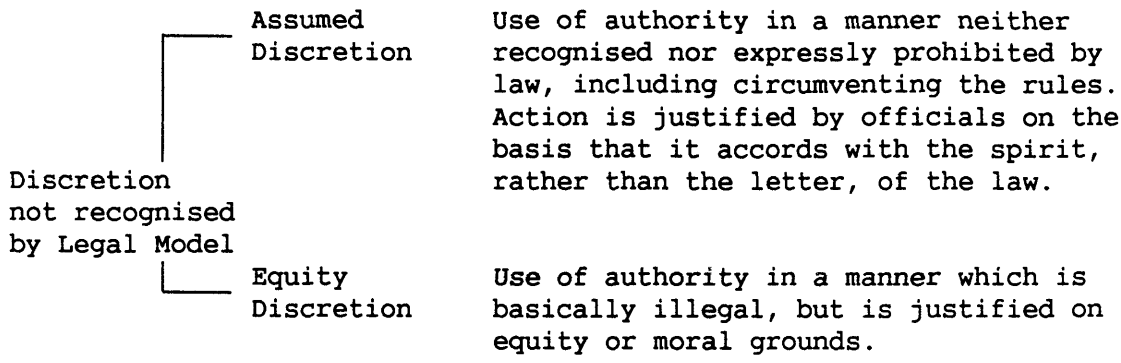
service of a statutory notice or a consent, or the institution of prosecution proceedings for failure to comply with a legal provision or with the terms of a notice or a consent.

The three discretion factors are not independent of one another. Discretion factor (iii) is affected by discretion factor (ii): if there is doubt on the part of enforcement agents as to whether the observed behaviour constitutes a contravention of the law, the agency will usually resort to informal methods since there is a need for certainty before a course of action is embarked upon which may end up in court (and court actions are expensive of time and financial resources). However, discretion factor (iii) is also seen to have an element of independence from discretion factor (ii). Even if the agency witnesses a definite offence, it can still choose to act informally if it considers this to be a more "satisfactory" course of action, however "satisfactory" may be defined. Discretion factor (i) would also be expected to influence discretion factor (iii). The enforcement agency may adopt a different enforcement policy, depending on what the goal of a particular legal mandate is perceived to be.

4.2.3 Relationships Between Law and Discretion

The above classification of enforcement discretion, however, does not comment specifically on the relationship of discretion to law. It is helpful to consider here a typology proposed by Salem (1983). Salem classified the relationship between law and discretion as follows:

Discretion recognised by Legal Model	┌	Explicitly Delegated Discretion	The legislation delegates responsibility for making detailed rules to an administrative agency.
	└	Implicitly Delegated Discretion	Use of broad guidelines (such as 'nuisance', 'reasonable', 'best practicable means') in legislation.



The Legal Model only considers discretion which is expressly permitted by the legal mandate: in the above typology this corresponds to explicitly and implicitly delegated discretion. Examples of enforcement discretion which are not recognised by the Legal Model (assumed and equity discretion) are considered in the Operational Model (Chapter 6).

4.3 STRUCTURE OF THE CHAPTER

The legal mandate for neighbourhood noise is examined below to observe the extent of legal control of enforcement discretion. Legalisation is considered first, with the three aspects of enforcement discretion - goal discretion, discretion to determine unlawful behaviour and sanctioning discretion - being examined in turn. Within this general analytical structure, the extent to which the legal mandate has been rendered more precise by the inclusion of technical criteria is emphasised. Judicialisation of Part III of COPA is then covered more briefly, prior to conclusions being made.

4.4 LEGALISATION OF PART III OF COPA

4.4.1 Goal Discretion in Part III of COPA

In hypothetical terms, some of the overall aims of neighbourhood noise legislation could be to prevent ambient noise levels from increasing (preserving the status quo); to secure a positive reduction in ambient noise levels; or to provide orderly procedures for resolving disputes

about noise between neighbours as an alternative to possibly violent self-help remedies. There is no explicit Government policy statement explaining the overall intention of Part III of COPA, although the purpose of noise abatement zones has been declared to be "preventing deterioration in environmental noise levels and achieving reductions in noise levels wherever practicable" (Circular 2/76).

Although Central Government has no manifest policy with respect to the goals of neighbourhood noise control, this does not mean that the enforcement agency itself will not develop its own policy goal or goals. Agency goals, however, are not part of the legal mandate and fall outside the ambit of the Legal Model.

4.4.2 Discretion to Determine Unlawful Behaviour in Part III of COPA

In this Section the provisions of the legal mandate are analysed along the spectrum of specificity in the definition of unlawful behaviour, from statutory nuisance at the non-specific end, through byelaws, s.62 (noise in streets), provisions relating to construction noise (s.s 60 and 61), codes of practice and BS 4142, to NAZs at the specific end of the spectrum. Table 4.1 summarises the provisions of Part III of COPA. Although not part of COPA, byelaws are included in the analysis since some authorities use them to augment their statutory powers (see Chapter 6). Codes of practice authorised under s.71 have both formal and informal uses: the former in relation to determining BPM, the latter as a guide to determining what is a nuisance. BS 4142 is of use in an informal capacity, as an aid to the determination of nuisance.

The analysis brings out the increasing technical specificity along the spectrum, although other sorts of specificity in defining unlawful behaviour are also covered for the sake of completeness. Table 4.2 helps to structure the analysis by summarising the neighbourhood noise provisions with which this Chapter is concerned in terms of the types of substantive specificity outlined in Chapter 2 (Section 2.6.4).

TABLE 4.1

PROVISIONS OF PART III OF THE CONTROL OF POLLUTION ACT 1974

SECTION	
57	Local authority responsibilities regarding noise nuisance and noise abatement zones
58	Local authority control of noise nuisance
59	Private action in noise nuisance
60	Local authority control of noise from construction sites
61	Prior consent for construction work
62	Control of loudspeakers in streets
63-67	Noise abatement zone provisions
68	Empowers Secretary of State to make regulations controlling noise from plant or machinery (not implemented)
71	Empowers Secretary of State to issue or approve codes of practice for minimising noise from specified activities, for example, burglar alarms; model aircraft; ice-cream van chimes; construction sites

TABLE 4.2

SUBSTANTIVE SPECIFICITY IN NEIGHBOURHOOD NOISE PROVISIONS

Provision	Application	Type	Sources Subject to Control	Time Limitations	Pollution Control Standard
58	Mandatory	Prohibition	Generic - any noise from "premises"	Not specified	Qualitative ("nuisance")
59	Private action by occupier of premises	Prohibition	Generic - any noise from "premises"	Not specified	Qualitative ("nuisance")
60	Discretionary	Limitation	Specific to construction noise	Not specified	Not specified
61	Discretionary (in response to applicant)	Consent (with limitations)	Specific to construction noise	Not specified	Not specified
62	Mandatory	Absolute prohibition coupled with exemptions	Specific (loudspeakers in streets)	Specified	Not specified
Noise Abatement Zones (63-67)	Discretionary	Prohibition	Generic (but not domestic premises)	At discretion of local authority	Emission limit in Leq (dB(A)) (equivalent continuous noise level)
Byelaws	Discretionary	Prohibition	Specific	Specified in some byelaws	Qualitative or not specified

4.4.2.1 Statutory Nuisance

The main provisions covering local authority (LA) action in statutory noise nuisance are shown in Table 4.3. An offence under s.58 is committed when the terms of a noise abatement notice (NAN) are contravened without reasonable excuse. The terms of the NAN are tailored to the nuisance in question and can be very specific, listing noise levels in decibels that must not be exceeded, and providing an inventory of equipment that must or must not be used, or details of noise abatement works that must be undertaken. But the criterion for service of a NAN in the first instance is the existence of what the LA considers to be a noise nuisance. So the determination of unlawful behaviour ultimately hinges on the question of what is a noise nuisance.

Nuisance is not defined in statute and at face value the term leaves enforcement agents with a wide discretion to determine unlawful behaviour. 'Nuisance' is a classic example of the legislator's use of a broad guideline, albeit one which has been given a distinct legal meaning and has been rendered more specific by centuries of judicial processing, first as a common law tort and more recently also as a statutory crime.

The question which this Section sets out to answer is how much is this apparent discretion in the determination of a noise nuisance bounded by the legal mandate. How specific are the instructions, if any, for the assessment of noise nuisances by enforcement agents contained in, (a) the statutory provisions, (b) official advice, and (c) judicial interpretations?

Official advice to LAs implementing the Noise Abatement Act 1960 (Circular 58/60) was to base their determination of a statutory nuisance on whether or not the noise was sufficient to cause a nuisance at common law. Although not directly binding on noise nuisance, case law relating to statutory nuisance under the Public Health Act 1936 (National Coal Board v Thorne (1976) 74 LGR 429)

TABLE 4.3

STATUTORY NOISE NUISANCE

S.57 "It shall be the duty of every local authority to cause its area to be inspected from time to time -

(a) to detect anything which ought to be dealt with under the following section; .....

S.58 -(1) Where a local authority is satisfied that noise amounting to a nuisance exists, or is likely to occur or recur, in the area of the local authority, the local authority shall serve a notice imposing all or any of the following requirements -

(a) requiring the abatement of the nuisance or prohibiting or restricting its occurrence or recurrence;
(b) requiring the execution of such works, and the taking of such other steps, as may be necessary for the purpose of the notice or as may be specificed in the notice;

and the notice shall specify the time or times within which the requirements of the notice are to be complied with.

(2) The notice shall be served on the person responsible for the nuisance or, if that person cannot be found or the nuisance has not yet occurred, on the owner or occupier of the premises from which the noise is emitted or would be emitted.

(3) The person served with the notice may appeal against the notice to a magistrates' court within twenty-one days from the service of the notice.

(4) If a person on whom a notice is served under this section without reasonable excuse contravenes any requirement of the notice, he shall be guilty of an offence against this Part of this Act. "

(8) "If a local authority is of the opinion that proceedings for an offence under subsection (4).....would afford an inadequate remedy in the case of any noise which is a nuisance, they may take proceedings in the High Court....."

S.59 -(1) "A Magistrates' court may act under this section on a complaint made by the occupier of any premises on the ground that in his capacity as occupier of the premises he is aggrieved by noise amounting to a nuisance."

suggests that the term 'statutory nuisance' implies the same standards appropriate to a public or private nuisance at common law.

A legal authority states that the term 'nuisance' is not capable of exact definition (Halsbury's Laws, 1980). Indeed, the often quoted judicial definitions of the torts of private and public nuisance leave a broad discretion:

> Private nuisance; "an unlawful interference with a person's use or enjoyment of land, or of some right over, or in connection with it" (Read v Lyons & Co Ltd (1945) K.B.216).
>
> Public nuisance; an act or omission which materially affects "the reasonable comfort and convenience of life of a class of Her Majesty's subjects" (Attorney General v PYA Quarries Ltd (1957) 1 All ER 894).

A recent case concerning s.58 made considerable progress in attempting to clarify the difference between common law nuisance and statutory noise nuisance. In A Lambert Flat Management Ltd v Lomas ((1981) 2 All ER 280), the common law defences to nuisance were considered irrelevant to the determination of statutory nuisance: "To my mind s.58 is concerned with what can conveniently be labelled a statutory nuisance, that is a nuisance where the conduct complained of unduly interferes with the use or enjoyment of the land of another, but in regard to which the various common law defences are irrelevant" (Ackner, J. at p.285).

The case made it clear that the principles established by common law are of relevance to s.58 only as guidelines in determining the point at which a noise merits designation as a nuisance. Skinner, J. (at p.285) stated that "The only relevance of the tort of nuisance in proceedings under s.58 is to establish the level of noise which exists; it is a measure or standard. Once that level has been established to the satisfaction of the local authority, the procedure laid down by s.58 comes into play." On this basis the major elements of common law nuisance which are of relevance in determining whether a statutory nuisance exists are as follows:

(1) The Nature of the Locality

The concept of nuisance does not lay down any absolute rights to peace and quiet. Provided there is an absence of physical damage, the nature of the locality is taken into account. In the words of Thesiger, L.J., "What would be a nuisance in Belgravia would not necessarily be so in Bermondsey" (Sturges v Bridgman (1879) 11 Ch.D 852). A hundred years later the updated version was, "If one lived next door to a farm, it was no use applying to the volume of noise, the purity of the air and the freedom from insect life, the standards of the most select suburb in Bournemouth" (Milner v Spencer (1976) 239 EG 573). The courts do not adopt a single universal standard of nuisance, but one which varies with the locality. The principle is relevant where noise is concerned since annoyance is considered to depend, amongst other things, on the magnitude of the noise over and above the background level (this is the rationale adopted in BS 4142) and the background level varies with the locality.

(2) The Extent of the Harm

To count as a nuisance at law it seems that the matter must be a serious interference as judged by the reactions of "ordinary people", or by the hackneyed "man on the Clapham omnibus": abnormally sensitive reactions will not count. The definition of nuisance in Walter v Selfe ((1851) 4 De G and Sm 315) made this clear: "An inconvenience materially interfering with the ordinary comfort, physically, of human existence, not merely according to elegant or dainty modes of living, but according to plain and sober and simple notions amongst English people".

(3) De Minimis Non Curat Lex

This is a general principle of the courts permitting them to overlook or ignore what are considered to be trivial complaints, even if technically amounting to a breach of the law. It literally means "the law is not concerned with mere trifles".

(4) The Character of the Noise

The time of day when the nuisance occurs may be significant, for instance people are typically more sensitive to noise at night. The duration of the noise is another important factor: transient or occasional noise - unless regularly repeated - would not generally qualify as a nuisance at common law. However, with regard to statutory nuisance, Circular 2/76 states that "It is hoped that the Act....will assist local authorities in dealing with transient noise nuisance of all types". Whether the courts take the common law view or agree with the official view is a matter for conjecture.

Penn (1979), himself an Environmental Health Officer, stated that in determining whether a noise constitutes a nuisance an EHO will apply the common law principles by taking the following into account:

(a) nature of the noise (continuous or intermittent, frequency characteristics (rumble, whistle, whine, clatter etc));
(b) duration of the noise;
(c) effects of the noise;
(d) number of people affected; private nuisance only requires that one person need be affected, but generally speaking the more people suffering a nuisance, the more serious the problem.

Once the common law principles have been applied in the assessment of whether or not a noise reaches the standard of a nuisance, the common law and statute law part company: the procedure laid down by s.58 now completely determines enforcement behaviour. This procedure maps out additional boundaries to the definition of unlawful behaviour in three ways:

(1) statutory definitions and applications;
(2) grounds for appeal;
(3) statutory defences.

(1) **Statutory definitions and applications**

(a) 'Noise' includes vibration (s.73(1)).

(b) Part III of COPA does not apply to noise from aircraft other than model aircraft (s.73(4)).

(c) The 'person responsible' for the nuisance, is the person 'to whose act, default or sufferance the noise is attributable' (s.73(1)).

Whilst not setting a legal precedent, some recent cases in the London magistrates' courts have placed an interesting interpretation on 'person responsible' for noise nuisance, by extending liability to landlords of rented property where the nuisance originated from inadequate interfloor sound insulation (Macrory, 1986c; Trevor-Jones, 1986). The occupants of neighbouring flats were not served with NANs since their activities were nothing out of the ordinary. These decisions "could set a trend for extending the scope of liability for noise pollution, which will have serious implications for all landlords, and perhaps even architects and builders" (Macrory, ibid.).

At least one of these cases exploited the precedent set by a common law action in private noise nuisance, which established that the landlord of rented or leased property could be liable for any noise nuisance arising from weaknesses in the structure of the building (Sampson v Hodson-Pressinger and Another (1981) 3 All ER 710).

(d) The 'owner' means the person for the time being receiving the rackrent of the premises in connection with which the word is used, whether on his own account or as agent or trustee for another person, or who would so receive the rackrent if the premises were let at a rackrent (s.105(1)).

(e) 'Premises' are defined in the Act as including land (s.105(1)), and boats (s.73(2)). The High Court held that s.58 actions cannot be

taken against noise in streets as these do not constitute 'premises' (L.B. Tower Hamlets v Manzoni and Walder (1984) 148 JP 123). This case has set a rather worrying precedent: although there is nothing in s.58(1) to restrict its ambit to noise emitted from premises, the judgement was based on a reading of the whole of Part III, and in particular on s.59(2) where magistrates may only act on a private complaint if satisfied "that the alleged nuisance exists, or that although abated it is likely to recur on the same premises". The reasoning was that if a s.59 nuisance must occur on premises, then so too must a s.58 nuisance. Additionally, a notice under s.58 must be served on "the person responsible for the nuisance or, if that person cannot be found or the nuisance has not yet occurred, on the owner or occupier of the premises from which the noise is emitted or would be emitted" (s.58(2)).

Macrory (1984) argues that if the Manzoni judgement is correct, then s.60 notices should also only be served on noise emanating from premises ("Where it appears to a local authority that works to which this section applies are being, or are going to be, carried out on any premises...." (s.60(2))), even though this section specifically covers road repairs (s.60(1)(a) and (b)). Macrory also argues that the use of the word "premises" (as in s.59(2)) does not necessarily refer to the premises from which the noise is emitted, but could be the premises where the effect of the nuisance is suffered. Interestingly, in the Scottish case of Strathclyde Regional Council v Tudhope (Scots Law Times, January 7 1983, p.22), the competency of serving a s.58 notice on the regional council, as highway authority responsible for certain road-breaking actions, was not questioned by the High Court of Justiciary.

(2) **Grounds for Appeal**

The Control of Noise (Appeals) Regulations 1975: S.I.1975 No.2116 (made under s.70(2)) provide a comprehensive list of grounds for appeal against a noise abatement notice under s.58 (Table 4.4). There had been no right of appeal against a NAN under the NAA

TABLE 4.4

STATUTORY GROUNDS FOR APPEAL AGAINST A NOISE ABATEMENT NOTICE

Regulation 4(2):

"(a) that the notice is not justified by the terms of section 58; [ie. the noise does not amount to a nuisance at law]

(b) that there has been some informality, defect or error in, or in connection with, the notice; [but the court can dismiss this ground if it is satisfied that the informality, defect or error was not a material one (Regulation 4(3)]

(c) that the authority have refused unreasonably to accept compliance with alternative requirements, or that the requirements of the notice are otherwise unreasonable in character or extent, or are unnecessary;

(d) that the time, or, where more than one time is specified, any of the times, within which the requirements of the notice are to be complied with is not reasonably sufficient for the purpose;

(e) where the noise to which the notice relates is noise caused in the course of a trade of business, that the best practicable means have been used for preventing, or for counteracting the effect of, the noise;

(f) that the requirements imposed by the notice are more onerous than the requirements for the time being in force, in relation to the noise to which the notice relates, of -

(i) any notice served under section 60 or 66, or
(ii) any consent given under section 61 or 65, or
(iii) any determination made under secton 67;

(g) that the notice should have been served on some other person instead of the appellant, being the person responsible for the noise;

(h) that the notice might have been served on some person instead of or in addition to the appellant, being the owner or occupier of the premises from which the noise is emitted or would be emitted, and that it would have been equitable for it to have been so served;

(i) that the notice might lawfully have been served on some person in addition to the appellant, being a person also responsible for the noise, and that it would have been equitable for it to have been so served."

(although the terms of a noise nuisance order made by a magistrates' court could be appealed against (s.290 Public Health Act 1936)), and so these Regulations introduced a new procedural code for noise nuisance under COPA.

The procedural requirements for making an appeal are specified in detail: the appeal must be made within 21 days to the local magistrates' court (s.58(3)), and the NAN must include a statement indicating right of appeal and the time-limit within which the appeal must be brought (s.87(4)). The NAN is not normally suspended pending an appeal unless it requires some expenditure on works, or the noise in question is due to some duty imposed by law on the appellant. But even if either of these conditions is met, the LA still has a broad discretion to decide whether to suspend the notice or not, as Regulation 10(2) states:

> "A notice.....shall not be suspended if in the opinion of the local authority -
> (a) the noise to which the notice relates -
> (i) is injurious to health, or
> (ii) is likely to be of a limited duration such that suspension of the notice would render the notice of no practical effect, or
> (b) the expenditure which would be incurred by any person in the carrying out of works in compliance with the notice before any appeal has been decided would not be disproportionate to the public benefit to be expected in that period from such compliance."

Whilst forming a procedural code for noise nuisance appeals, the Regulations also help to define the substance of an actionable nuisance under s.58: a LA will obviously try to avoid serving a NAN which could provide the recipient with valid grounds for appeal. The authority will try to ensure that the notice:

(a) Is justified by the terms of s.58 (Regulation 4(2)a), in other words that the noise is sufficient to reach the standard of nuisance suggested by the relevant common law elements.
(b) Is correctly drawn up and served (4(2)b).
(c) Is reasonable in its requirements (4(2)c and d).

(d) Is not more onerous in its requirements than any other notice or consent issued under Part III in relation to the noise in question (4(2)f).

(e) Does not require a trade or business to employ more than the best practicable means to prevent, or counteract the effect of, the noise (4(2)e).

(f) Is served on the correct person or people (4(2)g,h and i).

In a recent case concerning the reasonableness (Regulation 4(2)c) of a s.58 notice served on a coach operator (Wycombe District Council v Jeffways and Pilot Coaches (H.W) Ltd and Another (1983) 81 LGR 662; Braund and Strevens, 1983), the Court of Appeal provided a very broad interpretation of what they considered a reasonable notice to be. In determining whether the requirements of a NAN were reasonable, the Court held that the LA should try to balance the interests of the company responsible for the nuisance against the interests of the ratepayers. A reasonable notice was considered to be one which had achieved a fair balance. Stephenson, L.J. stated that Regulation 4(2)c ".....does indicate that the local authority have to consider all the inhabitants of their area - their ratepayers - in deciding what their duty is under sections 57 and 58.....; and those inhabitants include industry, however late it has arrived in the area, as well as householders."

In this case, the court considered the hours of a night-time curfew (between 11.30 pm and 6.30 am) in a NAN served on the coach operators to be unreasonable since:

(a) the company would be forced to break important contracts if these hours were complied with;

(b) the company provided a valuable social service by undertaking emergency work for the police and British Rail; and

(c) background traffic noise from nearby major roads was substantial.

It could be argued, however, that a commonsense reading of Regulation 4(2)c infers that an unreasonable notice is one which demands more than is strictly necessary to abate the nuisance: balancing the interests of the noise-maker against those of the community seems to be a very wide interpretation of this Regulation. Indeed, the counsel for the respondents argued this point convincingly: a notice cannot be unreasonable, he stated, unless it is unnecessarily wide in extent and strong in character for the purpose of abating the nuisance. The interests and contracts of the company were only relevant, and the need to balance the interests of the company versus the community was only permissible when dealing with the defence of 'best practicable means' under Regulation 4(2)e.

(3) **Statutory Defences**

In proceedings for failure to comply with the terms of the NAN, s.58 specifies certain matters which, if proved in court, amount to statutory defences to the action in nuisance. To reiterate, none of the defences relevant to a civil action in tort can be used, and the civil defence of whether or not the matter amounts to a nuisance must be raised on appeal (ie. Regulation 4(2)a) and not as a defence in proceedings for contravention of a notice (A Lambert Flat Management v Lomas (1981) 2 All ER 280). The statutory defences are as follows:

(a) The person served with a NAN has a reasonable excuse for failing to comply with its terms (s.58(4)).

(b) In relation to noise caused in the course of a trade or business, that the best practicable means have been used for preventing, or counteracting the effect of, the noise (s.58(5)).

(c) The alleged offence was committed at a time when the premises were subject to noise control requirements under another section of Part III of COPA and that these requirements have been complied with (s.58(6)).

1. **Reasonable Excuse**

No statutory definition of this term is provided, but judicial interpretations are more illuminating. In Saddleworth Urban District Council v Aggregate and Sand Ltd ((1971) 69 LGR 103), the High Court held that lack of finance could not form the basis of any reasonable excuse for failure to comply with the terms of a notice. More pertinently, in A Lambert Flat Management v Lomas ((1981) 2 All ER 280), the High Court held that the defence of reasonable excuse had a narrow meaning. Skinner J. maintained that an excuse could not be 'reasonable' if it involved matters which could have been raised beforehand on appeal (and, as illustrated above, the grounds for appeal are wide), unless these matters arose after the appeal was heard or, if there was no appeal, after the 21 days for appeal had expired. Ackner LJ. added that only if there were special reasons, such as non-receipt of the notice or illness, could there be a reasonable excuse for non-compliance with the terms of the notice.

2.**Best Practicable Means**

The phrase receives an open-textured definition in s.72 of the Act: 'practicable' means "reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications" (s.72(2)). This recognises that there is a limit to what it is reasonable to require a person or company to do or to spend to reduce noise; it also recognises that there may be technical limitations (Department of the Environment, 1982d). "The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery and the design, construction and maintenance of buildings and acoustic structures" (s.72(3)). Three provisos are added:

(a) The test of best practicable means (BPM) is to apply only so far as compatible with any duty imposed by law. In particular, with respect to statutory undertakers, the test of BPM will apply only so far as is compatible with their statutory duties (s.72(4)).

(b) The test of BPM will apply only so far as compatible with safety and safe working conditions and with the demands of any emergency or unforseeable circumstances (s.72(5)); for instance, if vibrations had caused a building to become unsafe, then the defence of BPM would not be tenable.

(c) The provisions of any code of practice approved by the Secretary of State under s.71 of the Act must be considered in determining whether or not BPM have been used (s.72(6)).

The concept of BPM does not exist in common law, but as mentioned in Chapter 2 it holds an impressive position in the arena of pollution regulation. However, the phrase has still not been interpreted by the higher courts (Guruswamy and Tromans, 1986). Guruswamy and Tromans provide some possible explanations to account for this phenomenon. Firstly, the courts were and are reluctant to interfere in decisions based on scientific and technical expertise and, since the determination of BPM is so much a technical matter, it is not really surprising that the decisions of pollution inspectorates have hardly ever been challenged. The court's decision in the Scottish case of Tudhope v Lee ((1982) SCCR 409), to accept the LA's interpretation of BPM without question, is indicative of this characteristic. Secondly, very few pollution cases ever get to court, so in reality the opportunities for the judiciary to interpret BPM are scarce. For example, the Alkali Inspectorate (now HMIP), who have used BPM for over 100 years, brought just three prosecutions between 1920 and 1967 (McKnight, 1974). In 1981 they brought 17 prosecutions (Health and Safety Executive, 1981), but 15 were for illegal cable burning (s.78(1) of COPA) where a consideration of BPM is irrelevant to the determination of the offence.

The burden of proof that the BPM have been used rests with the defendant, but in order to counter such a claim, both as a ground for appeal against a notice under Regulation 4(2)e and as a statutory defence against proceedings for contravention of a notice, the LA must be in a position to submit evidence to the contrary. Critics of BPM

claim that the term usually means what noisemakers say they can afford, and that this is not a matter which most officials are particularly well equipped to evaluate (for example, Osborn, 1974). However, Chapter 6 provides some evidence to the contrary. In addition a recent case, concerning the use of BPM to prevent dust nuisance under the Public Health Act 1936 (s.92(1)d), may be indicative of a trend towards the courts requiring fairly detailed information about company finances, before they will accept the word of the company that BPM are being used (Wivenhoe Port Limited v Colchester Borough Council (1985) JPL 175). The justices rejected the defence of BPM in this instance, as they considered that the company had not provided sufficient financial information to enable them to make a detailed assessment of the situation.

4.4.2.2 Byelaws

A byelaw is a local law which, provided it is validly made, can be enforced in the criminal courts (Kerse, 1975). The validity of a byelaw depends on its being made in accordance with an Act of Parliament, and confirmed by the relevant authority (previously the Home Office and now the Department of the Environment). Most are now made under s.235(1) of the Local Government Act 1972. Local prohibitions of specific noisy activities were the earliest legislative responses to the problem of noise (Chapter 3), and noise byelaws adopt the same approach.

Whilst matters covered by noise byelaws are defined specifically and in most cases there is no requirement that a noise must amount to a nuisance, the definition of unlawful behaviour often still depends on discretionary terms, such as that the noise must give "reasonable cause for annoyance to", or "cause annoyance to" people in the locality. These phrases have been interpreted to mean that on prosecution the court must be satisfied that the noise was likely to cause annoyance, but no evidence need be given that anyone was in fact annoyed (Raymond v Cook (1958) WLR 1098).

The majority of the model byelaws create straightforward offences, but in two cases (concerning noisy animals and causing annoyance by the use of "any wireless set, gramophone, amplifier or similar instrument") a notice must first be served on the person responsible for the noise, giving them 14 days grace to abate the noise, otherwise proceedings will then ensue.

Where a statute deals with precisely the same matter as a byelaw, the byelaw is regarded as repugnant to the general law and invalid (Galer v Morrissey (1955) 1 All ER 380), a point also emphasised by s.235(3) of the Local Government Act 1972. The Department of the Environment will no longer confirm byelaws for matters which are covered by Part III of COPA (Macrory, 1984). However, as s.58 actions cannot be taken against noise in streets (the precedent set by the Manzoni case), the use of byelaws to control some sorts of street noise not covered by s.62 may still be valid.

4.4.2.3 Noise in Streets

Section 62 of COPA (which is identical to s.2 of the NAA), is very similar in style to the noise byelaw provisions: it prohibits a particular source of noise, in this case the use of loudspeakers in streets, without requiring that the noise constitutes a nuisance. This similarity in style is not surprising since the section is based on a model provision included in some local Acts and byelaws prior to the NAA. Again, like most byelaws, s.62 creates a "one-step" offence: unlike s.s 58 and 59 of the Act, where the unlawful activity is the contravention of a statutory notice, a s.62 offence is the result of behaviour which the statute itself (rather than a notice) has expressly declared to be unlawful. S.62 amounts to an absolute prohibition with a catalogue of statutory exemptions. Subsection 1 states that:

> "Subject to the provisions of this section, a loudspeaker in a street shall not be operated -
>
> (a) Between the hours of nine in the evening and eight in the

following morning, for any purpose;
(b) At any other time, for the purpose of advertising any entertainment, trade or business.
And any person who operates or permits the operation of a loudspeaker in contravention of this subsection shall be guilty of an offence against this Part of this Act."

During daytime hours loudspeakers used for purposes other than advertising entertainment, trade or business are exempt from this prohibition. In addition, several specific exemptions are listed in subsections 2 and 3 (Table 4.5). Subsection 3 is the 'ice-cream vendors' exemption' discussed in Chapter 3.

This precise definition of a specific offence with its catalogue of exemptions seems to permit little discretionary interpretation. The only instances of discretionary terminology are in the two exemptions which permit the noise provided it does not give "reasonable cause for annoyance to persons in the vicinity" (s.62(2)d and s.62(3)c). Again this is very similar to byelaw provisions. And as with byelaws, there are no statutory defences such as use of BPM, nor any right of appeal except against sentence to the Crown Court.

A statutory definition is provided for 'street' as "a highway and any other road, footway, square or court which is for the time being open to the public" (s.62(1)). A recent case held that a covered marketplace, open on three sides and used for the majority of the time as a car-park, was a street for the purposes of this section (Tower Hamlets London Borough Council v Creitzman (1985) 83 LGR 72). 'Loudspeaker' is not defined in COPA, although s.2(5) of the NAA stated that a loudspeaker included a megaphone or any other device for amplifying sound.

TABLE 4.5

EXEMPTIONS TO THE PROHIBITION ON THE USE OF LOUDSPEAKERS IN STREETS

The operation of a loudspeaker in a street for the following purposes is not subject to the general prohibition in s.62:

S.62(2)
"(a) for police, fire brigade or ambulance purposes, by a water authority in the exercise of any of its functions, or by a local authority within its area;

(b) for communicating with persons on a vessel for the purpose of directing the movement of that or any other vessel;

(c) if the loudspeaker forms part of a public telephone system;

(d) if the loudspeaker -

(i) is in or fixed to a vehicle, and
(ii) is operated solely for the entertainment of or for communicating with the driver or a passenger of the vehicle or, where the loudspeaker is or forms part of the horn or similar warning instrument of the vehicle, solely for giving warning to other traffic, and
(iii) is so operated as not to give reasonable cause for annoyance to persons in the vicinity;

(e) otherwise than on a highway, by persons employed in connection with a transport undertaking used by the public in a case where the loudspeaker is operated solely for making announcements to passengers or prospective passengers or to other person so employed;

(f) by a travelling showman on land which is being used for the purposes of a pleasure fair;

(g) in case of emergency."

S.62(3)
".....between the hours of noon and seven in the evening on the same day if the loudspeaker -

(a) is fixed to a vehicle which is being used for the conveyance of a perishable commodity for human consumption; and

(b) is operated solely for informing members of the public (otherwise than by means of words) that the commodity is on sale from the vehicle; and

(c) is so operated as not to give reasonable cause for annoyance to persons in the vicinity."

4.4.2.4 Control of Noise on Construction Sites

Sections 60 and 61 are provisions introduced for the first time in Part III of COPA, specifically for the control of noise from construction and allied works, which are defined in detail in the Act as follows:

> "(a) the erection, construction, alteration, repair or maintenance of buildings, structures or roads;
> (b) breaking up, opening or boring under any road or adjacent land in connection with the construction, inspection, maintenance or removal of works;
> (c) demolition or dredging work; and
> (d) .....any work of engineering construction" (s.60(1)). "Work of engineering construction" is precisely and laboriously defined in s.73(1)).

Unlike s.58, s.s 60 and 61 do not require the noise in question to amount to a nuisance. However, the LA's powers to control construction works under these sections stop short of halting them completely: if this remedy is required, the LA must act under s.58 (and then only if the noise amounts to a nuisance).

Section 60

Section 60 provides LAs with a discretionary power to control noise from construction works, both while work is in progress and prior to work commencing. The LA can serve a notice, specifying the type of plant or machinery which can or cannot be used; setting out the hours during which work can be carried out, and limiting the level of noise which can be emitted from the site (s.60(3)). The recipient of the notice can appeal to a magistrates' court within 21 days of the service of the notice (s.60(7)) and the grounds for appeal are as wide as those under s.58 (Control of Noise (Appeals) Regulations 1975, Regulation 5). Failure to comply with the terms of a s.60 notice, without reasonable excuse, is an offence against Part III of COPA (s.60(8)). Compliance with a s.60 notice precludes the LA from taking action under s.58, but does not prevent private actions under s.59.

Before serving a notice, however, the LA must take account of:

(a) the relevant provisions of BS 5228;
(b) the need to ensure that the BPM are employed to minimise noise;
(c) alternative methods, or plant and machinery, that might be equally effective in minimising noise, and more acceptable to the recipients of the notice;
(d) the need to protect people in the locality of the site from the effects of the noise (s.60(4)).

If the s.60 procedure proves inadequate to control noise from construction sites, the LA may be able to institute civil proceedings in the High Court under s.222 of the Local Government Act 1972 to obtain an injunction to abate the noise. This remedy was used successfully by a London borough (London Borough of Camden v Alpenoak Ltd, Environmental Health, 1986).

Section 61

Under this section, a developer or contractor intending to carry out construction work can apply to the LA to determine its noise requirements prior to work commencing. It is not mandatory that applications for prior consent are made, but it could be advantageous to the applicant since compliance with a consent under this section precludes the LA taking action under s.s 58 or 60 (although it does not prevent private actions under s.59). In addition, it should be cheaper to plan work from the outset in accordance with noise control requirements, rather than be required to alter working methods half-way through a project in order to achieve compliance with notices served by the LA under s.s 58 or 60.

An application for a s.61 consent must contain details of the nature of the works, and the way they are to be carried out, and the proposed steps to be taken to minimise noise (s.61(3)): informal discussions with the LA to determine their requirements prior to making a formal application are recommended (BS 5228, Part 2). A LA must give its

consent if the application contains sufficient information and, if the works are carried out in accordance with the application, the authority would not serve a s.60 notice on the works (s.61(4)). Consent can be given subject to certain conditions and limitations, however (s.61(5)). When deciding whether or not to give consent and whether to make the consent conditional, the LA must bear in mind the same considerations that apply to the service of a notice under s.60(4). An offence is committed if anyone "knowingly carries out the works, or permits the works to be carried out, in contravention of any conditions attached to a consent under this section" (s.61(5)).

An applicant for prior consent can appeal to a magistrates' court if the LA fails to give its consent within 28 days, or if the consent is given subject to any conditions or limitations. The grounds for appeal are as follows (Regulation 6(3)):

(a) that any condition is not justified by the terms of s.61;
(b) that the consent has been improperly issued;
(c) that the requirements of any condition are unreasonable in character or extent, or are unnecessary;
(d) that insufficient time has been given to comply with any of the conditions.

Where an appeal concerns the LA's failure or refusal to grant a consent, the magistrates must give both parties the opportunity of making representations to the court. The magistrates can then either adjourn the appeal to give the applicant another chance to re-apply to the authority, or the court itself can make an order giving consent to the applicant either conditionally or unconditionally (Regulation 6(6)).

4.4.2.5 Codes of Practice

Section 71 of COPA delegates a discretionary power to the Secretary of State for the Environment to prepare and approve codes of practice "for the purpose of giving guidance on appropriate methods (including the use of specified types of plant or machinery) for minimising noise". The section also creates a mandatory duty for the Minister to

prepare and approve a code of practice for noise control on construction sites for use in relation to s.s 60 and 61. The codes do not in themselves create offences or mandatory legal requirements. Their purpose is twofold:

(1) Formally, in aiding both magistrates' courts and LAs to determine whether or not the BPM have been used (s.72(6)), and in these cases the provisions of the code must be taken into account.

(2) Although in the strict legal sense, compliance with a code of practice does not confer immunity from legal proceedings, the codes have an informal use in helping to define the standard of unlawful behaviour which constitutes a noise nuisance, or, in the case of ice-cream van chimes in s.62(3)c, 'reasonable cause for annoyance to persons in the vicinity'. They provide criteria by which the LA, and the magistrates' court, can determine whether or not a noise amounts to a nuisance at law. Additionally they provide guidelines to operators to help them remain within the law.

With respect to noise nuisance, the formal use blends with the informal: if a code specifies BPM for a particular activity, then compliance with the code would generally mean that BPM are being used, and this is a valid ground for appeal against a notice under s.58 and a good defence to proceedings under s.s 58 and 59. It would then be unlikely that a LA would issue a notice or a court make an order against the noise.

As mentioned in Chapter 3, four codes of practice have been issued so far: BS 5228 approved as the code for noise control on construction sites, and codes for the control of noise from ice-cream van chimes, burglar alarms and model aircraft.

A. Formal Use of Codes to Determine BPM

BS 5228: Noise Control on Construction and Open Sites

BS 5228 effectively provides an operational definition of BPM for controlling noise from construction and allied works. Although the code stresses that compliance with its terms does not of itself confer immunity from legal proceedings (Foreword to BS 5228 Part 1), it represents a standard of good practice which in most instances would meet the requirements of BPM. The code is issued in four parts:

Part 1 - Code of practice for basic information and procedures for noise control.
Part 2 - Guide to noise control legislation for construction and demolition, including road construction and maintenance.
Part 3 - Code of practice for noise control applicable to surface coal extraction by opencast methods.
Part 4 - Code of practice for noise control applicable to piling operations.

The construction site noise control provisions in sections 60 and 61 COPA do not require that the noise constitute a nuisance. So the formal use of BS 5228, in helping to define BPM (s.72(6)), is also in this instance its major use. LAs can also take action against construction noise under s.58 (but only if it is a nuisance). BS 5228 is therefore of use in the following circumstances:

(i) In deciding whether to serve a s.60 notice or issue a s.61 consent, and what requirements to impose, LAs must have regard to the relevant provisions of BS 5228 and the need to ensure that BPM are used to limit noise (s.60(4) and s.61(5)).

(ii) If a s.60 notice is appealed against on the ground that the LA did not have regard to BPM or a relevant code of practice (Control of Noise (Appeals) Regulations 1975 No.2116, Regulation 5(2)(g)), BS 5228 should be of use to magistrates in determining the appeal.

(iii) If a s.61 consent is appealed against on the ground that any condition imposed by the LA is not justified by the terms of s.61 (Control of Noise (Appeals) Regulations, 6(3)(a)), then magistrates may have to determine whether the LA had regard to BPM or BS 5228 when drafting the condition.

(iv) In helping LAs and magistrates' courts to determine whether noise from construction sites is an actionable nuisance: compliance with BS 5228 generally implies that the BPM are being used which, as a valid ground for appeal against a s.58 notice and a good defence against proceedings under s.s 58 and 59, would presumably mean that nuisance proceedings would fail. BS 5228 also helps LAs to specify the terms of a s.58 notice so that they do not demand more than the BPM for controlling noise.

(v) In providing guidance to developers, contractors and all those involved in construction work, on how to conduct operations in a manner which will minimise disturbance and annoyance to people in the locality of the works, so minimising the grounds for public complaint and reducing the possibility of the LA serving a notice under s.s 58 or 60, compliance with which may be expensive.

BS 5228 covers the following aspects of noise control for construction sites:

1. Recommendations concerning community relations, and procedures for establishing effective liaison between developers, site operators and local authorities.
2. Training requirements for site personnel to inform them of the need to minimise nose, in terms of both the health hazards to site workers from exposure to excessive noise and annoyance to people living in the vicinity.
3. Criteria for setting noise control targets. BS 5228 recommends that the following factors should be considered when determining whether noise levels from sites are acceptable and, if not, the degree of

control necessary:

(i) Site location
(ii) Existing ambient noise levels
(iii) Duration of site operations
(iv) Hours of work
(v) Attitude to the site operator
(vi) Noise characteristics

4. Methods for predicting expected noise levels from sites. Typical values of sound power levels for site equipment and site activities are listed and form the basis of the prediction methods.
5. Methods of monitoring actual noise levels from construction sites, using the equivalent continuous A-weighted sound pressure level - Leq - (see Chapter 5) and the maximum sound level where necessary.
6. Project supervision, covering both preparatory stages and the execution of the project.
7. Methods of controlling noise at source and techniques for reducing the propagation of noise.

B. Informal Use of Codes in the Determination of Unlawful Behaviour

The codes for ice-cream van chimes and model aircraft are of most use in the informal context: BPM is not available as a defence to actions under s.62 concerning ice-cream vendors, and few model aircraft are flown for trade or industrial purposes. BPM is relevant to burglar alarms, however, as these may be used on trade or business premises.

Tables 4.6, 4.7 and 4.8 provide summaries of the codes for ice-cream van chimes, model aircraft and burglar alarms. The criteria used in the codes are fairly precise, and some of them technical: for instance, ice cream chimes should not be played louder than 80 dB(A) at 7.5 metres and model aircraft should not be operated to produce a sound level in excess of 82 dB(A) at 7 metres. The code for burglar alarms even goes so far as to suggest when the LA may consider taking action under s.58 (for instance, in cases of repeated ringing, or a

TABLE 4.6

CODE OF PRACTICE ON NOISE FROM ICE-CREAM VAN CHIMES

Summary

Chimes should not be sounded:

1. For longer than 4 seconds at a time.
2. More than once every 3 minutes.
3. When the vehicle is stationary.
4. Except on approach to the selling area.
5. When in sight of another vehicle which is trading.
6. When within 50 metres of schools (during school hours), hospitals, and places of worship (on Sundays and other recognised days of worship).
7. More often than once every 2 hours in the same length of street.
8. Louder than 80 dB(A) at 7.5 metres.
9. As loudly in quiet areas or narrow streets as elsewhere.

TABLE 4.7

CODE OF PRACTICE ON NOISE FROM MODEL AIRCRAFT

The code recommends:

(1) That model aircraft should be fitted with noise mufflers wherever this is practical. No model should be operated to produce a sound level in excess of 82 dB(A) at 7 metres, measured in accordance with the method specified in the code. These conditions do not, however, apply to competitive flying. In some instances the LA may assist with measurements.

(2) That in general models should not be flown closer than 200 metres from noise sensitive premises, such as houses, schools, hospitals and churches.

(3) That times of operation should be controlled to minimise annoyance. In general it is recommended that where detailed control of numbers and flying distances is not possible, or is inadequate to avoid substantial disturbance at the more sensitive times, flying should not be allowed outside the hours of 9am to 7pm on weekdays and 10am to 7pm on Sundays and Bank Holidays.

(4) That models which produce a sound level near the maximum level specified in (1) should be flown on their own, lest the combined levels are in excess of 82 dB(A).

(5) Making use of topographical features to attenuate the levels of noise reaching premises.

(6) Methods of minimising the disturbance caused by major model-flying events and recommends publicising the event and informing the LA in advance.

TABLE 4.8

CODE OF PRACTICE ON NOISE FROM AUDIBLE INTRUDER ALARMS

The nuisance from burglar alarms arises from the duration of the ringing rather than the volume of noise produced. The code states that the best way to reduce undue disturbance is to prevent false alarms.

Consequently alarm-holders should notify the police and the LA that they have installed an alarm, and provide them with the names and addresses of two key-holders who are prepared to switch off the alarm whenever necessary.

The code recommends fitting automatic cut-out devices, which would stop the ringing of the alarm within 20 minutes. If the alarm has not been fitted with an automatic cut-out, the alarm-holder should make arrangements to ensure that the alarm can be switched off within 20 minutes. Failure to respond within 20 minutes (or such longer period as may have been agreed by the alarm-holder, the police and the LA) will be relevant to any consideration of whether a noise nuisance has occurred in any particular case of prolonged ringing. Repeated failure to respond may result in the LA serving a notice under s.58 COPA, requiring the fitting of an automatic cut-out. The code also states that a single occurrence of extremely prolonged ringing, without reasonable excuse, may also justify action under s.58.

single occurrence of extremely prolonged ringing without reasonable excuse).

By breaking down the concepts of nuisance or BPM into specific criteria, it is possible to reduce the discretion inherent in their interpretation. These codes are a good example of the point made by Jowell (1973), that legal guidelines (such as nuisance or BPM) may be rendered more precise by 'criteria'; facts that are to be taken into account. However, it would be extremely time consuming to produce codes of practice for all noise-creating activities. Some form of generic control is preferable, as emphasised by Jasanoff (1982) in her study of the regulation of carcinogens in the United States.

4.4.2.6 BS 4142: Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

The previous Section showed how codes of practice, providing both technical and non-technical criteria, have the effect of reducing the discretion inherent in the definition of legal guidelines such as nuisance and BPM for specific sorts of noise problem. BS 4142 goes one stage further by providing a set of technical rules by which to measure any noise from factories, industrial premises and other fixed installations, and to quantify the likelihood of its giving rise to public complaint and, by implication, its potential as a nuisance.

BS 4142 works on the basis of the elements of common law nuisance (nature of the locality, extent of the harm, character of the noise) to provide a relative, quantitative standard of acceptability. (Chapter 5 provides a technical description and critique of the BS 4142 procedure). However, in terms of the legal model, the use of BS 4142 by LAs as a guide to the determination of a noise nuisance has two important provisos:

1. Its use for noise nuisance assessments has never been formally approved by Ministerial order, in the way that the codes under s.71 have. The Department of the Environment, however, informed LAs of its

impending publication in 1967 (Circular 22/67), and its use for planning purposes was recommended in Circular 10/73.

2. The foreword to the standard states that BS 4142 can be used to predict the likelihood that a noise will give rise to complaints, but warns that, "Although, in general, there will be a relation between the incidence of complaints and the level of general community annoyance, quantitative assessment of the latter is beyond the scope of the standard". As mentioned in Chapter 3, whilst the standard is a useful guide, it should not be relied on totally as noise nuisance can undoubtedly exist without BS 4142 predicting complaints (Penn, 1979; Taylor, 1981).

4.4.2.7 Noise Abatement Zones

The LA has complete discretion to decide whether or not to set up a NAZ in its area ("A local authority may by order.....designate all or any part of its area a noise abatement zone" (s.63(1))), although under s.57 it is mandatory that a LA should at least give serious thought to the matter, by inspecting its area "from time to time.....to decide how to exercise its powers concerning noise abatement zones".

Circular 2/76, which was published to coincide with the implementation of Part III of COPA in 1976, contains detailed instructions for establishing NAZs. From an operational perspective, it contains more detailed advice - or more of the 'legal mandate' - than do the statutory provisions (s.s 63-67 and Schedule 1 of COPA and regulations made thereunder). Possibly either the novelty of the concept or the implications for public expenditure of establishing NAZs prompted Government to issue explicit guidance to LAs over and above that contained in the legislative provisions.

LAs have complete discretion to determine the size of a NAZ. Circular 2/76 states that "a noise abatement zone may include the whole or any part of a local authority area as part of the zone". That a NAZ can

apply to a single premises is given tentative support by the statement in the circular that "the noise abatement zone powers are self-contained and can be used as such to deal with specific noise problems". On the other hand a NAZ can be established over a wider area to be used "as a more general tool of planning to maintain or to improve environmental standards". Additionally the circular indicates that "the form of a zone once designated is not immutable": further noise abatement orders can be made adding to or reducing the numbers of premises within the zone which are subject to control (s.63(3)). However, as LAs are obliged to work within their existing resources, ".....Noise Abatement Orders should only be made where adequate resources are available" (Circular 2/76).

Concerning the types of premises within a proposed zone to which controls should apply (these are called "classified premises"), again the authority is left with a broad discretionary power. The circular states that NAZ procedures are not suitable for controlling noise from domestic premises, or from relatively transient sources such as construction sites. The circular stresses that local conditions and circumstances are of paramount importance in deciding which premises merit control, and states that "it is intended that only those classes of premises for which control is practicable and where control may afford some benefit should be subject to control. To control all premises in an area will not normally be a practicable undertaking". Premises should be classified "broadly by function". Circular 2/76 provides a list of broad classes which authorities could use, but this is purely for guidance and is not meant to be followed rigorously if more appropriate categories can be defined. Categories of premises used in rating lists can also be used. However there seems to be nothing in the circular to prohibit the specification of individual named premises (Penn, 1979). Classes of premises that will be subject to control may be designated even though there are no buildings of that class presently in the zone: this allows for the control of noise from new developments fitting these categories.

Once the classified premises have been determined, the procedure for designating a zone, which is by means of a 'Noise Abatement Order', is defined in Schedule 1 of COPA (amended by Schedule 2 of the Local Government, Planning and Land Act 1980). The purpose of the notification procedure is to inform the public of the authority's intention of establishing a zone and to enable objections to be heard. The procedure is precisely defined, but authorities are left with a wide discretion to determine how objections are to be dealt with.

In its original format Schedule 1 stated that all noise abatement orders had to be confirmed by the Secretary of State, to whom all objections were addressed. This is no longer required, subsequent to the implementation of the Local Government, Planning and Land Act 1980. The amended Schedule now states that the LA "must consider" all objections, unless they are satisfied that this is unnecessary having regard:

> "(a) to the nature of the premises to which the order will relate when it comes into force; or
> (b) to the nature of the interests of the persons who have made the objections which have not been withdrawn."

This is a very wide discretion. How the LA should "consider" objections, for instance whether to hold a local inquiry or to proceed on the basis of written statements from the objectors, is also left for each authority to decide (Circular 8/81).

The background to the Local Government, Planning and Land Act 1980 can be found in a Department of the Environment White Paper announcing the Government's intention to reduce the number of bureaucratic controls over LAs (Department of the Environment, 1979). The White Paper proposed relaxing all NAZ provisions concerning appeals to the Secretary of State. But in practice only two provisions were relaxed in the subsequent legislation: these were the necessity for the Secretary of State to confirm a noise abatement order, and to give consent to the postponement of the coming into operation of a noise abatement order.

Precise Definition of Unlawful Behaviour

The preceding paragraphs have painted a picture of the NAZ as a noise abatement provision where the ultimate discretion, as to whether a zone is set up, how large it is and what premises within it are subject to control, rests with the LA. In terms of defining unlawful behaviour, however, the NAZ procedure permits very little discretion to LAs since it provides a very precise, quantitative definition of an offence.

Each classified premises in a NAZ must have its typical levels of noise emissions, at various points round the boundary of the site, measured by the LA (s.64(1)). These noise levels, known as registered levels, are entered in a 'noise level register', kept by the LA in accordance with the precise instructions in Regulation 6 of the Control of Noise (Measurements and Registers) Regulations 1976. The register must be open to public inspection (s.64(7)). The owners or occupiers of classified premises have the right of appeal to the Secretary of State, if they have reason to doubt the validity or accuracy of the registered levels (s.64 (3)). After allowing for any appeal, the registered levels become binding and it is then an offence to exceed the levels without the consent of the LA (s.65(5)). The precision of this definition of unlawful behaviour has two aspects:

(i) The law specifies a precise, quantitative standard of behaviour: the registered noise level. An offence is committed if this level is exceeded without the consent of the LA. There are no statutory defences. The registered levels thus form the basis for control in NAZs. Circular 2/76 states, however, that, "There will naturally be some variations of level about the values recorded. This is inevitable and it is not intended that individual measurements should lead to the prosecution of those responsible. But where monitoring shows that there is a consistently measurable increase in noise levels, even if small, of a more permanent nature the person responsible will be liable to prosecution for an offence."

(ii) In the determination of the lawful standard of behaviour for each classified premises, the LA has a strictly defined set of instructions to follow. These are the instructions for measuring registered noise levels contained in the Schedule to the Control of Noise (Measurement and Registers) Regulations 1976, and largely reiterated in Circular 2/76. The unit of measurement is the equivalent continuous sound level (Leq), supplemented in some instances by the peak level. The methodology employed to determine Leq values depends on the variability of the noise source, but is described in detail in the regulations. LAs may only depart from this procedure with the consent of the Secretary of State. This dispensation will only be given if the LA has specific problems using the method in the regulations, and it can be shown that the alternative method is necessary "in order to facilitate the effective, or more effective, performance by a local authority of its functions in pursuance of any of the provisions of sections 64 to 66" [of COPA] (Regulation 4(2) of the Control of Noise (Measurement and Registers) Regulations 1976). An example of permission to depart from the regulation method is provided by Wright (1982): a London borough received a dispensation from the Secretary of State to use L10 instead of Leq as the unit of measurement for a building in a NAZ badly affected by traffic noise.

Some discretionary elements remain in the statutory procedure for measuring registered levels:

(i) No time limit is specified for the completion of the measurements. It is up to the LA to determine when the measurements are to be made (s.64(6)).
(ii) The length of time taken for the determination of Leq at each measuring point is also left to the discretion of the LA. The aim is to determine typical levels of noise from the classified premises. The periods when measurements are taken should be selected to meet the particular needs at each measurement point. Within the constraints set by the availability of resources, the period will be determined by the pattern of variation of noise and the type of control of the noise

that is needed (Circular 2/76).

Consent to Exceed the Registered Level

Any owner, lessee or occupier of classified premises may apply to the LA for a consent to exceed the registered level (s.65(1)). The LA is given a broad discretion to decide whether to accept the application conditionally or unconditionally, or to refuse to give consent. Circular 2/76 provides some criteria which the LA may wish to take into account in considering applications. But the fact that compliance with the terms of a s.65 consent is a good defence in noise nuisance proceedings under s.58 (whereas compliance with a registered noise level is not) may deter authorities from giving their consent. However, any applicant who is dissatisfied with the LA's decision may appeal to the Secretary of State (s.65(4)), whose decision is binding.

Noise Reduction Notices

S.66 gives LAs a discretionary power to request the reduction of registered noise levels from any classified premises within a zone (regardless of whether or not the noise is a nuisance) provided:

"(a) that the level of noise ....is not acceptable having regard to the purposes for which the order was made; and
(b) that a reduction in that level is practicable at reasonable cost and would afford a public benefit" (s.66(1)).

The LA's discretion in this instance is also curbed by the fact that anyone served with a noise reduction notice can appeal to the local magistrates' court within 3 months from the service of the notice (s.66(7)), and the grounds for appeal are nearly as broad as those under s.58 (Control of Noise (Appeals) Regulations 1975, Regulation 7). Contravention of a noise reduction notice is an offence (s.66(8)), but the statute provides for defences of 'reasonable excuse' or BPM for trade or business premises (s.66(9)). Although

there is no case law on the subject, 'reasonable excuse' would probably receive a similarly strict definition as in s.58, since the grounds for appeal are so broad. But once again the authority must limit its demands for noise control to the BPM.

New Development

S.67 gives LAs a discretionary power to extend NAZ controls to new or converted premises within a zone which will fall within a class to which the noise abatement order relates on completion. The authority may determine a registered level on its own initiative or at the request of the owner or occupier, or anyone negotiating to acquire an interest in the premises. Right of appeal to the Secretary of State lies with anyone whose application for determination of a registered level has been refused, or who wants to contest the registered level set by the LA, and the Minister's decision is binding (s.67(3) and (4)).

Where new or converted premises, which are of a class to which the noise abatement order applies, come into use in a zone and no registered level has been determined for them, s.67(5) permits the LA to serve a noise reduction notice on the premises. But unlike s.66, the LA no longer has to satisfy the requirement that the registered noise level must be practicable at reasonable cost and of public benefit, and in proceedings for contravention of a notice the defence of BPM does not apply. Thus the LA is provided with strong powers to control noise from new premises in NAZs, preventing anyone exploiting the special character of a zone.

4.4.3 Sanctioning Discretion

In this country, both the police and non-police enforcement agencies effectively have total discretion as to whether or not to prosecute breaches of the law (Sanders, 1985a). Authorities are under no legal obligation to undertake a prosecution, even in the clearest of cases.

The conciliatory approach to the regulation of pollution was remarked on in Chapter 2. The official (Department of the Environment) view in relation to statutory noise nuisance recognises the conciliatory approach: "In practice most environmental noise nuisance matters are dealt with informally by the local Environmental Health Department, although the number of complaints being made is rising, as is the number of actions taken in the courts (Department of the Environment, 1981). Circular 2/76 stated that, "The formal service of a notice will sometimes be necessary to fulfil the requirements of the Act, but it is not intended that this should discourage local authorities from using informal approaches...."

Official advice to LAs, concerning the offence of exceeding the registered level in a NAZ, also adopts a rather conciliatory attitude: "There will naturally be some variations of level about the values recorded. This is inevitable and it is not intended that individual measurements should lead to the prosecution of those responsible. But where monitoring shows that there is a consistently measurable increase in noise levels, even if small, of a more permanent nature the person responsible will be liable to prosecution for an offence" (Circular 2/76). The Department of the Environment advice is similar in effect to the policy of some police forces to ignore speeding motorists unless they are driving at more than so many miles in excess of the speed limit (Steer, 1980).

The statutory provisions create mandatory duties or discretionary duties for enforcement agents by the use of the words "shall" and "may". For example, a LA "shall" (mandatory duty) serve a NAN where they are satisfied that a nuisance exists (s.58(1)), but the power to

serve notices to control noise from construction sites is discretionary ("....the local authority may serve a notice..." (s.60(2))). Other discretionary duties in Part III of COPA are the designation of noise abatement zones (s.63(1)), the service of noise reduction notices (s.66(1)) on classified premises in zones and the determination of registered levels for new development in zones (s.67(1)). All the other duties are mandatory, however.

4.4.3.1 Sanctioning Discretion in Statutory Noise Nuisance

The LA "shall" inspect its area from time to time to detect noise nuisances (s.57), it "shall" serve a noise abatement notice where it is satisfied that a nuisance exists (s.58(1)) and, if the terms of the notice are contravened without a reasonable excuse, the recipient of the notice "shall" be guilty of an offence (s.58(4)). These duties can be summarised as:

- duty to investigate noise nuisances
- duty to serve abatement notices
- duty to prosecute

(1) **Duty to investigate noise nuisances**

Section 57 imposes a statutory duty on LAs to inspect their areas "from time to time" to detect any noise nuisances which could be dealt with under s.58 of the Act. Circular 2/76 does not give any advice concerning the way in which inspection should be carried out, or exactly what 'from time to time' means. This phrase stems from the Public Health Act 1936, and aroused some debate in the Lords during the passage of the Protection of the Environment Bill, when Lord Craighton suggested amending the phrase 'from time to time' to a specific period of time, for example not less than every two years. The Government, however, considered this amendment to be impractical due to the local nature of noise, meaning that some LAs would have to inspect much more frequently than every 2 years, while others in rural areas much less frequently (HL Debates 1974d).

In fact the Operational Model (Chapter 6) shows that the impression of active LA inspection patrols conveyed by a straight reading of the legal mandate, and as understood by Parliament, is largely erroneous: the majority of enforcement activity under s.58 is generated in response to public complaint. The question which then arises is, does the authority have a statutory duty under s.57 to investigate every complaint about noise? Obviously matters which fall outside the ambit of statutory noise nuisance, such as aircraft and traffic noise, would be excluded. However, as Chapter 6 illustrates, some authorities have developed administrative procedures for dealing with complaints about certain domestic noise problems which effectively by-pass any investigation on the part of the authority. The procedures comprise minor variations on a theme of sending the complainant a standard package, consisting of all the information and forms necessary to take a private action under s.59 of the Act: in other words a 'do-it-yourself kit'.

Although there have not as yet been any reported court cases concerning the legality of this approach, the Ombudsman found that one authority's use of the procedure amounted to maladministration (C.Lees, Bromsgrove District Council, pers. comm.). The authority in question had been using the DIY-kit procedure for many years to deal with complaints from a single household of alleged noise nuisance from animals (dogs, ducks, geese, donkeys etc.) or from neighbours' stereos, drum practising and so forth. The Ombudsman stressed that a LA had a duty under s.57 to investigate all noise complaints, however trivial. The Ombudsman's report stated that:

> "....good administration dictates that the Council, when a complaint is made, should make sufficient enquiries to establish whether or not a statutory nuisance exists or existed....When an EHO is asked to look into a noise complaint the crucial point is that he must make a judgement as to whether the noise amounts to a statutory nuisance; he cannot simply rely on the evidence produced by the complainant....." (Avon, Gloucestershire and Somerset Environmental Monitoring Committee, 1988).

(ii) **Duty to Serve Abatement Notices**

There are no reported court cases concerning the mandatory duty to serve an abatement notice, but the Ombudsman, reporting on a complaint against Breckland District Council (Gittins, 1986), concluded that "If a council are satisfied that a noise or other nuisance exists they have a statutory duty to serve notices requiring its abatement - I do not question the good faith of officers who were concerned that legal action might prejudice negotiations, but this concern should not have been allowed to override the legal obligation of the council to take action."

(iii) **Duty to Prosecute**

As mentioned above, it has never been the rule in Britain that suspected criminal offences must automatically be the subject of prosecution. In principle, the police and other enforcement agencies are answerable for their prosecution decisions and policies, if at all, to the courts alone (Sanders, 1985a). There are no reported court cases concerning the discretion to prosecute neighbourhood noise offences, although in theory there is a possibility that the courts could intervene by way of judicial review (see Section 4.5.3).

A few cases have illustrated the power of the judiciary to limit the discretion of the police to prosecute. In R v Metropolitan Police Commissioner ex parte Blackburn ((1968) 2 QB 118), Lord Denning said that the courts could, in principle, countermand general policy decisions of the police not to prosecute whole classes of offence, but that the courts would not question police discretion when properly exercised, for example in not prosecuting offenders who for some special reason were not blameworthy in the way contemplated by the Act creating the offence.

4.5 JUDICIALISATION OF PART III OF COPA

Apart from legalisation, the other legal method for curbing enforcement discretion is judicialisation, in other words subjecting official decisions to appellate procedures, judicial review and other methods of formal accountability. In Britain, the main form of judicial control over administrative discretion is adjudication by a tribunal (Hill, 1975). Whilst Part III of COPA makes no provision for appeals tribunals (cf. the Health and Safety at Work, Etc., Act 1974 in relation to the control of industrial air pollution by HMIP), the following measures are available for accountablility or redress:

- Appeals
- Default powers of the Secretary of State
- Judicial review of administrative action
- Local Commissioners for Administration, or "Ombudsmen"

4.5.1 Appeals

(a) Broad grounds for appeal to the magistrates' court against statutory notices.
(b) Appeals to the Secretary of State concerning various provisions in NAZs.
(c) Appeals against sentence to a higher court.

4.5.2 Default Powers of the Secretary of State

(a) S.96 of COPA enables the Secretary of State to hold a local public inquiry on any matter under the Act that in his opinion warrants it.

(b) Under s.97 of COPA the Secretary of State may make an order declaring any authority, which has failed to perform any statutory duty under the Act, to be in default and directing the authority to carry out those duties. If the defaulting authority fails to comply with any directions contained in the order, the Secretary of State may

transfer specific functions to himself.

4.5.3 Judicial Review of Administrative Action

> "The power of the superior courts to review the legality and validity of the actings and decisions of persons and bodies exercising administrative powers, whether of a legislative, executive or judicial or adjudicatory character. This is quite distinct from political and administrative challenge.....and from any right of appeal which may exist in a particular case" (Walker, 1980).

There is some doubt, however, whether judicial review is available for cases concerning Part III of COPA, since s.97 provides its own specific remedy. In Regina v Kensington and Chelsea (Royal) London Borough Council, ex parte Birdwood ((1976) 74 LGR 424), an application for an order of mandamus directed to the council to compel them to carry out their statutory duties under the Public Health Act 1936, with regard to refuse collection and street cleansing, was refused by the High Court. It was held that this was a case where judicial review would not normally apply, since s.322 of the Public Health Act 1936 already provided its own specific remedy (which is a very similar power to s.97 of COPA). Lord Widgery, CJ. (at p.427) said "....this is, in my opinion, one of those cases where the statute in question has supplied its own exclusive remedy, and in those cases only the exclusive remedy is open to the person aggrieved and mandamus from this court will not normally go."

4.5.4 Local Commissioners for Administration or "Ombudsmen"

Strictly speaking, Ombudsmen provide a form of administrative, rather than judicial, control of enforcement discretion (Hill, 1975). Introduced in 1974, coincident with the reorganisation of local government, Ombudsmen can be called on usually via public complaint to a councillor, to investigate complaints of injustice caused by maladministration by local authorities, joint planning boards and police authorities (except the Metropolitan Police who are accountable to the Home Secretary). They have no remedial powers beyond the preparation of a report which must be considered by the authority

concerned (Greenwood and Wilson, 1984). The Middlesex Officers' Liaison Group on Noise Control (1982) provide several examples of cases concerning Part III of COPA where Ombudsmen have been called in.

4.6 CONCLUSIONS

The Chapter has illustrated how the incorporation of scientific and technical criteria into the legal mandate reduces discretion to define unlawful behaviour and makes decision-making more rule-bound. The offence of exceeding the registered level in a NAZ is a classic example: the discretion involved in determining whether or not the behaviour is lawful does not involve anything much different from a speeding offence.

A broad sanctioning discretion applies in British law. Nevertheless from the perspective of the Legal Model, it could be proposed that a more precise mandate would tend to encourage a stricter enforcement strategy. This is because precise rules tend to make a decision not to prosecute an offence more 'visible' and also tend to make prosecution an easier path to take by reducing the number of points of uncertainty in proving a case in court. (Although, as mentioned in Chapter 2, Pepinsky (1976) argued that the number of areas of discretion actually increase as the provisions of the body of the criminal law are further specified.)

The Legal Model therefore predicts that the observed tendency of British pollution control legislation to contain more scientific and technical terms should produce a stricter or more 'sanctioning' (see Table 2.2, Chapter 2) approach to enforcement. Whether or not this is a reasonable prediction will be considered in Chapter 7, when the main points raised by the Legal, Operational and Technical Models are integrated.

The final stage along the continuum of technical specificity in law can be called "automated justice", a term attributable to Skolnick (1966), who used it to describe the use of meters to regulate car-

parking. Other examples can be gleaned from traffic regulation, and include tachometers, speed-guns and intoximeters. The term is also applicable to the use of technology to determine pollution offences: monitoring registered noise levels in NAZs, for example. "Automated justice" means that enforcement agents effectively hand over their discretion to determine unlawful behaviour to a machine.

Statutory defences and grounds for appeal against statutory notices and consents tend to put further boundaries on the definition of unlawful behaviour, several of which involve discretionary terms such as BPM and that a notice is 'unreasonable'. This means that even if a prohibited act is defined in quantitative terms, the establishment of criminal liability will contain some discretionary elements. For instance, a noise reduction notice (s.66) sets a noise emission limit in decibels. But the Control of Noise (Appeals) Regulations 1975 provide broad grounds for appeal against the notice (including the grounds that the notice is unreasonable and that the BPM are already being used to control noise from trade and business premises) and BPM is also available as a statutory defence. Exceeding the registered level in a NAZ, however, is an offence for which there are no statutory defences, although an appeal can be made to the Secretary of State against the registered level within 28 days of its being set.

As mentioned in Chapter 2, pollution offences are generally considered to be strict liability offences (Moodie, 1981; Richardson, 1982), contrasting with the general requirement for liability in the criminal law that the defendant should possess "mens rea". However, the existence of broad grounds for appeal against statutory notices and consents, and of statutory defences in prosecution proceedings, has the effect of introducing an element of mens rea into the definition of otherwise strict liability offences.

Codes of practice made under s.71 of COPA (such as BS 5228), which help to define unlawful behaviour, play a similar role to the 'Notes on Best Practicable Means' issued by HMIP for the control of industrial air pollution from scheduled processes. However, as

mentioned above (Section 4.4.2.5), it would be impractical to attempt to devise codes for all potential sources of noise nuisance. A generic approach is preferable, as emphasised by Jasanoff (1982) in relation to the regulation of carcinogens in the United States.

Scientific and technical criteria can be accommodated more readily in delegated legislation than in primary legislation. For example, the technical details concerning the measurement of registered levels in NAZs are contained in the Control of Noise (Measurement and Registers) Regulations 1976.

Primary legislation is subject to Parliamentary debate and must meet the strict demands of the Parliamentary timetable. Bills must be comprehensible to Members of Parliament: in 1901 a legal expert explained that a Minister in charge of a Bill, ".....will eschew technical terms, except where they are clearly necessary, remembering that his proposals will have to be expounded to, and understood by, an assembly of laymen" (Ilbert, 1901 quoted in Miers and Page, 1982). This comment is still relevant today.

It is unusual for delegated legislation to be debated by Parliament since the majority of statutory instruments are so-called 'negative instruments', which become effective automatically unless annulled by resolution (or 'prayed against'). Although various Parliamentary committees have the power to investigate every statutory instrument laid before Parliament, in practice time pressures allow only a small proportion to be scrutinised. This means that broad powers are delegated to the executive to draft statutory instruments and, in the case of technical instruments, civil servants in consultation with client groups effectively have a largely free hand in preparing them (Greenwood and Wilson, 1984).

This raises questions of democratic accountability: who should have the power to determine the substantive and procedural limits of the law? The legislature (in accordance with theories of democracy) or an official? By defining unlawful behaviour in technical terms, this

power is increasingly delegated to civil servants. Technical specificity in legislation also tends to reduce the scope for judicial interpretation of unlawful behaviour.

4.6.1 Critique of the Legal Model

The Legal Model makes the assumption that law enforcement in practice is similar to law enforcement in principle. It considers the enforcement agency to be a 'black box', with the legal mandate as an input producing an output of enforcement actions predictable from the form of the mandate, and unperturbed by constraints and variables hidden in the black box.

Several studies have criticised policy analysts for frequently adopting a similar black box approach to studies of policy implementation (for example, Levitt, 1980; Jackson, 1985). As Jackson (1985) says: "Those who prescribe policy actions and generate blue-prints for governments to follow take the implementation system as given. It is regarded as some external, neutral and unproblematic set of relationships. Policy decisions are somehow translated into actions which generate the desired outputs of the socio-political system. This 'black box' approach to policy analysis has permeated the literature for some time now and serves little useful purpose in trying to understand why policy outcomes ex post are not equivalent to those intended ex ante".

Consequently, Chapter 6 (the Operational Model) examines the day-to-day decision-making behaviour of EHOs responsible for the enforcement of neighbourhood noise provisions, and thereby aims to identify the operational constraints acting on the enforcement system.

Prior to this, Chapter 5 (the Technical Model) looks at the historical development of technology to measure environmental noise and of methods for the determination of 'dose-effect' relationships for neighbourhood noise, as a means of evaluating the scientific basis of the legal mandate.

CHAPTER 5

THE TECHNICAL MODEL

5.1 INTRODUCTION

At its broadest level, the Technical Model examines the key characteristics which underlie the scientific process of attempting to quantify the relationship between a pollutant and the potential or actual impact of that pollutant on 'targets' or receptors in the environment. Quantifying this 'dose-effect' relationship involves three processes:

A. Detection;
B. Measurement and monitoring;
C. Dose-effect determination.

A. DETECTION

The presence of some pollutants in the environment can be perceived immediately, for example, smoke, noise, odours and rubbish. Other forms of pollution are insidious in as much as their presence is imperceptible, although their adverse effects will be suffered at high enough concentrations: examples being radiation, pesticide residues in food, carbon monoxide and micropollutants in water. The detection of pollutants which cannot be perceived by the human senses depends on the use of technology. Detection of these pollutants is 'technology-led'.

B. MEASUREMENT AND MONITORING

Scientific measurement relies on the development of accurate, precise and replicable measurement procedures. This involves the calibration of instrumentation and the standardisation of instruments and techniques. Monitoring is required to determine the distribution of the pollutant in the environment, both spatially and temporally.

Scientific measurement requires both accuracy and precision. Although the terms are synonymous in everyday usage, 'precision' in this context means the replicability of a measurement procedure. 'Accuracy' is the term used to define how near to the 'real' value the answer is. The achievement of accurate and precise measurement involves calibration and standardisation. Calibration involves the graduation of an instrument to enable measurements in definite units to be made with it, and also the routine checking of instrumentation to maintain the dimensions of those units, thus ensuring the accuracy, and also the precision of the measurements. Standardisation involves specifying criteria for the design of measurement instrumentation and for the measurement procedures used, to enable precision and accuracy of techniques.

C. DOSE-EFFECT DETERMINATION

What is referred to in this thesis as the 'dose-effect relationship' involves the correlation of pollutant levels with effects. If it is possible to forecast how much pollution a target or receptor is likely to receive, and also to know how the target reacts to the pollutant, it should be possible to forecast the likely levels of damage, harm or interference (Holdgate, 1979). Scientific evaluation is often imperfect, however, as a result of insufficient data on which to base the assessment; of the complexity of the relationship between pollutants and effects; or of problems in quantifying subjective effects or levels of disamenity. The evaluation also becomes more difficult if the potential long-term effects of pollution are considered in addition to the short-term, or if concern is extended from local effects to global.

Although it may be possible to quantify scientifically the effects of pollution on particular targets, the questions as to what level of effect can be tolerated and what level of damage to the environment is 'acceptable' involve more than a purely scientific assessment. The definition of pollution involves some form of value judgement: "It is

at once evident that the criteria for a pollutant cannot be entirely objective" (HMSO, 1972). Holdgate (1979) states that "pollution is controlled in order to protect targets from unacceptable damage", but what exactly does 'unacceptable' mean? Scientific evaluation provides the basic data on which to base policy decisions, but the actual policy standard which is set will be determined in the light of economic, political and social goals.

The Technical Model examines each of the processes outlined above, using environmental noise as an example of a pollutant which exerts a negative effect on individuals or the community, living in the vicinity of the noise, who are the targets of the pollutant in this case.

5.2 DETECTION OF NOISE

Noise was defined in Chapter 1 as 'unwanted sound'. In other words, noise is a physical signal which elicits a negative subjective evaluation from the hearer. "At every stage, the acoustical scientist is conscious of the dual nature of noise - of its physical aspect as sound obeying the laws of classical physics, and of the subjective aspect of human reaction with its much more complex workings" (Robinson, 1962). Appendix 2 provides a description of the physical characteristics and units of measurement of sound.

5.2.1 Perception of Sound

In contrast to many pollutants whose presence in the environment cannot be perceived directly by the human body (although the impact of their adverse effects will be detected at high enough levels of the pollutant), noise is immediately recognised by the healthy ear.

The ear is a pressure and frequency sensitive organ. Its sensitivity is incredible: a pressure change of 20 uPa is so small that it causes the ear drum to deflect a distance less than the diameter of a single hydrogen atom, and yet this sound can still be

perceived by the ear (Bruel and Kjaer, 1984). The ear acts as a transducer: it converts sound waves in air into mechanical vibrations which are conveyed from the eardrum to fluid in the part of the inner ear known as the cochlea. The vibrations disturb the fluid in the cochlea and cause the distortion of very sensitive hair cells on part of the cochlea known as the basilar membrane. This distortion of the hair cells is transformed into nervous impulses, which are conveyed to the brain. While much is understood of the means by which the ear perceives sound, "the action of the brain in interpreting the complex signals from the ear is barely elucidated" (Jones and Chapman, 1984a).

"The complete hearing process seems to consist of a number of separate processes which, in themselves, are fairly complicated, so no simple and unique relationship exists between the physical measurement of a sound pressure level and the human perception of the sound" (Broch, 1962).

The perception of sound is a complex field in its own right and one that occupies psychoacousticians in studies which, although fascinating, are outside the scope of this thesis. Further information on audition and the perception of sound is provided by Kryter (1970); Burns (1968) and Jones and Chapman (1984b).

5.2.2 Other Types of Noise

Although strictly speaking, 'sound' and hence 'noise' refer to audible pressure variations, three types of pressure waves which may not be detected by the ear are also considered to be noise. These are ultrasound, infrasound and vibration.

5.2.2.1. Ultrasound

'Ultrasound' is the name given to pressure waves with frequencies above the limit of human audibility, in other words from about 20 kilohertz up to about 10 megahertz. Although ultrasound is a relatively new energy source, it is being increasingly used in various

industrial, medical, scientific and consumer applications (World Health Organisation, 1972). There is some evidence that ultrasound is harmless to the human ear at pressure levels below about 140 dB, but unpleasant non-auditory effects can be produced, such as increased skin heat and a metallic feeling in the teeth (Dawson, 1984). Adverse effects from exposure to ultrasound are probably more of an occupational problem than an environmental one, since ultrasound tends to fall off very rapidly with distance from the source (ibid.).

5.2.2.2. Infrasound

At the other end of the frequency spectrum is 'infrasound', incorporating pressure waves in air at frequencies below about 20 hertz (the lower limit of hearing). As the ear is insensitive to frequencies at these low levels, the chance of hearing damage from infrasound is slight, but unpleasant physiological effects can be induced by such sounds. These include headache, nausea, vomiting, palpitations, and feelings of stress and undue fatigue (ibid.). Infrasound is produced in lorries, and to a lesser extent in cars, when driven at motorway speeds. The sound pressure levels reached at these low frequencies are thought to be sufficient to produce adverse effects in a sensitive minority of drivers, and this could have implications for motorway safety (Tempest and Bryan, 1972). Berry (1981) mentions that research interest has been growing in the effects of high levels of infrasound. Other sources of infrasound include boiler installations, large air compressors and powerful diesel engines.

5.2.2.3. Vibration

Vibrations are pressure waves in a solid medium, such as the ground or building structures. Vibrations are specifically considered to be a type of noise for the purposes of Part III of COPA (s.73(1)). They are low frequency waves with frequencies ranging from 1-80 hertz (BS 6472), and consequently can be below the audible threshold for sound, although they may well be felt by the body. BS 6742 states that people

will begin to complain about vibration when levels are only just above the human perception level. Annoyance due to vibration is often a result of people's fear of damage to their homes and buildings, but high levels of vibration can cause physiological effects such as nausea and headache (Avon, Gloucestershire and Somerset Environmental Monitoring Committee, 1985). A straightforward introduction to the measurement of vibration is provided by Bruel and Kjaer (1982), a more advanced text on vibration measurement and analysis by Broch (1984).

5.3 MEASUREMENT OF NOISE

The science of acoustics has a long history which is covered by Bruce-Lindsay (1966 and 1973) and Miller (1935). In terms of instrumentation for measuring sound pressure and frequency, and the development of physical analogues for loudness approximations, however, it was not until the advent of electronics that substantial progress was made. Basically this is because sound power levels are extremely small, necessitating the use of some means of amplification before accurate measurements can be made.

This Section provides an overview of the major developments in noise measuring equipment. It traces the development of noise measuring instrumentation from early mechanical methods to electronic devices and finally to the new generation of microprocessor-based equipment. The major types of present-day noise measuring instruments are described, with particular emphasis being placed on equipment which is, or could be, used by EHOs in enforcing their legal mandate with respect to neighbourhood noise. Finally, future trends in the design and capability of noise measuring equipment are considered. As the aim of the chapter is to highlight the key characteristics of the Technical Model, rather than to provide an exhaustive description of noise measuring techniques, the specialist fields of vibration analysis and of measurements in building acoustics are omitted.

5.3.1 Instruments for Measuring Sound

Until electronics came to assist with amplification, there were only two methods for measuring sound: one was the human ear, the other was various sorts of mechanical techniques. No physical analogue yet devised can approach the sensitivity of the ear or its ability to differentiate between various types of sound. It is immensely sensitive, but quite uncalibrated and prone to a high degree of subjective variability.

Mechanical methods tended to be insensitive and difficult to use. Topler and Boltzmann (1870, as reported in Meij, 1971) made one of the earliest determinations of sound pressure, by using an optical technique to measure the change in refractive index of the air in an organ pipe. According to Tempest and Bryan (1976), in 1882 Lord Rayleigh published a paper which described a direct method of measuring sound pressure by means of a small, thin disc, which became known as the 'Rayleigh disc'. This method was based on the principle that when a small disc is suspended in an air-stream, it will tend to set itself at right angles to the stream. When the surrounding air is set in vibration by a sound wave, the disc twists through a small angle which is proportional to the intensity of the sound. The Rayleigh disc was considered to be the most accurate method for the determination of sound pressures, and was used by the National Physical Laboratory until the Second World War as an absolute standard to calibrate electrical meters (ibid.). However, it could only be used in the laboratory and was not suitable for field measurements of environmental noise.

By 1926 portable instruments consisting of a microphone, an amplifier, and an indicating instrument were being used to measure noise. These were the first 'sound level meters'. However, most were uncalibrated and were used to compare the relative magnitude of one sound with another, rather than to determine an objective measure of sound pressure (King, 1965). Later versions were calibrated, however, by reference to the Rayleigh disc, to read in decibels. They were

basically "sound pressure meters", since they gave a measure of the physical magnitude of a noise, and not of its perceived loudness.

Although the technology has developed rapidly, and now there are many sound measuring systems available, the basic pattern is still the same: a microphone is followed by a processing section, which includes amplifiers and a rectifier, and then by a display unit or indicator (Figure 5.1).

5.3.1.1 The Microphone

The first condenser microphone was designed by E C Wente in 1915 (Bruel and Kjaer, 1986). Combined with a reliable method for calibrating the microphone, this provided the basis for the accurate measurement of sound pressure (Robinson, 1972).

A microphone is a transducer, converting sound energy into electrical energy. In theory, any method of converting a mechanical signal into an electrical signal can be used as the basis for a microphone, and in practice many different systems have been developed for various purposes. However, for the purpose of precision measurements of sound, the condenser (or capacitor) microphone dominates the field: the overriding advantage of the condenser microphone over most other types is its stability in performance over a long period of time, and its smooth frequency response (Figure 5.2) (Tempest and Bryan, 1976).

In simple terms the condenser microphone consists of a taut stainless-steel diaphragm, mounted close to a fixed backplate. A sound wave will cause the diaphragm to vibrate, producing an alternating charge in the capacitance between the diaphragm and the fixed plate. This in turn alters the electrical potential across a high resistance, and the resulting electrical signal is then amplified.

FIGURE 5.1
BLOCK DIAGRAM OF A TYPICAL SOUND LEVEL METER
(KOHLER, 1984)

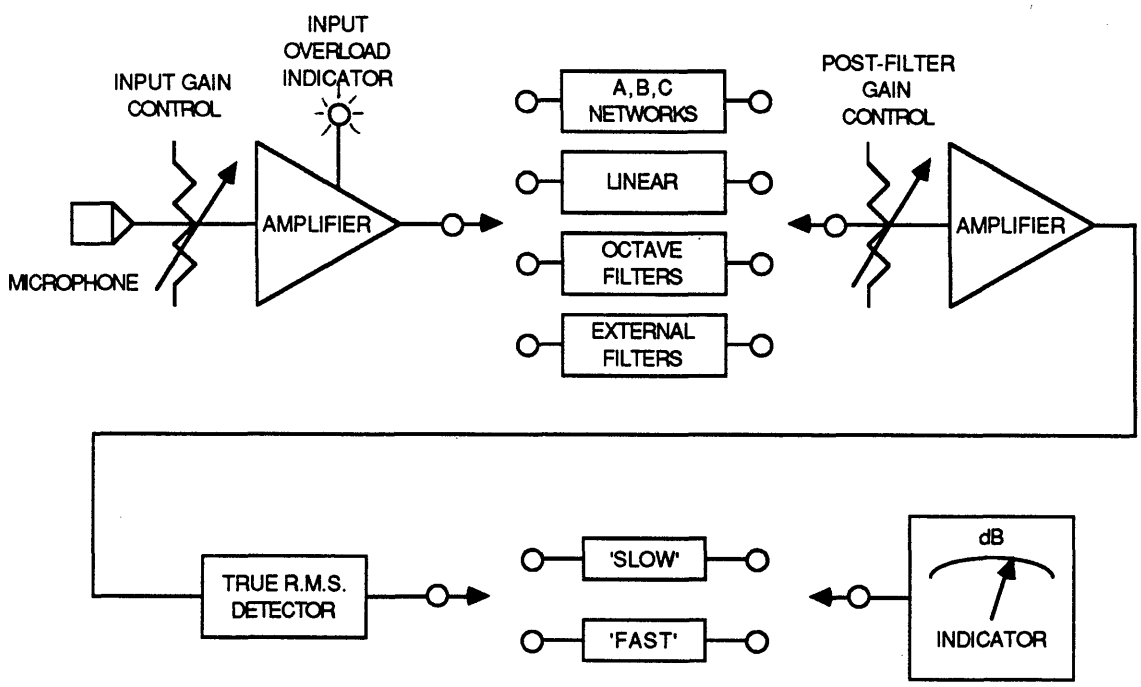
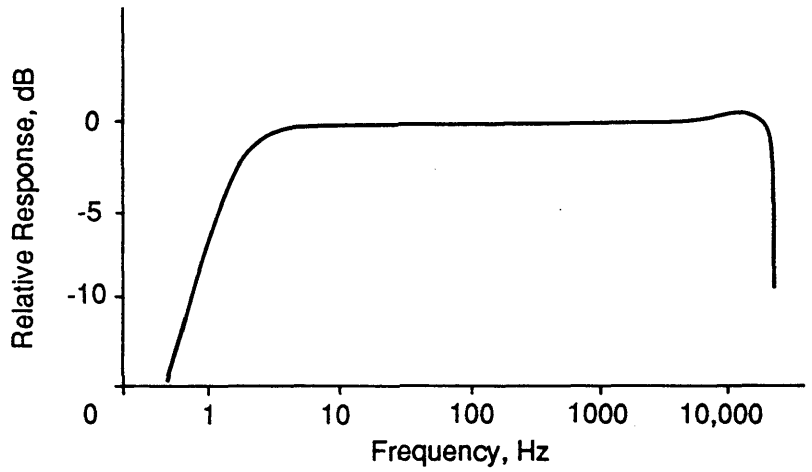


FIGURE 5.2
FREQUENCY RESPONSE OF A CONDENSER MICROPHONE
(Tempest and Bryan, 1976)



5.3.1.2 The Amplifier

The first triode amplifier was invented by L de Forest in 1906 (Bruel and Kjaer, 1986). In a sound measuring system, the amplifier is used to enlarge the small electrical signal from the microphone to a measurable size. Sound level meters generally have two amplifiers: the pre-amplifier is found immediately after the microphone and amplifies the signal from the microphone prior to processing. A further amplifier magnifies the signal for rectifying and display.

5.3.1.3 The Rectifier

The rectifier circuit converts all the a.c. (alternating current) voltages originating from the microphone into a d.c. (direct current) component, from which the RMS value (root mean square, a particular type of average, see Appendix 2) can be calculated by another circuit known as the RMS detector. The RMS is widely used in sound measurement since it is directly related to the amount of energy in the sound signal. Alternatively, the peak value of the wave may be determined. Modern sound level meters have in addition a variety of other circuits and filters, whose functions are described later.

5.3.1.4 The Indicator

In the early sound level meters this was basically a direct reading dial micro-ammeter, which had been suitably graduated to read in decibels. Meter damping was later introduced in order that a meaningful reading of rapidly fluctuating sound signals could be obtained. Two indicator response characteristics were standardised, known as "F" (fast) and "S" (slow), using time constants of 0.125 seconds and 1 second respectively (Bruel and Kjaer, 1984). Many modern sound level meters have digital displays which largely overcome the problem of fluctuating displays, by indicating the maximum RMS value measured within the preceding second (ibid.).

5.3.2 Physical Analogues of the Ear

From the beginning it was the goal of acoustic research to develop an instrument which could respond to sound signals in a way which had a close correspondence with the subjective human response. "It was also apparent, however, that this was so difficult to achieve, in practice and in principle, as to be nearly impossible" (Schultz, 1982).

5.3.2.1 Subjective Sound Level Meters

In the 1930s so-called "subjective" sound level meters were in vogue (Robinson, 1972). This was in contrast to the "objective" type as described above. Two subjective methods were used, one with more success than the other.

(a) The Masking Method

This method, attributable to Barkhausen (1926) and described by King (1965), measured the degree to which a noise was capable of masking - or drowning out - a standard tone or buzzer relayed to the observer through earphones. The earphones were spaced a short way off the ears of the observer, so that the noise in question and the tone or buzzer could be heard simultaneously. The observer adjusted the magnitude of the reference tone to the level at which it was just audible above the noise in question. The level at which the reference tone could just be heard was then determined without the noise present. The difference between these two readings in decibels gave the masking effect of the noise. It was not a direct measure of noise, but of its masking, or deafening, effect and was based on the assumption that the masking ability of a noise depended on its sound pressure level. It was later found that this relationship does not always hold, as the masking effect is also frequency dependent, and the method was discontinued towards the end of the 1930s (ibid.).

(b) The Loudness Balance Method

This method is described by Kaye in an article for the Noise Abatement Exhibition at the Science Museum, London in 1935, and is attributable to Churcher and King (1937). The loudness of the noise in question was determined by making an aural comparison with a reference tone or buzzer of a specified frequency (usually 1000 Hz). The tone or buzzer was heard through a telephone earpiece held tightly to one ear, leaving the other ear free to listen to the noise in question. The magnitude of the reference tone could then be adjusted by the operator until, in his or her estimation, it sounded as loud as the noise in question. A reading of the noise level could then be made in phons (see Appendix 2).

The problems with these subjective methods were firstly that individuals differed quite widely in their judgement of masking or equal loudness: even the same individual was not always consistent. A team of experienced observers could be used to determine the mean response when higher accuracy was desired. Secondly, unexpected or short-lived impulsive noises were difficult to measure, since their duration was too short to enable a determination of masking or equal loudness to be made. However, the loudness balance method was considered to give a more faithful indication of the subjective loudness of a noise than could be provided by any objective meter (King, 1965).

5.3.2.2 Objective Measurements of Noise: Frequency Weighting Networks

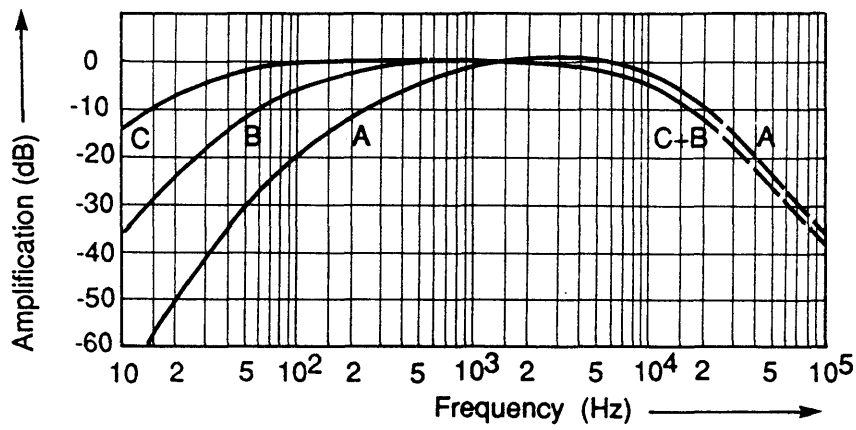
According to Schultz (1982), the earliest systematic noise measurements to be made in the USA were those of noise in New York City (Brown et al., 1930). Most of the measurements were made using subjective noise meters, but some utilised an objective-type meter which incorporated a frequency weighting network corresponding to an inverted Fletcher-Munson equal loudness contour (see Appendix 2) for a loudness level of 30 phons.

By 1933 sound level meters with frequency weighting networks were on the market (Robinson, 1972). King (1965) mentions that one of the first instruments of this type was marketed by the General Radio Company of Cambridge, Massachusetts, USA, and also used weighting networks based on the inverted equal loudness contours of Fletcher and Munson (1933). Kaye (1935) notes that other meters were developed which used the Kingsbury loudness-frequency curve (Kingsbury, 1927).

The weighting networks most commonly used were the A, B and C weighting scales, which attempted to simulate the loudness response of the ear to pure tones of 1000 Hz at sound levels of 40, 70 and 100 decibels respectively (Figure 5.3). The A-weighting scale weighted a sound signal in a way which approximated to an inverted equal loudness contour at low sound pressure levels (40 phons). The B-weighting network corresponded to an inverted equal loudness contour at medium sound pressure levels (70 phons) and the C-weighting to an inverted equal loudness contour at high sound pressure levels (100 phons). Sound pressure levels measured using the A-weighting scale became known as 'A-weighted decibels' or dB(A), while measurements made with the B and C weighting scales became known as dB(B) and dB(C) respectively.

The limitations of frequency weighting networks are discussed by King (1965), Kuehn (1963) and Keast (1960). They considered that the weighted sound level meter was a good instrument for comparing the loudness of pure tones, and adequate for comparing the loudness of noises with similar frequency spectra, but was incapable of giving a consistent comparison of the loudness of noises with complex spectra (that is, most 'noises'). The equal loudness contours, on which the frequency weighting networks were based, were devised in relation to pure tones and not complex noises. According to King (1965), the weighted sound level meter always reads low in phons when compared with a subjective test for complex noises. So despite the incorporation of frequency weighting networks, sound level meters do not measure the perceived loudness of noises, but provide a weighted

FIGURE 5.3
WEIGHTING NETWORKS OF A SOUND LEVEL METER AS PROPOSED BY THE INTERNATIONAL ELECTROTECHNICAL COMMISSION
(Kuehn, 1963)



measure of the sound pressure level, which often shows a reasonably good correspondence with perceived loudness. Consequently the readings made with a sound level meter are always in units of sound pressure level (weighted decibels) and not phons.

In 1944, the A, B and C weightings for sound level meters were standardised by the American Standards Association (ASA Z24.3, 1944). Later, similar frequency weighting scales were standardised by the International Electrotechnical Commission (1961), and these were subsequently adopted by Britain (BS 3489 and BS 4197) in the 1960s. These standards have now been updated internationally, and adopted by Britain as BS 5969 (1981). Although the sensitivity, accuracy and reliability of modern sound level meters show a great improvement over equipment from the early experimental days, the basis for determination of the weighted sound pressure level has not fundamentally changed.

5.3.2.3 The Ubiquity of the A-Weighting Scale

It was originally intended to use the A-scale for measuring the loudness of sound levels below 55 dB, the B-scale for sound levels between 55-85 dB and the C-scale for sound levels above 85 dB (Schultz, 1982). In fact, the B and C-weighting scales have hardly been used at all, while the A-weighting scale has been generally adopted for the majority of environmental noise measurements, with the exception of aircraft noise for which a specific weighting curve - the D-weighting scale - was developed by Kryter (1960).

What led to the A-weighting scale being so universally adopted as a measure of environmental noise at all sound pressure levels? According to Schultz (1982), scarcely any systematic research was undertaken at the time of the development of the weighted sound level meter to determine the correspondence between the A-weighting scale and human subjective response to noise. It was argued that the B-curve did not differ greatly in slope from the A-curve, and the small increase in accuracy to be gained by using the B-scale for noises of medium

intensity was outweighed by the convenience of using a single weighting network for all levels of noise. The C-curve, approximating to the unweighted sound pressure level, agreed no better with the subjective response than did the unweighted pressure level. Consequently, as a result of its simplicity and convenience, the A-scale was adopted for general use and became enshrined in the literature.

It was not until after the weighting scales had been standardised (ASA Z24.3, 1944) that experimental work was carried out to determine their relative correlation with the subjective response to noise (for example, Mills and Robinson, 1963). Fortunately, the A-scale was found to correlate with subjective response as well as, if not better than, any other scale with which it was compared (Schultz, 1982). It should be reiterated, however, that the A-weighted sound level meter does not measure perceived loudness, but only a reasonable physical approximation of the subjective response. In 1971 the International Organisation for Standardisation adopted the A-weighting for all forms of community noise rating, with the exception of aircraft noise (ISO R1996).

5.3.2.4 Problems With Low Frequencies

Low frequency noise tends to persist over longer distances than high frequency signals, whose shorter wavelengths are more easily absorbed by the air, building structures and trees. Although generally more annoying than low frequency noise, high frequencies are consequently more amenable to attenuation by acoustic insulation than the low frequency component. As a result, in some circumstances low frequency noise can be a serious annoyance: the base 'thump' of heavy rock music and the rumble of lorry traffic providing common examples. As the A-scale weights low frequencies less than higher frequencies, readings of low frequency noises in dB(A) may tend to underrate their potential for annoyance (Flindell, pers. comm.). In view of the inadequacy of the correspondence between the A-scale and the subjective response at low frequencies, it has been suggested that the

unweighted, linear sound pressure level should be used for frequencies below about 1000 Hz (Flindell, pers. comm.).

5.3.2.5 Transistorisation

The 1950s saw the development of transistors and their incorporation into sound level meters, replacing thermionic valves as amplification devices. Transistors were much less bulky and fragile than valves, and enabled the development of smaller, more compact acoustic instrumentation: an example is provided by the 'Soundscope', manufactured by the Mine Safety Appliances Company in the USA, which combined a sound level meter, a frequency analyser and an acoustic calibrator in a single, portable instrument (Keast, 1960). Parkin et al. (1968) mention the inconvenience of waiting for valves to warm up before instrumentation could be used, a problem overcome by the use of transistors.

5.3.3 Growth of Regulatory Interest in Noise Control

Chapter 3 described how interest in noise from a regulatory persective really began in Britain in the 1960s. 1960 saw the passing of the Noise Abatement Act, and the appointment of the Wilson Committee to investigate the problem of noise. In 1961 the London County Council, concerned about the potential impact of planned helicopter stations on ambient noise levels in London, commissioned the Building Research Station and the Central Office of Information to conduct a major survey of noise levels in the central area of the capital. The Wilson Committee themselves commissioned a substantial amount of original research, including the first comprehensive noise survey around London (Heathrow) Airport. The National Physical Laboratory hosted a symposium on "The Control of Noise" in the summer of 1961. In 1962 the Ministry of Labour awarded a major research contract to the Medical Research Council and the National Physical Laboratory to evaluate occupational hearing damage risk (Penn, 1979).

Chapter 3 raised the argument that the report of the Wilson Committee, published in 1963, provided the impetus for beginning to frame noise control laws in scientific and technical terms, rather than in qualitative terms borrowed from the traditions of the common law. Where standards for neighbourhood noise were concerned, the Comittee proposed tentative values for noise quality objectives in dwellings (based on the preliminary results of the London County Council noise survey mentioned above), and limits for noise from construction sites. Statutory limits were also recommended for noise from powered equipment used on construction and demolition sites, and for noise from motor lawn-mowers, and it was suggested that the provision of information concerning noise levels emitted by domestic equipment would help consumers to choose quieter products. Research commissioned by the Committee led to the development of a quantitative procedure for assessing reaction to industrial noise in mixed residential and industrial areas.

The Wilson report referred to the need for the provision of training in techniques of noise measurement and control for all LA officers who had to deal with noise problems in the course of their work. The report certainly provoked interest in noise measurement and assessment amongst Public Health Inspectors (Campbell pers. comm.) at a time when, according to Duerden (1970), "....there were many inspectors who....were unable to operate a sound level meter, and....there were inspectors who had never even seen a sound level meter".

The increased interest in noise monitoring and assessment prompted by the Wilson Report had knock-on effects on the acoustic instrumentation industry. One British firm which produced hearing-aids, and microphones for the music industry, branched into the production of simple hand-held sound level meters aimed at the new - and as yet small - local authority market (Campbell, pers. comm.). This market expanded when BS 4142 was published in 1967.

5.3.4 Statistical Distribution Analysis

A major characteristic of environmental noise is its tendency to show level fluctuations over a period of time. It is apparent that a single number reading from a sound level meter will not give a representative impression of the variation in magnitude over time. This problem can be overcome by using statistical distribution analysis: in other words, sampling the noise level at regular time-intervals and then plotting the number of readings which fall into particular sound level bands. The distribution of sound levels is usually expressed cumulatively. The noise level exceeded for 90% of the measurement period is referred to as the 'L90', which is basically equivalent to the background noise level. The level exceeded for 50% of the time is the 'L50' or average level, while the level exceeded for just 10% of the time is the 'L10' which, to all intents and purposes, is equivalent to the peak noise level. The extent to which a sound level fluctuates can be determined from the difference between the L90 and the L10 (this is called the 'noise climate'). In theory 'L' can have any value between 1 and 100, although the L10, L50 and L90 are the most commonly used descriptors. L-values are mainly used for rating traffic noise, although L90 is used for measurement of background noise in BS 4142.

Statistical distribution analysis was first used in this country by researchers involved in the London County Council noise survey of 1961-62 (Parkin et al., (1968), whose method was based on that developed by the Dutch acoustician, Van den Eijk. Most of Parkin et al.'s monitoring results were presented in terms of L10 and L90 values. Statistical distribution analysis can be done manually by linking a sound level meter to a chart recorder (which marks dots corresponding to periodic readings of the meter on a slowly moving chart) and by then determining the cumulative distribution of the dots. Alternatively, the electrical signal from the sound level meter can be converted into a continuous ink-trace, by connecting the meter to a graphic level recorder. Both these methods, however, are very time-consuming and are impractical for large-scale survey work or for

routine application. So that L-values could be computed automatically, the London noise survey researchers built themselves a piece of equipment which was very similar in design to the Bruel and Kjaer 'statistical distribution analyser' described below, which first became commercially available in 1964.

The Bruel and Kjaer statistical distribution analyser (Kittelsen and Poulsen, 1964) incorporated a sliding contact which could be attached to the writing arm of a graphic level recorder. The sliding contact moved over twelve fixed contacts, each of which operated a digital counter on the statistical distribution analyser. By this method the number of intervals (which could be adjusted between 0.1 and 10 seconds) during which a noise source had a sound pressure level within a certain band (2.5, 5 or 10 dB) was recorded. Each counter ran up to 999,999 so that, even using the shortest sampling interval, the apparatus could count data for 24 hours. In general, it was more convenient to make a calibrated tape recording of the noise in question on site, and then to play back the recording through a level recorder and statistical distribution analyser at a location where these instruments were available.

The early 1970s saw the development of more sophisticated systems using digital noise level recorders, or 'data loggers': these converted sound pressure levels (via a microphone and a logarithmic amplifier) into digital form for storage on a magnetic tape cassette (for example, the NOMAL system by Digitronix). Back in the laboratory, the data on the cassette could be analysed using a programmable desk-top calculator or a mini-computer to give a full statistical distribution analysis. Systems such as these could be left unattended on site to record automatically. However, it was soon found to be a wise policy to make in addition a normal analogue tape recording of the noise so that possible interference, such as from a blaring transistor radio left in close proximity to the monitoring system, could be detected.

5.3.5 Automatic Integrating Meters

In 1970 the results of the Medical Research Council / National Physical Laboratory research project on occupational hearing damage risk were published (Burns and Robinson, 1970). Burns and Robinson recommended the use of the equivalent continuous noise level (Leq) to rate noise for purposes of occupational exposure. The Leq is the continuous A-weighted sound level that is equivalent in terms of energy content to the actual fluctuating noise level over a period of observation. Although the Leq of a steady noise is numerically equal to its A-weighted level, the determination of Leq for a fluctuating noise is more complicated: it can be calculated, for instance, by integrating statistical distribution data. In the NOMAL system, for example, Leq could be calculated from digital data on tape by the use of a suitably progammed calculator or mini-computer. However, methods such as these were expensive and time-consuming.

In 1972 the Department of Employment published a code of practice for industry on the control of occupational noise, based on the work of Burns and Robinson (Department of Employment, 1972). Implementation of the code required the availability of simple hand-held meters which could give direct readings of Leq. In 1970, when Burns and Robinson published their results, no instrument was available which could compute Leq automatically. The Department of Employment's intention of publishing the code of practice led to a contract from the National Physical Laboratory to a small computer firm (Computer Engineering Limited, CEL) for the development of such an instrument (Campbell, pers. comm.). This led, in 1972, to the first integrating meter - the 'Noise Average Meter' - being launched on the market by CEL (ibid.).

The basis for the noise average meter was the capacitor-integrator. A capacitor is a means of storing an electrical charge. As charge accumulates in a capacitor, the voltage in the circuit rises as a time integral of the capacitor charge. The microphone converts the sound signal to an electrical signal - with a capacitor in the circuit, the voltage rises as an analogue of the sound energy. A capacitor has a

finite charge-storing capacity, so a switching system was used to discharge the capacitor very rapidly. In practice, a cascade arrangement of a series of capacitors was used. This system derived the total sound energy. Leq was then determined by dividing the total energy by the time period (ibid.). The noise average meter was a precision laboratory instrument, but by 1974 simple, portable integrating meters were on the market for occupational noise dose evaluation ('noise dose meters'), and for field measurements of environmental noise (ibid.).

On the international front, 1971 saw the publication by the International Organisation for Standardisation (ISO) of ISO R1996, which recommended the use of Leq to rate community response to all forms of environmental noise with the exception of aircraft noise. ISO R1996 was never adopted in Britain, since BS 4142 performed broadly the same function. At national level, BS 5228, published in 1975, recommended the use of Leq for the measurement of noise from construction sites. The following year the first set of environmental noise regulations to specify the use of Leq for noise rating (the Control of Noise (Measurement and Registers) Regulations 1976) were published.

5.3.6 Environmental Noise Analysers

By 1974/75 comprehensive noise analysing systems were available for the measurement of environmental noise (Campbell, pers. comm.). Under the generic title of 'environmental noise analysers', these portable 'boxes' were capable of statistical distribution analysis, integrating measurements, and the computation of complex ratings such as the traffic noise index and the noise pollution level. Depending on the sampling rate, these systems could be set up to record about a week's worth of data automatically. Many had inbuilt alphanumeric printers for immediate display of the data.

5.3.7 The Incorporation of Microprocessors

The early 1980s saw the development of microprocessor-controlled acoustic equipment (ibid.). Like everything else touched by the 'chip revolution', it enabled noise measuring equipment to become smaller and more versatile. As microprocessors themselves decreased in size, it proved possible to accommodate increasingly complex signal processing circuits into smaller casings. This was obviously beneficial from the point of view of portability.

Microprocessor-based acoustic equipment uses digital sampling of the sound signal, facilitating a direct interface with microcomputers and programmable desk calculators, and increasing the scope for storage, analysis and manipulation of data. The use of microprocessors is encouraging the development of a new generation of 'universal' instruments, which can be programmed individually by the user for a variety of noise analysis tasks. For instance, the Bruel and Kjaer environmental noise analyser type 4427 can store nine different programs, three of which are fixed and cannot be altered by the operator, the remaining six being user-definable (Bernard, 1986). 'Modular' sound level meters, aimed at the user who may not be expert in acoustics, first appeared on the market in 1985. Modular sound level meters accept a variety of interchangeable plug-in modules. These enable the user to alter the analysis functions, without having to resort to programming. A variety of modules have been produced, including those which perform integrating measurements, statistical distribution and frequency analysis functions.

5.3.8 The Zwicker Phon Meter

In the mid-1960s Hewlett-Packard marketed the 'loudness analyser type 8051A', which gave a direct reading of loudness in phons, using the Zwicker phon calculation procedure (see Appendix 2). The instrument was later withdrawn (Tempest and Bryan, 1976). However, interest in the development of instruments using complex loudness calculation procedures, such as the Zwicker phon method, has shown a resurgence in

recent years (Berry, 1981; Campbell, pers. comm.). This owes a great deal to microprocessor technology, and the increasing ability to fit very complex computational systems into small boxes. However, no such instrument has yet been launched on the market, in this country at least (Campbell, pers. comm.).

5.3.9 Frequency Analysis

Electronic circuits, which filter a sound signal into frequency bands, have been in existence since the early days of sound level meters in the 1930s (an early example is given by Churcher and King, 1930). Frequency analysis is particularly useful in noise reduction work for identifying annoying tonal components in a noise spectrum. Originally there were two basic types of sound spectrum analyser:

(i) Constant Percentage Bandwidth Filter Sets;

The noise signal was analysed into standard octave or 1/3 octave contiguous bands from 2Hz to 20kHz, via a set of bandpass filters. (An octave band is defined as a range of frequencies in which the highest frequency within the range is twice the lowest frequency within the range). The set of bandpass filters was either contained in a separate piece of equipment, or could be attached directly to a suitable sound level meter. The centre frequency and width of each band, whether octave or 1/3 octave, have been standardised (BS 2475, 1964).

(ii) Constant Bandwidth Analysers;

These analysed the noise signal into tunable pass-bands of, for instance, 10 Hz. Modern versions, for example the Bruel and Kjaer heterodyne analyser Type 2010, enable analysis in bandwidths which can be tuned from 3.16 to 1000 Hz. Constant bandwidth analysis permits resolution into narrower frequency bands than does the percentage bandwidth method.

5.3.9.1 Real Time Frequency Analysis

The methods of frequency analysis described above passed the noise signal through a filter, and recorded the output as the analyser was switched from one filter to another, or else swept continuously, through the frequency range of interest. Although these methods could be performed automatically (by mechanical synchronisation of the filter switching with a level recorder), they nevertheless required a total time which was equal to the measurement time multiplied by the number of filters used. They were also most suited to noises which were constant, or else varied only slowly with time. Real time analysers enable rapidly varying noise signals to be analysed in 'real time': the signal is presented simultaneously to all the filters in the chosen frequency range, and the output is fed to a continuous display device, such as a cathode ray screen, where they are displayed together as a complete spectrum. The most recent generation of real-time analysers sample the signal digitally via FFT (fast fourier transform) at high speed, such that the displayed spectrum is updated several times a second (Hassall and Zaveri, 1979).

5.3.10 Sound Intensity Measurements

In 1987, Bruel and Kjaer introduced the first portable sound intensity analyser. This enabled direct measurements of sound intensity to be made in the field. As intensity is equivalent to sound power per unit area (see Appendix 2), the sound power of a source can be calculated directly from intensity measurements. Prior to this breakthrough, sound power measurements could only be made in anechoic or reverberant chambers, in whose carefully controlled conditions specific assumptions about the sound field could be applied in order to relate sound pressure measurements to sound power (Bruel and Kjaer, 1986).

A sound intensity analysing system consists of a probe and an analyser (ibid.). The probe comprises two microphones mounted face to face with a solid spacer in between. The microphones measure the pressure

gradient, ie., the rate at which the instantaneous pressure changes with distance. The analyser performs the calculations and integration necessary to determine the sound intensity from the pressure gradient. The theoretical equations relating the pressure gradient to intensity (and hence to sound power) are not new: sound intensity was fundamental to Lord Rayleigh's "Theory of Sound", published in 1878 (ibid.). What is new is the use of modern, digital signal processing techniques which can put the theory into practice.

Sound intensity measurements are applicable to building acoustics (such as sound transmission and reverberation time studies), intensity mapping and sound source location for noise reduction purposes. Intensity analysis is only of use in the 'near field' (generally speaking, measurements made indoors or in confined spaces). In the free field (generally speaking, measurements made out-of-doors) the pressure and intensity levels in the direction of propagation of a sound wave are numerically equal (see Appendix 2).

5.4 ACCURACY AND PRECISION OF SOUND MEASUREMENT

In physical terms, sound is an extremely difficult quantity to measure, and, in comparison with electrical and mechanical quantities, can only be measured to a poor degree of accuracy. The highest grade microphones can still only measure sound pressures to an accuracy of 2% (Tempest and Bryan, 1976). The explanation for this apparent difficulty is to be found in the nature of sound itself.

Firstly, sound measuring equipment has to deal with the million-to-one range of audible sound pressures in a single instrument. Secondly, sound power levels are incredibly small. Normal sound waves range in intensity between 10^{-12} W/m^2 to 1 W/m^2, extremely low levels which illustrate the sensitivity of the ear. The roar of a football crowd cheering a goal will just about generate enough sound power to heat a cup of coffee (Pain, 1976). Such small power levels mean that the electrical signal from a microphone will need amplification, and also, that the accuracy of measurements may be reduced by the internal

noise of the meter. Indeed, the lower limit for the measuring range of sound level meters is determined by instrument noise, while the upper limit is set by overload distortion (Delaney et al, 1976). The difference between the lower and upper measurement limits is referred to as the 'dynamic range' of the instrument.

5.4.1 Sources of Instrumental Inaccuracy

Electrical instrument noise, or 'microphonics', can be detected by replacing the measurement microphone with a 'dummy' microphone, which has the same electrical impedance as the original microphone but no electrical output. The internal noise level of sound level meters is typically in the region of 20-30 dB. The lowest sound level that can be measured with reasonable accuracy is approximately 6 dB above the internal noise level (Kuehn, 1963).

Overload distortion is a potential problem when measuring impulsive or very loud noises. For impulsive noises, use of an impulse sound level meter, with a specialised response characteristic, is generally recommended (see Section 5.6.4.1). When making environmental noise measurements, it is usually possible to avoid problems of overload distortion by increasing the distance between the source and the measurement position, thereby reducing the sound pressure level (the rate of decrease in pressure level is approximately 6 dB with every doubling of distance).

5.4.2 Sources of Procedural Inaccuracy

The following description of sources of procedural inaccuracy in environmental noise measurements is drawn from Gill and Large (1979); Sutton (1979) and Crocker and Price (1975). Microphones are sensitive to humidity, temperature, and magnetic and electrostatic fields. Sound level meters should not be used in strong winds (above about 5 metres per second), since the meter will read wind noise, rather than the noise in question. Microphone windshields are generally used for environmental measurements in order to reduce interference effects.

Wind can also cause unrepresentatively low readings, in cases where it is blowing away from the noise source relative to the measuring position. It is often recommended that readings should not be taken in conditions of temperature inversion, snow, rain or fog (for example, as in the Control of Noise (Measurement and Registers) Regulations 1976). Interference caused by the presence of an observer and a sound level meter in the sound field can cause 2-3 dB errors in meter readings at frequencies above 1000 Hz (Keast, 1960): holding the meter at arm's length or using an extension cord can get round this problem. Finally, as all portable equipment is battery powered, the battery charge must be checked before taking a set of measurements.

5.4.3 Calibration

The effective calibration of a sound level meter depends almost entirely on the calibration of the microphone, since the rest of the instrument involves only straightforward electrical measurement techniques (Kuehn, 1963). There are various levels of accuracy of calibration:

A. Absolute Calibration - the Reciprocity Method

Absolute calibration of a microphone requires a specialist laboratory set-up, such as that provided by the Department of Trade and Industry's National Physical Laboratory. As the UK's national standards' laboratory, the National Physical Laboratory develops and maintains the ultimate reference standards for measurement instruments, such as microphones used in acoustic equipment (NAMAS Executive, 1985). The method usually used for absolute calibration of a microphone is the reciprocity method (for details of this method, see Delaney, 1986).

B. Laboratory Calibration - the Comparison Technique

A 'standard' microphone, which is calibrated by an absolute method and periodically checked, is used to measure the sound pressure at a point

in a sound field, usually produced by a loudspeaker in an anechoic chamber. The standard microphone is then replaced by the microphone under calibration and the outputs of the two microphones compared over the whole range of frequencies of interest.

C. Field Calibration

There are several simple methods for checking the accuracy of sound level meters both before and after taking a set of measurements. Many sound level meters can be purchased with a portable, battery-operated acoustic calibrator included in the set. Some sound level meters are now provided with a built-in internal calibrator. One of the most popular types of portable calibrator is the 'pistonphone', which fits over the microphone and produces a standard sound pressure level (typically 94 dB(A) at 1000 Hz) in the cavity in front of the microphone, caused by a piston moving to and fro. An alternative method, specifically for condenser microphones, is an electrostatic actuator. When making tape recordings of a noise source, it is important to include a recording of a calibration tone, to facilitate subsequent play-back at accurate sound pressure levels.

5.4.4 Traceability Chain

Accurate and precise calibration of instrumentation necessitates the adoption of some form of traceability chain, in other words a means of tracing the calibration of all instruments back ultimately to an absolute standard. At present there is no statutory scheme in Britain to ensure that this occurs. Regulations commonly specify that sound level meters must be calibrated before and after taking a measurement by reference to a field calibrator, but instructions concerning checking the accuracy of the field calibrator and microphone, by reference to a standard microphone, are often vague (Berry, 1986). For example, the Control of Noise (Measurement and Registers) Regulations 1976 require only that the calibration of the measuring equipment "must be maintained".

As a result, the National Physical Laboratory undertook a survey of Environmental Health Departments to assess current practice on instrument calibration, with a view to the possible introduction of new regulations (Berry and Moss, 1987).Berry and Moss found that 47% of local authorities had a policy of regular recalibration of acoustical instruments, with the most common recalibration period being one year. However, none of these calibrations could be considered traceable to national standards. They suggested that the minimum requirement of new regulations might be that each authority should check regularly the calibration of its acoustic instruments, using a field calibrator which had itself been calibrated against a standard microphone. The requirement might specify that the calibration against a standard microphone should be made by a laboratory officially recognised for the purpose. The accreditation of acoustic calibration laboratories could be operated by the Department of Trade and Industry's NAMAS scheme (National Measurement Accreditation Service). By this means the calibration of instruments all over the UK could be traced back ultimately to the national reference standard for acoustical measurements.

5.4.5 Standardisation

The precision of acoustical measurements is controlled by the process of standardisation. There are two main sorts of standard: instrumentation standards and procedural standards. Instrumentation standards define design specifications for acoustic instrumentation which ensure precision of measurement within stated tolerances, or limits. Procedural standards define measurement procedures, stating what sort of equipment must be used; the number, duration and sampling frequency of measurements; the position of measurement sites relative to the noise source; details concerning the noise rating scale or index which is to be used and so forth.

International acoustic standards are set by the International Electrotechnical Commission (IEC) and the International Organisation for Standardisation (ISO). Both are based in Geneva. The ISO

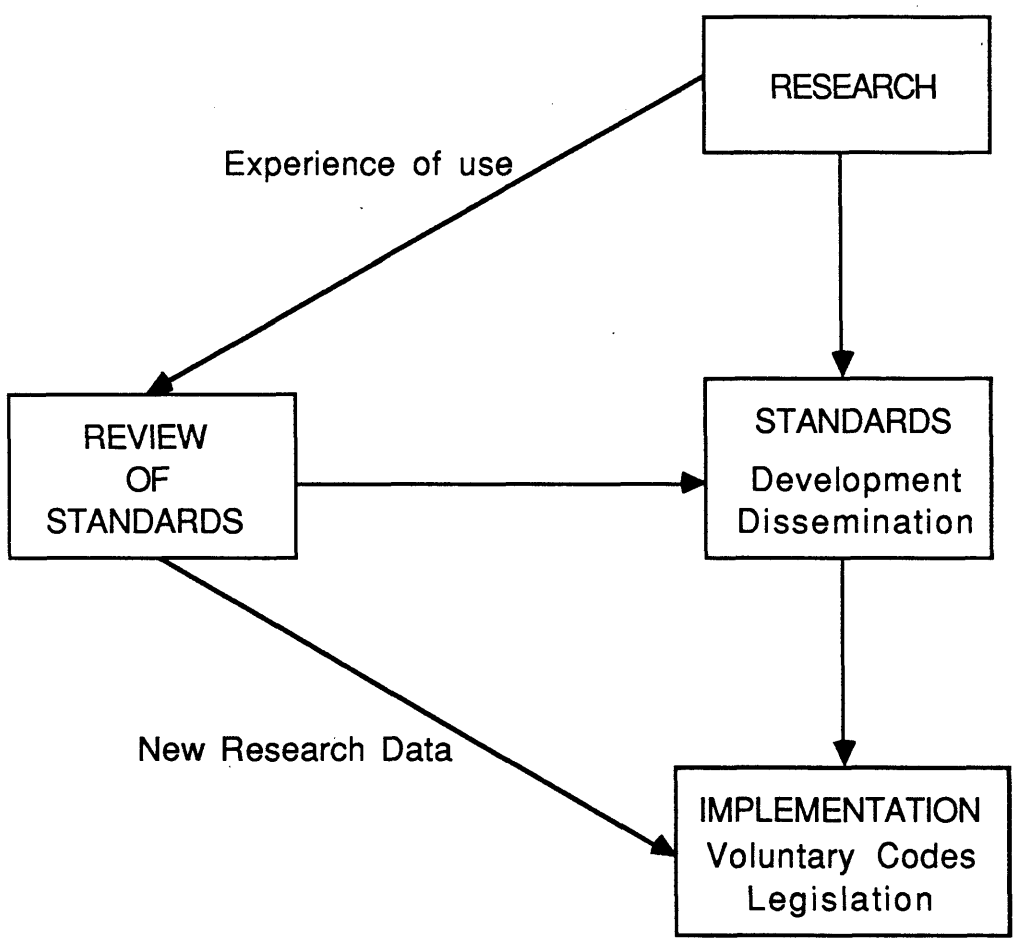
prepares standards on basic acoustics, psychoacoustics, principles and methods of measurement of noise, and on the effects of noise. The IEC, although organised independently, is effectively the electrical division of ISO and works in close liaison to issue publications on electro-acoustical instruments and on performance requirements for noise measuring equipment (Robinson, 1976).

International standards are produced through a vast network of technical committees, members being appointed from representatives of the national standardising institutions - the British Standards Institution, for example. These bodies exist primarily to prevent barriers to trade, and also "to establish voluntary norms where proliferation would be in nobody's interest" (Robinson, 1980). Adoption of international standards is voluntary but, in relation to export trade in acoustic instrumentation, is generally in most countries' interests. The British Standards Institution also works through a system of technical committees, with committee members being drawn from industry (including acoustic instrumentation manufacturers), research institutions (university and government), noise consultants, local and central government and non-government organisations. Figure 5.4 illustrates the evolution of standards. Standardisation means that current practice is inevitably some way behind the frontiers of research, since revision of standards is periodical and must not be too frequent for the sake of practicality (Robinson, 1976).

Instrumentation standards for sound level meters currently specify four levels of precision - types 0,1,2 and 3 (BS 5969, 1981). Type 0 instruments are for very high precision work in acoustic laboratories. Type 1 instruments include 'precision grade' sound level meters, of the type used for most enforcement and monitoring purposes when measurements may need to be used to determine compliance with codes of practice or regulations. Type 2 instruments are 'industrial grade' instruments of sufficient accuracy for most general purposes, and type 3 instruments are simple devices for noise survey work.

FIGURE 5.4
THE EVOLUTION OF STANDARDS

(Bernard Berry, pers. comm.)



5.5 EFFECTS OF ENVIRONMENTAL NOISE

It is relatively easy to establish that there is a noise problem, but there is still considerable debate concerning the severity of the problem (Gilbert, pers. comm.). As mentioned in Chapter 1, noise at levels encountered in the environment is not generally considered to pose a risk to hearing, but it can impair the intelligibility of conversation, the ability to concentrate and the quality of sleep, and can lead to feelings of annoyance and irritation in those subjected to it. Noise is also seen as one of the vast range of contributory stress factors in disorders of the cardiovascular and digestive systems (OECD, 1985). There is not as yet, however, any unequivocal evidence that noise at environmental levels causes any general adverse effects on health (Flindell, 1988). Consequently, for regulatory purposes noise is regarded primarily as a nuisance and a source of annoyance, and control measures aim to reduce the incidence of community annoyance to acceptable levels.

The significance of noise as a threat to health, however, really depends on the definition of 'health'. The World Health Organisation (WHO) states that "health is a state of complete physical, mental and social well-being, not merely an absence of disease and infirmity" (World Health Organisation Chronicle, 1947). Modern texts on environmental health often adopt a WHO-based definition of health: for instance, "to be healthy is not just to be free of obvious disease - it is a positive state of physical, social and mental well-being, each of these aspects interrelating with and influencing the others" (Rowland and Cooper, 1983). On the basis of these definitions, effects of exposure to environmental noise such as disturbance to sleep, rest and relaxation, and also stress, fatigue, irritability and annoyance must be considered to have implications for health. The WHO (1980) comments:

> "Noise can disturb people's work, rest, sleep and communication; it can damage hearing and evoke other psychological, physiological and possibly pathological reactions. However, because of their complexity, their variability and the interaction of noise with other environmental factors, the adverse health effects of noise

do not lend themselves to a straightforward analysis".

Although hearing damage is not normally associated with environmental noise levels, entertainment noise commonly falls within the ambit of 'environmental noise', and there is some evidence to suggest that devotees of pop concerts and discotheques may run the risk of hearing damage (Whittle and Robinson, 1974). Additionally, the OECD (1980) mentioned that populations living near airports, major roads and noisy industry could be exposed to noise levels above 75 dB(A) Leq. At this level, the WHO (1980) concluded that there was a risk of permanent hearing damage after 40 years exposure to a steady level for eight hours per day.

It was thought for a long time that the body could adjust reasonably well to noise, but recent experiments have shown that such habituation does not occur in the case of certain noises, such as motorcycle noise (OECD, 1985). Some studies of areas around major airports have suggested that increased rates of psychiatric disorder, cardiovascular disease and foetal abnormality can result directly from exposure to excessive noise. Ando and Hattori (1973) for example, reported that babies of mothers living close to flight paths from Osaka airport, Japan, were of abnormally low birth weight. However, studies such as these have been criticised for failing to take adequate account of the many other socio-economic and environmental factors that could have influenced the observed morbidity (Flindell, 1988), and other research has failed to confirm their findings. Whilst the evidence for direct effects of noise on mental health is equivocal, it seems reasonable to suggest that noise can be a contributory factor in mental illness (Langdon, 1985).

In relation to sleep, excess noise can cause difficulties in getting to sleep, while sudden noise may wake people out of sleep. In addition, Langdon (1985) reports the results of some studies which suggested that exposure to noise causes a reduction in the quality of sleep: in particular, noise reduces the extent of deep sleep and of periods of dreaming. The limited data available suggest that sleep disturbance may occur once the indoor sound level in Leq exceeds 30-35

dB(A) or once the peak level exceeds 40 dB(A) (OECD, 1986).

The WHO (1980) confirmed the need for further research on the possible long-term effects of noise, in particular the potential contribution of noise stress to the general morbidity of the population, the ability of people to adapt to environmental noise and the possibility of noise-induced disease. They also recommended the undertaking of studies on the possible health effects of sleep impairment as a result of noise.

5.5.1 Scale of the Problem

There are no reliable statistics to show how noise levels change over time or over the country as a whole. Most studies examining the impact of noise have been of the 'one-off' variety, and as such describe noise levels and community response to noise at one point in time and at selected sites (for example, the London noise survey of 1961/62 (Parkin et al., 1968) and more recently, the survey of Heathrow, Gatwick, Luton, Manchester and Aberdeen airports carried out by the Civil Aviation Authority (Brooker et al., 1985). The only national information available on a regular basis is the number of complaints made to Environmental Health Officers (see Chapter 6).

The OECD estimates that 130 million people in OECD countries are exposed to unacceptable noise levels (in excess of 65 dB(A) Leq) and 300 million are living in acoustic discomfort (55-65 dB(A) Leq), due largely to motor vehicle noise (OECD, 1986). These levels of acceptability are based on WHO criteria: the WHO (1980), interpreting noise survey data, concluded that where the general daytime noise exposure is below 55 dB(A) Leq, there will be few people seriously annoyed by noise. This level was recommended as a desirable noise exposure limit for the general community.

5.6 QUANTIFYING THE DOSE-EFFECT RELATIONSHIP OF ENVIRONMENTAL NOISE

This Section examines the underlying characteristics of the methods employed to determine the dose-effect relationship for community exposure to environmental noise. An evaluation of the effects of noise at occupational levels is necessarily omitted. The discussion is relevant to environmental noise in general, and includes a detailed analysis of the history of the development of BS 4142 and the equivalent continuous noise level (Leq), as the two main noise rating methods currently used in this country to evaluate neighbourhood noise for regulatory purposes. Unless otherwise referenced, much of the information in this Section has been derived from Schultz (1982).

5.6.1 Noise Rating

The process of assessing quantitatively the impact of environmental noise on the community is called 'noise rating'. Community noise rating looks for ways of measuring certain physical properties of environmental noise that are closely connected with people's subjective reaction to the noise. Sound measuring equipment is used to measure certain aspects of the noise that, either alone or in combination, can be used to predict accurately how people will respond to the noise. Any method of rating needs to be simple enough for general application at reasonable cost, although, as described in Section 5.3, advances in logic circuitry mean that acoustic equipment can now compute fairly complex rating methods automatically.

Two types of noise rating are used: the noise scale and the noise index (or procedure). A noise scale is a composite measure of the physical characteristics of a noise over a period of time, so that the numerical values along the scale correspond generally with the subjective effects of the noise. In practice, a noise index (or procedure) is often derived from a noise scale by incorporating additional factors which account for features of the noise to which the scale is insensitive (such as tonal components, duration, intermittency and impulsivity), or for features of the situation into

which the noise intrudes (for example, time of day, background noise level, type of neighbourhood) (Berry, 1981).

This Section of the Chapter looks at the development of noise rating scales and indices for the measurement and prediction of community annoyance, which is considered to be the most widespread effect of environmental noise (Tempest and Bryan, 1976). Consequently, the discussion omits noise ratings which specifically relate physical parameters to other effects of noise, such as the Articulation Index and the Speech Interference Level, which measure the degree of interference with speech. Although other negative effects of noise in addition to annoyance may well be suffered by the community (such as interference with sleep, speech and task performance, increased stress and irritability) these effects tend to add to the general feeling of annoyance. Fidell (1984) defines "community response to noise" completely in terms of annoyance, as follows: community response to noise ".....is generally understood to mean the prevalence, in a residential population, of individual attitudes of annoyance associated with exposure to noises of human activities."

High levels of complaint to the relevant authorities about noise may be indicative of a high degree of annoyance in the community, but complaint levels do not generally show a reliable correspondence with actual levels of community annoyance. Some people may be exceedingly annoyed but will not complain for a variety of reasons, such as not knowing the appropriate authority to complain to, or feeling that nothing can be done to remedy the situation. Problems also arise in determining the weight to attach to petitions and to multiple complaints made by one complainant. In addition, complainants may not be representative of the population as a whole. According to the Open University (1975), complainants tend to be of higher socio-economic status, older and more highly educated than the general population. They also tend to have political affiliations and to be in mental rather than physical pursuits. Consequently, community annoyance is generally determined by empirical methods (described in Section 5.6.3).

5.6.2 Proliferation of Noise Ratings

> "By the end of the 1960s, the impact of noise on communities, not only those affected by aircraft operations, had aroused the need for quantitative measures of environmental acceptability on a more general footing and social surveys led to the development of various indices for this purpose" (Robinson, 1976).

Pallett (1975) observed that the use of quantitative numerical descriptions of noise distinguishes the modern approach to noise control from that of earlier generations. A striking characteristic of noise rating is the sheer number of different scales and indices which have been developed to quantify the response to environmental noise. A good indication of this proliferation, which occurred mainly in the 1970s, is Schultz's work on noise rating. The first edition published in 1972 ("Community Noise Ratings") was 92 pages long, the second edition, published in 1982 ("Community Noise Rating"), had grown to 385 pages. The current position in Britain is that the Noise and Number Index is used to rate aircraft noise; traffic noise evaluation utilizes the 18-hour L10; industrial noise is rated in terms of the Corrected Noise Level; and noise from construction sites and noise abatement zones is rated according to the equivalent continuous noise level (Leq).

The 1960s and the 1970s saw an increasing interest in noise control from a regulatory perspective, which led to greater research and development activity in noise rating in general. Once a satisfactory rating scale or index had been developed, a numerical value (preferably in terms of a single number) could then be assigned by regulators as a level of acceptability for community exposure to noise. For instance, as mentioned in Chapter 3, the relevant authorities were prepared to give grants for acoustic insulation to homes where the occupants were, or would be, exposed to noise levels from road traffic in excess of 68 dB(A) L10 18-hour (the Noise Insulation Regulations 1973), or to noise levels from aircraft equal to or greater than 55 NNI (under s.15, Airports Authority Act 1965).

The basic explanation for the development of so many noise ratings is to be found in the empirical way in which they were devised. In general, noise rating scales and indices have been derived from fitting linear equations to survey or laboratory results correlating annoyance scores, or other indicators of the adverse subjective response to noise, with physical parameters of the noise. Each noise rating attempted to find physical parameters which mirrored the very complex subjective process of auditory perception and response, without being any more complex than necessary for the immediate problem at hand, which was usually a specific noise source, such as road traffic or aircraft, rather than noise from all environmental sources in general. This led to the development of a slightly different metric in each case (examples are provided by the Traffic Noise Index (Langdon and Scholes, 1968) and the Noise and Number Index (Committee on the Problem of Noise, 1963)), and each metric was only applicable to the particular types and levels of noise tested. In general there was no possibility of translating from one metric to another, except by crude approximation or by going right back to the raw data of measurements.

This has resulted in a complex situation, which Robinson (1977) describes in the following terms:

> "The study of environmental noise, which is already an intrinsically complicated subject, has been made more so by the multiplicity of units, scales and indices in use. Despite this, resistance arises when attempts are made to simplify it a little, and the protagonist of rationalization soon finds himself forced into a defensive posture. Yet can it really be sensible to have such a variety of different units for the physical and auditory magnitude of sounds: dB(A), dB(B), dB(C), dB(D), dB(PN), dB(TPN), phon, sone, and so on, not to mention minor variants of these? How many essentially different things do all these really measure? The same question may be asked of the even more numerous noise exposure measures: CNR, NEF, NNI, Leq, NIL, CNL, CNEL, L10, Ldn, FBI, Lepn, Q, Lax and so on.
>
> .....one may well ask how psychoacousticians fell into the trap of creating an acoustic Tower of Babel, with a different language of noise rating measures and descriptors to suit every occasion, incidentally bringing a certain disrepute on their profession at the hands of the public. One finds nothing quite like it elsewhere in metrology. True, there are several practical scales of length,

pressure, temperature and so on, but they are all uniquely related and it is a matter of convenience which one uses: a translation from one to another is pure arithmetic."

A cynical approach to the proliferation and complexity of noise ratings is provided by Botsford (1969), in what he calls the "Weighting Game". He suggested that the situation may be to the benefit of all interested parties, with the exception of the public who must continue to suffer the noise, as summarised in Table 5.1.

TABLE 5.1: Players in the Weighting Game (Botsford, 1969)

Player	Strategy	Winnings
Researcher	Refines weighting methods endlessly	Research contracts, publications, etc.
Noisemaker	Lacks information, supports research, waiting for answers	Expense of noise abatement postponed
Consultant	Helps clients use weightings	Fees
Public	Wants problems solved	None, pays bill

5.6.3 Procedures for Developing Scales and Indices for Annoyance Caused by Noise

These generally follow one of three basic methods:

(i) The survey;
(ii) The laboratory method;
(iii) The consultant's method.

(i) The Survey

A community's reaction to noise is determined from responses to a questionnaire survey of a sample of homes in the vicinity of the noise source (for example, an airport, factory or road system). A variety of interviewing techniques are used to try and elicit an unbiased response from interviewees concerning how they feel about the noise in question, and how much it disturbs them (for example, does it interfere with sleep, watching television, or enjoying the garden). Sample measurements of the physical characteristics of the noise are also made. A noise rating scale or index is then devised from the physical parameters of the noise which show the best correlation with annoyance scores. Figure 5.5 (from Mills and Robinson, 1963) provides an early example of this type of approach. The best questionnaires, however, only succeed in explaining about one quarter of the variability of different people's responses in terms of the noise parameters. The larger part of the variability is due to unexplained or unexplorable individual variations, or to extraneous factors. As a result, data of this type are almost equally well represented by a variety of different formulae (Robinson, 1976). For the results of surveys to be of significance, a large sample size is required, meaning that such exercises are costly (ibid.).

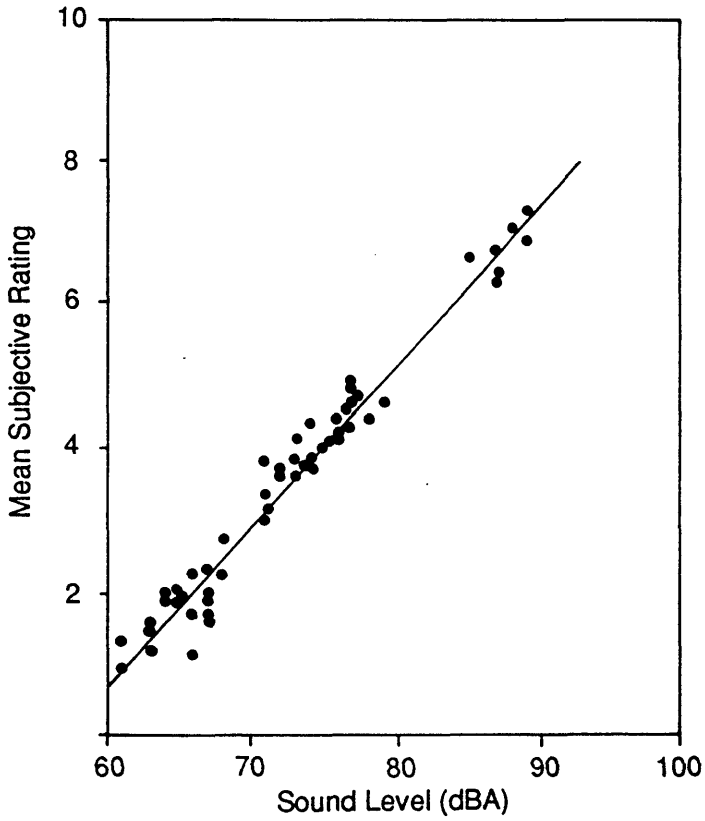
(ii) The Laboratory Method

A noise environment is created under closely controlled conditions in the laboratory. Participants listen to recordings of a variety of noises relayed to them through loudspeakers in a listening room. The laboratory method allows easy variation of the different physical parameters of the noise which are thought to influence adverse subjective reaction (such as tonality, impulsiveness, variation in noise level, duration). The responses of the participants to the noise may then be determined by questionnaire or interview, in a manner similar to the social survey method (an example of the laboratory method is provided by Fuller and Robinson, 1973), and a noise rating is then devised in much the same way. Although laboratory

FIGURE 5.5

CORRELATION OF MEAN SUBJECTIVE RATING WITH SOUND LEVEL OF ROAD VEHICLES

(Results of an experimental survey carried out by Mills and Robinson, 1963)



conditions provide a more sensitive way of determining the influence of separate physical parameters, practical considerations mean they are inappropriate for studying peoples' reactions to long-term noise exposure (Robinson, 1976). Fuller and Robinson (1973) point out that survey data are a more faithful reflection of real-life conditions, and should be used in preference to laboratory data for setting limits of acceptability for noise exposure.

(iii) The Consultants' Method

Some indices and scales have been devised from consulting practice, and are based largely on the practical experience of the consultant in the form of case histories and rules-of-thumb developed over the course of a career in noise control. A good example of this is the development of BS 4142, considered in more detail in Section 5.6.7.

5.6.4 Problems with Assessing the Annoyance Response

Annoyance is an emotional stimulus and so is difficult to define, measure or predict. It was originally thought that the loudness of a noise was the sole determinant of annoyance (Meij, 1971). It is now acknowledged that, while loudness is still considered to be the basic determinant of human response to noise, there are several other variables, both acoustic and non-acoustic, which in turn influence the annoyance response. The debate still continues on the difference, if any, between loudness and annoyance (Open University, 1975).

5.6.4.1 Acoustic Variables

(i) Duration and Frequency

In general, the longer the duration of the noise the more annoying it is. Higher frequencies tend to be more annoying than lower frequencies, even when judged to be equally loud.

(ii) Tonality

Laboratory studies and case histories have shown that a noise containing a pure tone component produces a more adverse response than a noise having the same broadband frequency distribution but without the tonal component. The basis for the tone correction in community noise rating procedures such as BS 4142 has been largely intuitive, based on consulting experience (Schultz, 1982). The findings of an American study (Scharf and Hellman, 1979), however, ran somewhat counter to this prevailing view. Although at noise levels in excess of 80 dB(A), Scharf and Hellman could find limited evidence in support of the previous studies, they were unable to find evidence that tonal components added to the subjective magnitude of broadband sounds at levels below 80 dB(A).

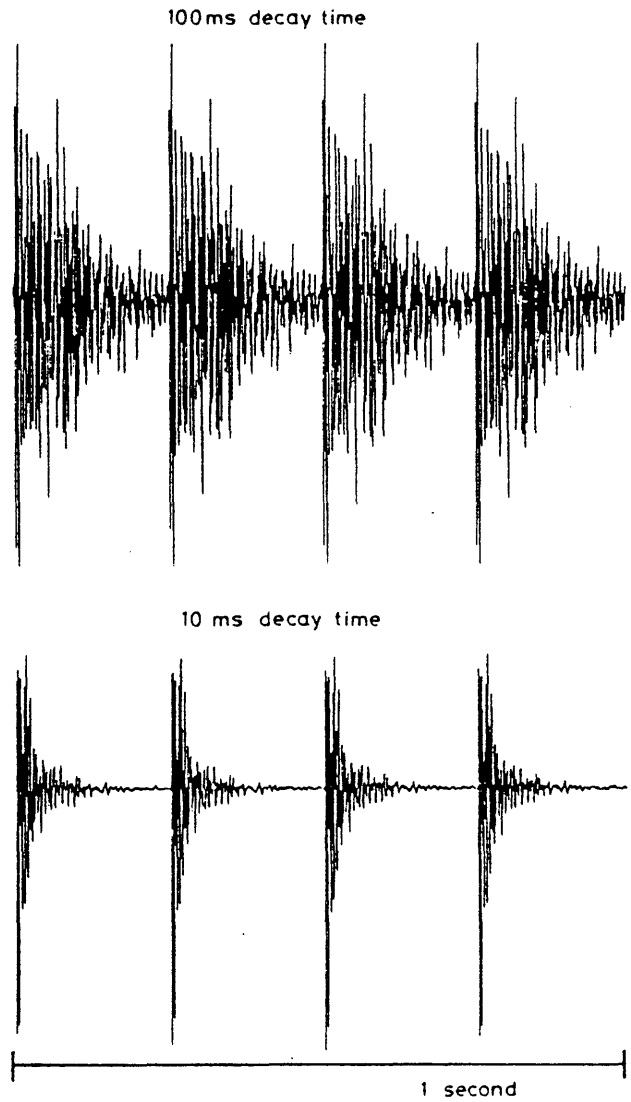
(iii) Impulsivity

Impulsive noises are those of short duration and often high intensity. Examples of impulsive noises include those from mine and quarry blasting and shooting ranges. Other impulsive noises may be repetitive, such as helicopter blade slap, pneumatic drills and piling hammers. Impulsive noises have been found to produce a more adverse effect than the same level of steady sound: this may be due to the fact that they tend to startle people. The acoustic definition of impulsive noise is "a noise consisting of one or more bursts of sound energy each of a duration less than about one second" (ISO 2204). The sound pressure level of impulsive noise shows a rapid rise time to a peak level followed by a slower decay (Figure 5.6), which produces a large peak-to-RMS ratio (or 'crest factor') of the wave. 'Impulse' sound level meters have a short time constant of 35 milliseconds to enable detection of the rapid peak of the impulse. However, the impulse time constant has been criticised for not providing an accurate representation of subjective response to impulsive noise (for example, Berry et al., 1979). Research is currently under way to use a very short time constant Leq (in milliseconds or even microseconds) to measure impulsiveness (Berry, pers. comm.).

FIGURE 5.6

WAVEFORMS OF TWO SYNTHETIC IMPULSE NOISES

(Berry, 1985)



(iv) Intermittency

Although some noise sources generate a constant level of noise (for example the hum of a generator or an extractor fan), the dominant characteristic of neighbourhood noise is its ability to fluctuate. At any particular location the sound level usually varies, periods of relative quietness interposed with periods of noisiness dependent on the time of day, time or week or time of year. Community response will depend on the temporal variation of noise levels.

(v) Time of day or year

People may be more sensitive to noise in summer, when windows tend to be open and gardens used. There is also greater sensitivity to noise at night, when people are going to sleep, than during the day.

(vi) Background noise

A given level of intrusive noise is more disturbing in quiet locations than in locations with high background noise levels. This forms the rationale for community noise rating procedures such as BS 4142.

5.6.4.2 Non-Acoustic Variables

> "A great many people...are not sensitive to noise....but they are just the very people who are also not sensitive to argument, to thought, or poetry or art, in a word to any kind of intellectual influence. On the other hand, noise is a torture to intellectual people". (Schopenhauer, 1890, from 'Studies in Pessimism", quoted in Tempest and Bryan, 1976).

Although social surveys have found fairly good correlations between the average annoyance response and certain physical characteristics of the noise (usually the percentage annoyed or highly annoyed as a function of noise level), the correlations found for individual annoyance and physical parameters have tended to be very poor indeed (Schultz, 1982). For example, the TRACOR study (1970) showed for the first time with respect to aircraft noise that NNI, or for that matter

any purely physical index, is inadequate to predict individual annoyance. Social surveys have found that whatever the level of noise, some individuals will always be bothered by it. Several factors which do not bear any relation to the physical characteristics of the noise itself, have been suggested which may well influence individual variability in the response to noise. These are described below.

(i) Previous Noise Exposure

It is often considered that the average community response to noise tends to decrease as the number of years of exposure to it increases. Environmental Health Officers often quote cases of newcomers to an industrial area, who will complain about the noise, whereas old established residents will be unperturbed by it. However, if noise levels are too high, annoyance will increase with increasing exposure to noise.

(ii) Socio-economic status

Schultz (1982) refers to some social surveys which have found that middle class respondents were more sensitive to noise than working class respondents. However, other studies reported no appreciable difference in degree of sensitivity in relation to socio-economic class.

(iii) Nature of the Activity into Which the Noise Intrudes

A reasonable level of background noise has been found to improve the performance of routine mental tasks, although tasks requiring a high degree of concentration may be disrupted by any noise. Above a certain level, noise will disrupt the concentration required even for the performance of the simplest tasks (for example, Fuller and Robinson, 1973).

(iv) Psychological Attitudes

Eysenck's theory of personality predicts that introversion should be linked to a greater sensitivity to noise (Eysenck, 1967). Fuller and Robinson (1973) found a significant correlation between introversion and negative reaction to noise in laboratory experiments. They also found a correlation between neuroticism and adverse reaction to noise.

(v) Age and Health

The old and the unwell may be more sensitive to noise as a stressor.

(vi) Unreliability of Methods of Scoring Annoyance

Langdon (1978) found that in a survey of community response to road traffic noise, the same respondents gave different answers on different occasions to the same set of questions concerning how annoyed the traffic made them. Schultz (1982) considers this a prime candidate for explaining the low correlation between individual annoyance scores and physical measures of the noise.

5.6.4.3 Annoyance due to Low Intensity Noise

Many low level environmental noises may be disproportionately annoying in that they seem to disturb people as much as noises of far higher levels. According to one Environmental Health Officer (Christie, 1982), a great many of the noise complaints received by Environmental Health Departments concern noises which may not even show up on a precision grade meter; for example, low frequency hum or neighbours talking and laughing. In many cases non-measurable, qualitative factors are of most importance; for instance, workmen swearing, a dog in a distant garden whining and barking or a baby crying. In fact, as Schultz (1982) observes, for noise sources below about 65 dB(A), community annoyance reactions are quite variable, and do not appear to be sufficiently strongly related to levels of noise exposure to support confident prediction of annoyance. Instead it appears that the

degree to which low level or infrequent high level noises annoy people may be more closely related to the degree to which they intrude upon awareness - in other words, their 'intrusiveness'. The concept of intrusiveness has not yet been successfully quantified (Schultz, 1982), although Fidell and Teffeteller (1981) made some progress in this direction.

The presence of non-acoustic variables means that it is virtually impossible to develop a noise rating where there is a good correlation between individual response to noise and the physical parameters of the noise itself (Schultz, 1982). Consequently, no attempt should be made to predict individual response to noise from rating scales and indices, although the response of a whole community can be predicted fairly accurately. This implies that environmental standards derived from noise ratings may well tend to leave some proportion of the affected population annoyed by the noise, whatever the level at which the criterion is set.

5.6.5 BS 4142: Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

As mentioned in Chapter 3, BS 4142 describes a procedure for assessing quantitatively the likelihood of complaints about noise from industrial premises and other fixed sources. It is an example of a composite noise rating index, which incorporates corrections to the measured or estimated sound level accounting for the character and duration of the noise and the type of neighbourhood. It is not applicable to domestic noise, or to noise from mobile sources.

Instead of stating a maximum permissible noise level in absolute terms, BS 4142 refers to a maximum acceptable relative level between the annoying source and the ambient or background level. The rating procedure comprises three separate tasks: the measurement of the intrusive noise; the measurement or estimation of the background noise; and a comparison of the intruding noise - corrected for tonal, impulsive and temporal characteristics - with the background noise

corrected for the type of neighbourhood. The A-weighting scale is used for all measurements, with the meter set to the 'slow' response. The typical level of the intrusive noise is measured (Ls) and significant noise peaks (Lh), if any. Corrections are then applied to Ls and Lh if the noise contains 'a distinguishable discrete continuous note' (a tone), or 'if there are distinct impulses in the noise'. The measured noise is also corrected for its duration characteristic, determined from two families of curves for day and night respectively. Ls and Lh, corrected accordingly, are called 'corrected noise levels'.

Ideally the background noise level should then be measured at the same location in the absence of the intrusive source. If this is not possible a 'notional background level' must be calculated from the procedure outlined in the standard. The basic background criterion for the notional level is taken as 50 dB(A). Corrections are applied to the criterion level depending on:

- the type of industrial installation;
- the type of neighbourhood;
- the time of day.

The corrected noise level is then compared with the measured background or the notional background level, and the relative difference in levels is interpreted as follows:

> "Complaints may be expected if either Ls or Lh or both exceed the measured background level [or the notional background level] by 10 dB(A), or more. Differences of 5 dB(A) are of marginal significance. If Ls and Lh are more than 10 dB(A) below the measured background level [or the notional background level], this may be taken as a positive indication that complaints are unlikely."

A further procedure can be used to determine which part of the frequency spectrum is likely to be the source of annoyance. An octave band analysis of the noise in question is plotted on a graph of a family of curves approximating equal loudness contours (Section 5.6.8).

An amendment to the standard published in 1975 recommended the use of L90 for measuring the background noise level and emphasised the need to use measured, rather than notional, background levels wherever possible. The British Standards Institution recently circulated a draft amendment to BS 4142 (Berry, pers. comm.), in which the corrected noise level was replaced by Leq with appropriate corrections.

5.6.6 ISO Recommendation 1996: Assessment of Noise with Respect to Community Response

ISO R1996 is another composite noise rating index which in many respects is very similar to BS 4142. It has never been officially adopted for use in this country since BS 4142 was considered to fulfil the same role, but some Environmental Health Officers use it in preference to the British Standard (Craik and Stirling, 1986). Unlike BS 4142, ISO R1996 is applicable to most forms of environmental noise, with the exception of aircraft noise. The recommendation uses the 'fast' meter response and states that Leq should be used to rate variable sound levels. In addition, the criterion level is more stringent for background noises which cannot be measured: a value between 35-45 dB(A) is suggested, unlike the 50 dB(A) used in BS 4142. The ISO recommendation also goes somewhat further in rating the noise, as indicated below:

Amount in dB(A) by which the intrusive sound level exceeds the noise criterion	Estimated Community Response	
	Category	Description
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very strong	Vigorous community action

A new ISO standard has replaced R1996. The new standard defines procedures for describing and measuring environmental noise, based on the use of Leq, but, unlike the original version, does not refer to acceptable limits. The first part was published in 1982, followed by Parts 2 and 3 in 1987 (ISO 1996).

5.6.7 BS 4142 in Practice

As is typical of noise ratings developed from consulting practice and case histories, little background literature is available concerning the development of BS 4142, or describing research undertaken to test its efficacy. Published professional opinion about the standard seems to be rather negative (for example, Institute of Acoustics, 1982). However, Utley (1977) found that BS 4142 was used extensively by local authorities, both with regard to industrial noise nuisance and in the assessment of planning applications. In a survey of 100 local authorities, Williams (pers. comm.) found that over half the authorities used the standard.

BS 4142 has been called "one of the most contentious documents ever to be published by the British Standards Institution" (Christie, 1982). Christie claims that the main error was in publishing "what [was] really rather tentative guidance as a British standard". He considered that noise control practitioners were tempted to use it as an accurate and reliable method, not only for predicting the likelihood of complaints about noise from industrial premises, but also for assessing the likely impact of an existing or proposed noise source on local residents - which was beyond the stated scope of the standard.

One aspect of BS 4142 which has received considerable criticism is the criterion of 50 dB(A) for the notional background level. Although the 1975 amendment emphasised the need to use measured background levels whenever possible, the notional level may have to be used in some circumstances and is considered to be pitched much too high (Attenborough, 1977; Christie, 1982). According to Williams and

Robinson (1985), the figure of 50 dB(A) was based on the London Noise Survey of 1962 (Parkin et al., 1968), and so must now be out of date.

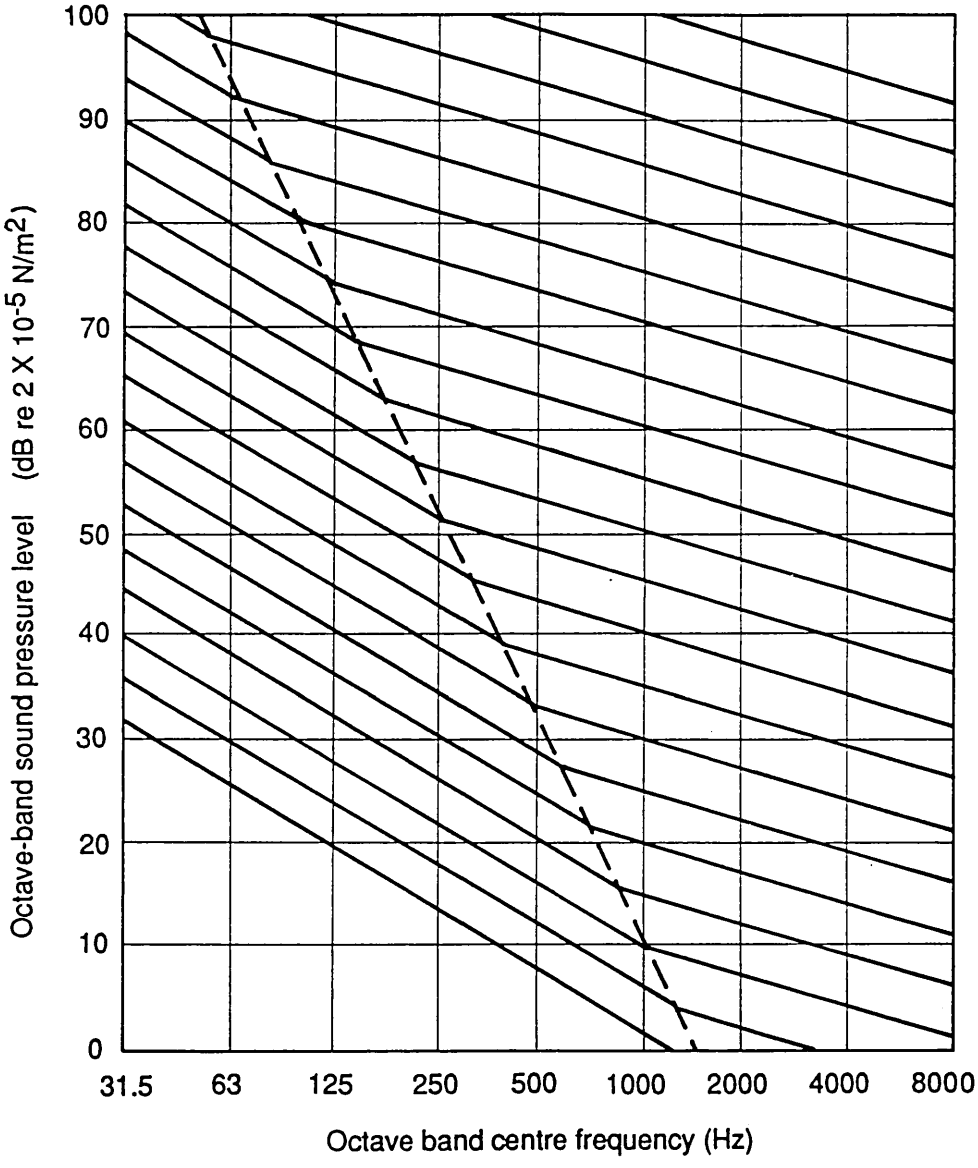
The 5 dB(A) fixed tone penalty is thought by some authors to underestimate the adverse subjective response to the noise (Fisher, 1982; Bramer and Eade, 1982). Research has recently been undertaken at the Institute of Sound and Vibration Research, Southampton, to develop a more representative tonal correction for BS 4142. It may require a frequency analysis of the intrusive noise as, for example, suggested by Fisher (1982). Consequently, this would replace the present subjective estimation of tonality with a physical indicator. The suggested penalty may vary between 0-12 dB(A) (Williams, pers. comm.). In addition, the subjective determination of impulsivity in the standard may eventually be replaced by a physical measure (Berry, pers. comm.).

Flindell (1982) argues that BS 4142 and ISO R1996 are both based on an erroneous assertion. He questions the assumption underlying the ratings that the annoyance caused by a noise depends upon the extent to which the background level is exceeded by the intrusive noise. Flindell considers that, "current research is showing that general community annoyance depends far more on the absolute noise level than on the margin of exceedance above the steady background level". In addition, this Chapter has already mentioned that the level of complaint does not show a good correspondence with the level of community annoyance. To complete his attack on BS 4142, Flindell (1982) states that the likelihood of complaints depends far more on non-acoustic variables than on noise levels alone, and it would be extremely difficult to include these variables in a rating index.

5.6.8 Noise Rating Curves (NR Curves)

Noise rating curves (Figure 5.7) appear in an appendix of BS 4142, for use in assessing which component of the frequency spectrum is most likely to cause annoyance, as an aid to remedial work. A similar set of curves appear in an appendix of ISO R1996, for use in assessing

FIGURE 5.7
NOISE RATING CURVES FROM BS4142



outdoor noise with respect to probable community response. The procedure is straighforward: an octave band spectrum of the noise to be evaluated is overlaid on the noise rating curves. The NR-value of the noise is determined from the value of the highest curve to which the spectrum is a tangent.

The probable origin of these curves was a paper by Beranek et al. (1953), although in this instance they were used specifically for rating noise indoors. No justification for the shape of the curves was offered in the paper, although Schultz (1982) notes that apparently the idea grew out of considerations of the shape of the equal loudness contours (see Appendix 2). The first curves for outdoor use were devised by Kosten and van Os (1962) and were called 'noise rating' curves. They were subsequently adopted for use in BS 4142 and ISO R1996, although they do not appear in the revision of the latter (ISO 1996).

5.7 THE NEED FOR A UNIFYING NOISE RATING

Several authors, notably Robinson (1972), have advocated the need for a unifying noise rating and have proposed various scales and indices which might fulfil this role. Whilst accepting that no simplistic number system could meet all the requirements, the USA Environmental Protection Agency (EPA) produced a list of criteria for a suitable noise rating (Environmental Protection Agency, 1974). In the UK, a working party of the Noise Advisory Council (NAC) also considered the necessary characteristics of a unifying noise rating scale (Noise Advisory Council, 1975b). The following list is a combination of EPA and NAC criteria:

1. The chosen method should be applicable to the evaluation of pervasive long-term noise.
2. It should correlate well with known effects of the noise environment on the individual and the public.
3. It should be simple, practical and accurate and in principle useful for predictive planning purposes, as well as for

enforcement or monitoring.

4. The required measuring equipment with standardised characteristics should be commercially available.
5. It should permit the influence of background noise to be determined.
6. The measure should lend itself to small, simple monitors which can be left unattended in public areas for long periods.
7. It should be closely related to methods currently in use, and should be accepted internationally.
8. It should be applicable to individual noises and to a mixture of noise sources, such that the total noise environment can be determined from the noise levels of contributory sources and, conversely, so that the contribution of one noise source to the overall level can be evaluated.
9. It should provide a method of translation between specialised scales and indices, enabling levels of equivalent annoyance to be determined between noises rated by specialised indices or scales. Since it should be applicable to all noise sources, it should restrict opportunities for misapplication.

5.7.1 The Equivalent Continuous Sound Level

The Working Party of the NAC finally recommended the equivalent continuous sound level (Leq) as a suitable unifying noise rating scale. The USA EPA recommended a slight variant of Leq: the day-night average sound level (DNL). This is a 24-hour A-weighted Leq with a 10 dB(A) penalty for all readings taken between 10 pm and 7 am, to account for increased sensitivity to noise at night. It has been used by the EPA for rating environmental noise since 1974.

According to Schultz (1982), Leq was originally developed in Germany, and was first introduced there in 1965 as a rating to evaluate the impact of aircraft noise on people in the vicinity of airports. It was first used in Britain in the assessment of noise-induced hearing loss (Burns and Robinson, 1970), since the noise dose rated in terms of its energy content showed good correspondence with the onset and

progress of permanent hearing loss.

The Department of the Environment, in a supplement to the NAC report (Noise Advisory Council, 1975b), stated that further adoption of the Leq scale would be aided by the availability of a guide on measurement and prediction methods. As a result, what became known as the "Leq Guide" was published (Noise Advisory Council, 1978). The Leq guide advocated the use of the single event noise exposure level (LAX) as a means of comparing noise environments resulting from individual events and also from sequences of events. The single event noise exposure level is the A-weighted level which, if constantly maintained for a period of one second, would convey the same sound energy as that actually received from a given noise event. It means that the relative impact of a particular noise event on the total noise environment can be determined, and also that the total Leq can be calculated from contributory noises rated in terms of LAX values. LAX and Leq enable the relative impact of different sorts of noise to be compared (for example, Higginson and Rennie (1980) who evaluated the noise from several sources around a passenger hovercraft terminus).

The equivalent continuous noise level is now used in Britain to rate environmental noise levels from noise abatement zones (the Control of Noise (Measurement and Registers) Regulations 1976) and construction sites (BS 5228), as well as occupational noise exposure.

Schultz (1982) mentions that numerous studies have been undertaken to determine the correspondence between Leq and the subjective response to noise, especially in the USA after the EPA adopted Leq for its environmental impact statements. Leq has stood up well against other ratings and is being more and more widely adopted for general community noise rating (ibid., 1982). The International Organisation for Standardisation (ISO) now recommends that all environmental noise sources, with the exception of aircraft noise, should be rated in terms of Leq (ISO 1996). Leq has gained a strong foothold in the EEC, and the OECD now expresses all noise data in Leq (OECD, 1985). The WHO also recommends the use of Leq as a common

measure of noise exposure (World Health Organisation, 1980). "The strongest worldwide tendency, at present, is to rely on the energy average A-weighted sound level (with or without a night-time penalty) as the basic measure of environmental noise" (Schultz, 1982).

5.7.2 Refinements to Leq - the Noise Pollution Level

Several refinements to the basic Leq have been suggested, such as the day-night average sound level. One which the working party of the NAC (Noise Advisory Council, 1975b) also considered was the noise pollution level (NPL), originally developed by Robinson (1971). The NPL is basically the Leq with the addition of a term accounting for the fluctuation of the noise levels: the greater the fluctuation in the level, the greater the correction factor added to Leq. The NPL was found to show a better correlation with annoyance caused by varying noise levels (Fuller and Robinson, 1973), but has not been adopted for general use as the simplicity of Leq is more appealing.

5.7.3 Criticisms of the Equivalent Continuous Sound Level

Despite the adoption by the ISO of Leq for environmental noise rating, it appears that not all acousticians are entirely happy with it: "the Leq unit is as fundamental to environmental noise as the kilowatt is to electric power, but taking the same analogy, just as the wattage of an appliance alone is not a sufficient descriptor of that appliance, neither is the Leq alone a sufficient descriptor of any specific noise environment" (Large et al., 1980). A common criticism is that nothing can be inferred about peak noise levels from Leq, since it provides an energy average level. Although Leq gives more weight in its averaging procedure to short bursts of high noise level than to periods of low noise level, it is rather insensitive to increases in the number of noise level peaks (as a doubling in energy level only gives a 3 dB(A) rise in sound level) (Taylor, 1975). However, there is no reason why energy average data cannot be augmented with measurements of peak levels, indeed modern acoustic equipment can cope with both.

5.8 CONCLUSIONS

1. The possible health effects of environmental noise are still very much open to debate. This has meant that for regulatory purposes, environmental noise is assessed in terms of its capacity to generate feelings of annoyance in a community exposed to it. The fundamental source of uncertainty in all environmental noise ratings stems from the fact that annoyance is a complex emotional response which is influenced both by the physical characteristics of the noise and by a wide range of psychological, social and economic factors.

Appendix 3 lists key events in the history of noise measurement technology and noise rating. Although extensive technical advances have been made regarding methods for the measurement and analysis of noise, there remains the difficulty of relating a set of physical parameters to a standard of annoyance or discomfort experienced by an individual. Although correlation coefficients between physical characteristics and community response are quite high, coefficients for individual response are rather low. This means that whilst noise quality standards (such as those used in the noise insulation schemes for aircraft and traffic noise, and the criteria in Circular 10/73, mentioned in Chapter 3) may constitute acceptable limits in terms of average community response, certain individuals within that community may still be bothered by the noise.

2. Since the 1960s, the relationship between objective noise measurements and subjective response has continued to be debated. This has resulted in a proliferation of noise indices; but no unified index of noise characteristics has been developed which relates to subjective annoyance at all times and under all circumstances (House of Lords Select Committee on Science and Technology, 1985).

As a result, policy standards based on one noise rating may not be directly comparable with standards based on a different noise rating. An example is provided by the intention of the Civil Aviation

Authority (CAA) to change from using the NNI to the 24-hour A-weighted Leq for rating aircraft noise, thereby bringing British practice in line with most other countries (CAA, pers. comm.). A noise survey of major British airports carried out by the CAA (Brooker et al., 1985), recommended the use of Leq in preference to NNI. The latter was considered to place too much weight on the number of aircraft heard, given that the new generation of jet aircraft are quieter than those of the 1960s, when the NNI was developed. In the summer of 1986 the Civil Aviation Authority made an application to the Minister for Aviation at the Department of Trade and Industry, to allow more night flights into Gatwick and Heathrow Airports. This proposal brought protests from people living close to Heathrow Airport (New Scientist, 1986a). According to the New Scientist, the CAA's case was aided by the fact that Leq weights the number of flights less than does NNI.

3. On detailed examination, the system of noise scales, indices and acceptability criteria turns out to be rather more arbitrary than at first sight might appear (Flindell, 1988). The A-weighting scale, although correlating with subjective response as well as, if not better than, other ratings, still only provides a reasonable physical approximation of loudness. It is important to realise that any policy standard based on rating methods will necessarily be fairly arbitrary and, in the final analysis, based on economic considerations rather than on a clearly defined dose-effect relationship. The significance of non-acoustic variables in determining subjective response to noise, and the annoyance elicited by low intensity noises - which may not even show up on a sound level meter - are both areas where further research is required.

4. Precision and accuracy are stressed by acousticians, both in respect to improving the tolerances of acoustic instrumentation and in respect to refining rating scales and procedures. However, in view of the uncertainties attached to noise ratings, the necessity of admitting that value judgement plays an inevitable role in the process of determining dose-effect relationships for environmental noise

should not be avoided. Some acousticians have themselves criticised the tendency to pursue precision and accuracy at the expense of pragmatism: "the continuing debate in acoustics circles over the optimum form of numerically describing noise may be hampering progress towards the ultimate aim of all those involved in noise assessment, that is, the reduction of noise to acceptable levels" (Berry, 1981). In similar vein, the Noise Council (1986) commented that "Scientific pedantry is not helpful and can prevent the achievement of practicable noise control legislation and defeat the objective of controlling noise pollution".

5. It is more expensive in terms of equipment, time and operator expertise to make complex measurements rather than simple ones. However, recent advances in microprocessor-based circuitry have made it possible to make relatively complex noise measurements simply and reasonably cheaply. The best example is the integrating sound level meter, which provides automatic readings of Leq. In future it may be possible to develop portable acoustic instrumentation which can rate the loudness of noise in accordance with such complex methods as the Zwicker or Steven's phon (see Appendix 2), or can determine the impulsivity and tonality of a noise from complex psycho-acoustic models. Thus the future may bring more realistic physical analogues of the ear.

The development of microprocessor-based equipment means that automatic monitoring of many environmental pollutants is now possible. The use of microprocessors allows complex, integrating circuitry to be small, and therefore portable, and also relatively cheap. This means that enforcement agents can have access to portable 'black boxes', which will monitor environmental pollutants in the field and automatically carry out complex integration and temporal statistical analysis of sample data in situ. As an alternative, digital sampling techniques enable data collected at monitoring sites in the field to be sent via telephone lines directly to computers in the laboratory for analysis. Automatic integration has led to the development of 'dose meters', which sample the environment over the period of

interest and determine what percentage of the 'acceptable' dose a particular target has been exposed to: the noise dose meter used in assessing occupational noise exposure provides an example. The use of microprocessors allows 'real-time' analysis of data, saving operators time which would otherwise be spent feeding data into a desk-top calculator or computer, in order to carry out retrospective statistical analysis of data.

5.8.1 Noise and Pollution

The subjectivity of the response to environmental noise has led some authors to declare that, in this respect, noise is very different from other forms of pollution (for example, Royal Commission on Environmental Pollution, 1984). However, as contemporary concerns shift from acute effects of pollution towards chronic and sub-chronic, long-term effects (see Chapter 2), it is becoming increasingly apparent that some of the characteristics exemplified by environmental noise are also illustrated by other forms of pollution. The basis and significance of the argument are outlined below:

1. At high enough exposure levels, the determination of the relationship between the 'dose' of a pollutant and its effects on people or the environment is usually quite straightforward (Holdgate, 1983). However, chronic and sub-chronic effects caused by exposure to low levels of environmental pollutants are much more difficult to quantify. The data may be inadequate to determine causal correlations for adverse effects which may only manifest themselves years after the original one-off exposure, or after years of continuous exposure to very low doses of a pollutant (for example, exposure to environmental carcinogens and the development of cancers). Alternatively, the presence of many confounding variables may mean that the dose-effect relationship is extremely complex. Issues such as these have been called 'trans-scientific', implying that their solutions may be beyond the reach of conventional science (for example, Council for Science and Society, 1977).

2. In simplistic terms, the adverse reaction to environmental noise is more connected with psychology than with physiology, whereas the effects of many other pollutants are centred strongly in the domain of physiology. In terms of popular credence, psychology implies subjectivity and uncertainty, whereas physiology implies objectivity and scientific certainty. However, if interest moves away from concern purely with the response of the 'average' person to concern with the individual, it becomes increasingly apparent that individuals show a great deal of variation, not just in their psychology but also in their physiology. Just as there is a range of sensitivity to environmental noise exposure, so too there is a range of sensitivity to radiation (Hawkes et al., 1986) and to toxic chemicals (New Scientist, 1986b).

3. The conventional approach to pollution control policy in Britain has been to resist the absolute removal or reduction of pollutants unless there is clear scientific evidence relating pollutant doses to effects (Macrory, 1986b). Policy on acid rain seems to have followed this approach (Boehmer-Christiansen, 1988). However, the decision to remove lead from petrol departed from this ideology (Southwood, 1986), and seems to have been more akin to the Royal Commission on Environmental Pollution's "prudent" approach. The prudent approach is best described by quoting from the Commission's Tenth Report (Royal Commission on Environmental Pollution, 1984):

> "We expect government to behave like a manager, not a scientific referee....This involves weighing up all the issues, both scientific and non-scientific, and arriving at reasonable judgements on the predictions which it would be prudent to adopt and on the action which should, in consequence, be taken. Rigorous scientific 'proof' should therefore not be regarded as a sine qua non."

It becomes increasingly difficult to apply the conventional approach in cases where the evaluation of the adverse effects of a pollutant is beset by uncertainty, or is characterised by professional dissent, or where the dose-effect relationship is so complex that it may be considered a 'trans-scientific' issue. In cases such as these, the ultimate goal of pollution control - which is the reduction of

pollution to acceptable levels - may be hindered. The "prudent" approach may then be more applicable.

CHAPTER 6

THE OPERATIONAL MODEL

6.1 THE OPERATIONAL MODEL

Chapter 4 analysed neighbourhood noise legislation in terms of legal controls on enforcement discretion. In this Chapter the operational constraints which further influence the pattern of enforcement behaviour are examined. The Operational Model can be visualised as a study of the law in practice, whereas Chapters 3 and 4 (the Legal Model) were concerned with the law in principle. Whilst the general aim of the Chapter is to describe the organisation of the enforcement agency and the procedures used for the enforcement of neighbourhood noise law, specific attention is drawn to the part played by the Technical Model within this process. In other words, the extent to which noise measuring equipment, noise ratings and other elements of technical approaches are used in the determination of unlawful behaviour.

The basis of the Chapter is an empirical study of a sample of Environmental Health Departments (EHDs). The majority of the data were gathered from interviews with Environmental Health Officers (EHOs) from 18 EHDs and from a structured questionnaire survey of the procedures used by 8 of these departments to enforce their legal mandate for neighbourhood noise. The survey is described in more detail in Section 6.4.

Theoretical approaches to empirical studies of regulatory agencies generally cluster in two areas (Shover et al, 1984):

(a) Studies of regulatory agencies as formal organisations, where attention is focused on problems relating to organisational structure and operating procedures (for example, Kagan, 1978);

(b) The 'socio-legal' studies which examine the exercise of discretion by regulatory agents, usually concentrating on field-level personnel as the unit of analysis (for example, Hawkins, 1984a; Richardson, 1982).

The perspective adopted by the Operational Model falls between these two approaches. The unifying concept of enforcement discretion used in the thesis is common to the socio-legal studies. The Operational Model, however, views the EHD primarily as a formal bureaucratic organisation. In addition, the interviews were conducted in the main with personnel of Principal Officer status (middle management), rather than with District Officers (equivalent to field-level personnel).

6.2 STUDIES OF THE ENFORCEMENT OF NEIGHBOURHOOD NOISE LAW

No other studies of the enforcement of neighbourhood noise law have addressed themselves in such detail to the question of identifying the operational constraints acting on the enforcement system. Hutter (1984), however, adopting a socio-legal approach, examined the procedures used by four EHDs in the enforcement of the whole suite of environmental health legislation.

A questionnaire survey of 76 local authorities (Bickerdike, 1972) examined the methods adopted for the investigation of noise complaints prior to the Control of Pollution Act 1974 (COPA), in terms of the resources available for, and used in, enforcement. In a similar exercise undertaken after the implementation of COPA, Mulholland (1979) sent a postal questionnaire to all EHDs in England and Wales to determine the equipment and staffing resources available for noise control, the number of authorities setting up noise abatement zones, and the frequency with which s.58 of COPA was used.

A questionnaire compiled by the Department of the Environment (DOE) in conjunction with the Institution of Environmental Health Officers was sent to all EHDs in England and Wales in 1985 (DOE, pers.

comm.), covering statutory nuisances of all types, of which noise formed one element. This was a fact-finding exercise in response to the Government White Paper "Lifting the Burden" (HMSO, 1985). The general aim of the White Paper was to reduce burdens on business by administrative and legislative regulation and the questionnaire was concerned with one aspect of this, in that its purpose was to review "local authority practice and court decisions on statutory nuisance, with the aim of preparing guidance to local authorities and making legislative changes if appropriate".

The question of the extent and nature of noise measurement activities carried out by EHDs was specifically addressed in a survey of 165 LAs by the National Physical Laboratory (Berry and Moss, 1987). Data were compiled on the use of noise measuring equipment both in relation to enforcement activities under COPA and also in relation to planning and licensing applications, health and safety responsibilities and the determination of compensation eligibility (for example, under the Noise Insulation Regulations 1973, as amended).

A study of complaints to EHOs about noise from domestic premises was undertaken by the Building Research Establishment (Utley and Buller, 1987) over a two-year period from mid-1984 to mid-1986.

Where relevant, this Chapter reviews the findings of these studies in the light of the present research undertaken for the thesis.

6.3 ENFORCEMENT STATISTICS

The annual reports of the Institution of Environmental Health Officers (IEHO) publish enforcement statistics relating to the whole range of environmental health responsibilities. The data are based on returns from 70-80% of all local authorities (LAs) in England and Wales which, since 1964, have been sent an annual questionnaire by the IEHO. Data relating to neighbourhood noise activities have been included in the reports since 1966. Some of these data are also published by the DOE in an annual "Digest of Environmental Protection

and Water Statistics".

The Home Office keep summary statistics of criminal court proceedings, undertaken both by the police and by non-police agencies. Statistics on prosecutions, convictions and levels of fines and costs awarded for cases under COPA are available from the Home Office Statistical Division. The responsibility for these statistical returns rests with the police. When compared with the data presented in the IEHO annual reports, however, the Home Office statistics consistently underrate the numbers of prosecutions taken under Part III of COPA. Lidstone et al. (1980) comment on the unreliability of the Home Office data for non-police prosecutions and suggest that the police may not be aware of considerable numbers of non-police prosecutions, or alternatively that non-police prosecutions may be recorded incorrectly as actually being prosecuted by the police. The IEHO data therefore provide a more detailed and accurate source of information concerning enforcement activity than the Home Office data. The latter, nevertheless, provide some indications concerning the level of fines and costs awarded in cases under Part III of COPA.

6.4 THE NOISE SURVEY

Although the surveys described above provide some useful insights into LA activity in relation to neighbourhood noise, they do not comment specifically on the operational constraints acting on the enforcement system. Consequently survey work directed towards this end was carried out for the purposes of this thesis in 1984 and 1985.

Several strategies of collecting data were used. At the inception of the research a week was spent observing the work of the Pollution Control Section of an EHD in a London borough. At this early exploratory stage of the project, attention was not confined to neighbourhood noise alone: the whole range of LA pollution control responsibilities was examined. Informal interviews were conducted with officers and technical assistants, case files were examined and officers were accompanied on visits.

Further exploratory research was carried out in the winter of 1984/1985, when a pilot interview survey was undertaken to investigate the procedures used by ten London boroughs to fulfil their pollution control responsibilities. The extent to which technology was used within this context was a central concern of the survey. As it was thought that pollution problems in the inner city might differ, both in type and in magnitude, from those of the suburbs, the sample of authorities was chosen to incorporate a balance of inner and outer area boroughs (five of each). In addition it was considered that the political atmosphere of the authority could influence both the significance afforded to pollution control and also the procedures adopted by the EHD in the fulfilment of their pollution control responsibilities. Consequently the sample was chosen to cover a range of political composition (four Conservative majority; five Labour majority; one Liberal majority).

Interviews lasting from one to two and a half hours were conducted with officers working in the Pollution Control Section (or its equivalent). In eight LAs the Principal Officer in charge of the Pollution Control Section was interviewed, whilst in the other two LAs the interview was conducted with a District Officer working in the section. Interviews were semi-structured or 'focused' (Mayntz et al, 1969), meaning that a scheme of guidelines to structure the discussion had been prepared, but the actual questions themselves were not standardised. This approach enables a general subject area to be covered during the interview, whilst leaving the interviewee free to dwell on particular topics which seem especially salient. The guidelines for discussion covered the procedures adopted, and the technology used, in the following functional areas:

1. The enforcement of neighbourhood noise law (Part III of COPA);
2. Other noise control responsibilities (for example, planning and licensing applications, agency work for the appropriate authority for the determination of eligibility for sound insulation against traffic or aircraft noise);

3. Statutory air pollution responsibilities;
4. Monitoring air pollutants;
5. Public health nuisances;
6. Other responsibilities of the Pollution Control Section.

The results of the pilot survey prompted the decision to concentrate the research on the enforcement of neighbourhood noise law (Part III of COPA). The reasons for this decision were covered in Chapter 1 (Section 1.3). To reiterate:

1. Part III of COPA provides a good example of an area of regulatory law currently expressing a complete spectrum of technical specificity;
2. It is a small enough body of law to permit detailed interdisciplinary study;
3. Neighbourhood noise is a growing cause of complaint to LAs (it currently comprises the major source of complaints to EHDs combined with a 5% annual increase in complaint level), and an area of growing concern with EHOs.

In order to design a survey which adequately addressed the problem of investigating the procedures used by EHOs to enforce neighbourhood noise law, it was necessary to take into consideration the diversity of local government.

6.4.1 Diversity of Local Government

There are 402 district councils in England and Wales (Institution of Environmental Health Officers, 1985), each subject to distinctive local influences, in terms of historical precedents and differing local environments (in the geographical, social and political senses of the word) (Byrne, 1983). It is reasonable to assert that these forces may influence the procedures used to apply the legal mandate. Due to this inherent diversity (Byrne, 1983; House of Lords Select Committee on Science and Technology, 1985), it was considered vital to choose as representative a sample of LAs as possible, within the

constraints set by time and resources.

In a strict legal sense LAs are independent from, rather than agents of, central government, but in no sense can the partnership be considered one of equals. Rhodes (1986b) comments that "If it is to be described as a partnership, it is a partnership in which central government holds the strongest cards". LAs are bound by statute - their actions must be *intra vires* - and the Secretary of State generally possesses a power to act if the LA is in default of its responsibilities (s.97 of COPA, for example), although these powers are very rarely, if ever, used. However, considerable discretion exists within this mandate. For instance, the powers conferred by central government may themselves be discretionary. But even mandatory duties provide scope for authorities to do more than the minimum required by law, if they so wish. The explicit duties conferred on local government also give rise to implied powers to enable them to carry out these explicit duties, for example appointing and training staff and purchasing equipment.

6.4.2 The Authorities

Eight authorities were chosen taking into account the following criteria:

1. Geographical distribution (NB. the scope of the survey was limited to England);
2. Political composition;
3. Rural or urban environment;
4. Prior knowledge of enforcement procedures. Some information of this nature had been gained from conversations with officers at the annual conference of the National Society for Clean Air (NSCA) in 1984. The NSCA has a large number of LAs amongst its members and, as mentioned in Chapter 3, is now a major pressure group where noise is concerned.

It was agreed with officers that LAs taking part in the field-work would remain anonymous. Consequently the eight authorities are referred to as authorities 1 to 8. Table 6.1 provides summary details of the eight authorities. The two London boroughs had already taken part in the pilot survey. Authority 1 is referred to as a 'metropolitan borough' since the research was conducted prior to 1 April 1986 when the Metropolitan County Councils and the Greater London Council were disbanded. This reorganisation of local government, however, left district and borough council responsibilities in the enforcement of neighbourhood noise law unchanged.

6.4.3 The Noise Complaint Questionnaire

Although interviews with officers can provide much useful data on enforcement procedures, there is a risk that interviewees will report the ideal, rather than the actual, situation. If possible, interview data should be validated and supplemented by other fieldwork techniques, such as an analysis of departmental records and case files, and/or observation of officers over a period of time. Several studies of regulatory agencies have collected empirical data primarily by periods of participant-observation, augmented by investigation of agency records (for example, Cranston, 1979; Hawkins, 1984a). Hutter (1984) and Richardson (1982) used both observation and structured interviews, together with some interrogation of records, in their respective studies of EHOs and Water Authority trade effluent officers.

Due to limitations on time and resources, research programmes where fieldwork is based primarily on observation or participant-observation are predisposed towards concentration on one or two divisions of an enforcement agency: Hutter's study (1984) was exceptional in using four LAs. As Cranston (1979) notes, participant-observation is less concerned with the frequency and distribution of events than with a thorough examination of the particular. Owing to the decision to use eight LAs in the survey, observation was not considered to be a

TABLE 6.1

THE EIGHT LOCAL AUTHORITIES

	Authority	Location	Political Composition	Description
1.	Metropolitan Borough	North	Stable Labour majority	Urban: an old centre of heavy industry and steel production, now attracting office development. Considerable re-development of the city centre has occurred to provide shopping and conference facilities.
2.	City Council	Midlands	Small Labour majority	Urban: originally one of the principal industrial centres of the Midlands. Now attracting commerce.
3.	London Borough		Stable Labour majority	Urban: mainly residential with some large housing estates. Some light industrial and commercial premises. Has a history of inner city problems.
4.	London Borough		Small Conservative majority	Urban: residential suburb with substantial ethnic minority. Due to its convenient location close to motorways and a major airport, it has areas of substantial light industry, providing a good level of local employment.
5.	District Council	South	Stable Conservative majority	Rural: a productive agricultural area with three towns of medium size. Some light industry confined to industrial estates. Tourism is low key.
6.	City Council	South-west	Hung (no overall majority)	Urban: a fairly prosperous university town, with heavy industry and busy docks. There are, nevertheless areas facing all the problems inner city deprivation.
7.	City Council	South-west	Stable Conservative majority	Urban: a popular seaside resort, with many hotels, restaurants and places of entertainment. Scarcely any industry.
8.	District Council	South-west	Non-party (although the mainstream political outlook is Conservative)	Rural: a rural hinterland combined with a small, but popular, seaside resort. An Area of Outstanding Natural Beauty. Some quarrying. A large tract of land is owned by the Ministry of Defence.

viable approach.

A possible survey method was considered to be interviews with officers combined with an analysis of case files. An examination of case files from two of the boroughs used in the pilot survey revealed, however, that the quality of files tended to be uneven and variable from authority to authority. Additionally some authorities contacted were reluctant to open their files to an outside researcher. Problems of this nature were also remarked upon by Hutter (1984).

To get round the problem of uneven quality of files and to obtain some real-time, rather than retrospective, data, it was decided to supplement information from interviews with officers from the eight authorities with a real-time survey, or so-called 'noise complaint questionnaire'. The objective of the questionnaire was to follow the course of a sample of noise complaints in each of the eight authorities for six months. It had been established, both from the pilot survey and from the Joint DOE/IEHO questionnaire (DOE, pers. comm.), that the EHOs' workload with respect to neighbourhood noise was primarily determined by public complaint. The exception to this is the decision to establish a noise abatement zone (NAZ), which is the result of a policy initiated by the council itself (although complaint levels are often influential factors in the council's decision). Since a complaint from the public marks the point at which the majority of enforcement activity is initiated, it was considered appropriate to address the questionnaire specifically to individual noise complaints. However, the questionnaire allowed for the possibility that some cases would enter the enforcement system via other means, such as detection by the officers themselves, or by another agency such as the police. Data concerning NAZs were derived from the interviews with officers.

Day visits were made to each authority and focused interviews were conducted with an officer responsible for noise control. This was usually the Principal Officer in charge of the Pollution Control Section (or its equivalent). The interviews were directed towards

obtaining a picture of the procedures used to enforce neighbourhood noise law, and the use made of technology within this context. The discussion covered the following functional areas:

1. Domestic noise;
2. Industrial noise;
3. Commercial noise (including noise from entertainment);
4. Construction site noise;
5. Ice cream chimes / burglar alarms;
6. Noise abatement zones.

In addition, in some authorities a sample of case files was scrutinised and noise measuring equipment was examined.

Once this initial contact had been established, the noise complaint questionnaire was run. The eight officers in the sample of authorities agreed to record all new noise complaints received by their departments during one week at the end of July 1985. At the end of the week the officers were contacted by telephone to establish how many complaints had been received. The contact officers were then sent a noise complaint questionnaire package. This consisted of the following items:

1. A covering letter, describing the contents of the package and giving instructions;
2. A brief description of the nature and objectives of the research project;
3. A form on which the officers recorded the identity of the premises complained about and ascribed a number to each, to ensure the anonymity of the members of the public concerned in all returns;
4. Sufficient copies of the noise complaint questionnaire (Table 6.2) to enable one copy to be filled in for each new noise complaint received that week;
5. 13 dated forms to be completed and returned at fortnightly intervals, finishing six months later with the last fortnight in January 1986. On these forms the officers were asked to record

TABLE 6.2

Noise Complaint Questionnaire

1. Number of complaint.....
   (Please refer to blue complaints listing sheet)

2. Date of complaint.....

3. How was the complaint received ? Please tick as appropriate.

   ☐ Phone call from complainant
   ☐ Letter from complainant
   ☐ Visit from complainant
   ☐ Other (please specify, eg. via police, petition, letter from councillor or MP, or proactive detection by the local authority.)

   .....

4. Brief description of nature of complaint

   .....

   .....

   .....

   Although this is considered to be a new complaint, has your Department received any previous complaint about noise from these premises in the last twelve months ?

   ☐ Yes
   ☐ No

   If yes, please could you indicate the nature of the previous complaint.

   .....

   .....

5. What action was taken as a result of the (new) complaint ? Please tick as appropriate.
   ☐ Visit to complainant
   ☐ Visit to person(s) complained of
   ☐ Phone call to complainant
   ☐ Phone call to person(s) complained of
   ☐ Standard letter to complainant
   ☐ Standard letter to person(s) complained of
   ☐ Personalised letter to complainant
   ☐ Personalised letter to person(s) complained of
   ☐ Other (please specify)

   .....

Questions 6-10 refer to any visits made concerning this complaint. If no visit was made please go on to Question 11.

6(i)If a visit was made, either to the complainant, to the person(s) complained of,or to both parties, please give a brief description of what occurred.

.....

.....

.....

.....

.....

(ii)Was the visit made during, or out of, working hours ?

.....

Questions 7-9, please tick as appropriate.

7. Was the noise occurring at the time of the visit ?
   - ☐ Yes
   - ☐ No

8. If Yes, did the noise amount to a nuisance in your opinion ?
   - ☐ Yes
   - ☐ No

9. How did you determine whether or not the noise amounted to a nuisance ?
   - ☐ Subjective assessment
   - ☐ Subjective assessment and monitoring
   - ☐ Monitoring

   What criteria did you use to reach this decision ?

.....

.....

.....

.....

.....

.....

.....

If monitored, please specify the type of sound level meter used and the procedure followed; eg. in accordance with BS4142 ?

.....

.....

.....

10. If the noise was considered to amount to a nuisance, what action was then taken ?

.....

.....

.....

.....

.....

11. Were any further complaints received, letters sent, visits made or notices served concerning these premises during the week 27 July to 2 August 1985 inclusive ?

.....

.....

.....

.....

.....

.....

.....

12. Please mention here any details about the case which have not been covered by the questions above.

.....

.....

.....

.....

.....

details of any further action taken in respect of the noise complaints received during the week in July 1985. (An example of one of the forms is shown in Table 6.3).

The noise complaint questionnaire yielded data on 122 complaints: all except 3 complaints (concerning construction noise) were amenable to treatment under s.s 58 or 59 of COPA. The numbers of complaints received by the authorities for the week varied between authority 8 with just 2 complaints, to authority 3 with 38 complaints. Some officers returned the questionnaires very quickly; others required prompting by phone. In the case of one authority a return visit was necessary before these data could be obtained. Once the questionnaires had been returned, letters were sent to the officers, thanking them for their cooperation and effort.

Questionnaire returns were analysed and simple summary statistics derived where possible. The following account is based on the noise complaint questionnaire and on interviews with officers from the eight authorities. It is supplemented by information from reference sources; the pilot survey of the London boroughs; the week of observation and from visits to two other LAs. 18 different authorities were visited in total. Over the course of the research, four court cases concerning noise and a licensing application where objections based on noise had been received, were attended.

6.5 OPERATIONAL CONSTRAINTS ON THE ENFORCEMENT SYSTEM

6.5.1 The Role of the Environmental Health Officer

The way in which EHOs perceive their role will tend to influence their attitude towards the stringency with which the law should be enforced. The role of the EHO is not simply that of an enforcement agent. Indeed, officers disliked any reference to their being "sanitary policemen". The enforcement function is only one aspect of a job that encompasses regulatory, advisory and educational functions. The role of EHO has been described recently by the Working Party on

TABLE 6.3

AN EXAMPLE OF ONE OF THE DATED FORMS REQUESTING FURTHER INFORMATION ON THE PROGRESS OF NOISE COMPLAINTS

The Fortnight 3-16 August 1985

Please fill in below details of any action taken by the Environmental Health Department in response to the complaints received by you between 27 July and 2 August 1985 inclusive. Please return the form even if nothing has happened: indicate that this is the case by 'N/A'.

Please include details of any:
(i) further complaints received concerning these premises. Did this take the form of a letter, phone call, visit or some other form?
(ii) phone calls which either you, or someone else in you department, have made either to the complainant or person(s) complained of.
(iii) letters sent out to either party; were these standardised or personalised letters?
(iv) visits made to either party.
(v) noise monitoring undertaken.
(vi) statutory notices served, including notices under the provisions of any local byelaws.
(vii) prosecution proceedings initiated.

Complaint Number	Action taken between 3-16 August 1985 inclusive

Please continue overpage

Environmental Health Education (1986) in the following terms:

> "The work of the environmental health officer is concerned with the inter-relationship between human beings, their health and the natural and built environments, including the impact of science, technology and socio-economic conditions. The primary role is to protect human health, ranging from the provision of solutions to specific problems to the development of strategies in furtherance of preventative health."

The primary role of the EHO in protecting and promoting human health has a long historical precedent. The major change in emphasis of the job over the years has been not in the definition of the primary role of the EHO, but in the broadening perception of the extent to which environmental factors influence human health, as the following account of the history of the environmental health profession reveals (drawn from Frazer, 1950 and Martin, 1978).

6.5.1.1 Brief History of the Environmental Health Profession

In 1842 the Poor Law Commission, chaired by Edwin Chadwick, reported on their "Inquiry into the Sanitary Condition of the Labouring Population of Great Britain". They specifically commented on the correlation between the general conditions of poverty (overcrowding, inadequate diet, insanitary accommodation and so forth) and poor health. Their report prompted Liverpool Corporation to promote a private Bill in Parliament, resulting in the Liverpool Sanitary Act 1846. This made provision, amongst other matters, for the appointment of an "Inspector of Nuisances", the original predecessor of the EHO.

The Liverpool Corporation Act 1846 formed the basic model for the first Public Health Act of 1848. Although a Public Act, the 1848 enactment generally had to be adopted by a LA before its provisions became legally binding. The consolidating Public Health Act of 1875, however, was of national application. By 1891, Inspectors of Nuisances had become known as "Sanitary Inspectors". Originally, building trade personnel had been encouraged to become Sanitary Inspectors. In the 1920s attempts were made to raise the status of the job, and put it

on a more professional basis. The Local Government Act of 1933 provided general powers to prescribe the qualifications and duties of Sanitary Inspectors.

The main emphasis in the early days was placed on matters having an immediate impact on physical health, such as bad sanitation; overcrowding; pest control; adulteration of food; infectious diseases and unfit housing. These functions could for the most part be discharged without recourse to scientific and technological support. By the 1940s and 1950s further responsibilities had been added to the Sanitary Inspector's job, producing an increase in the sophistication and technicality of the role. Technological developments caused some of the traditional functions to be viewed in a new way, food hygiene for example, and also added completely new functions such as pollution control (with the passing of the Clean Air Act 1956) (Rhodes, 1986a). By 1956 the broadening role of Sanitary Inspectors led to a change of name to "Public Health Inspectors", following a recommendation by the Working Party on the Recruitment, Training and Qualifications of Sanitary Inspectors (Ministry of Health, 1953).

As Chapter 3 describes, although some LAs have had powers in noise control since the 1930s, the control of noise nuisances was only made a national responsibility in 1960, with the passing of the Noise Abatement Act. However, it was not until the mid-1960s, following recommendations by the Wilson Committee, that LA noise control became established as a subject of some technical complexity.

One point to emerge from the reformation of local government, as a result of the Local Government Act 1972, was the renaming of "Public Health Inspectors" as "Environmental Health Officers". This reflected both the broadening scope of the job - from a concern with physical health as such, to the promotion of a better environment (and its concomitant bearing on health) - and also the current views of the time concerning the environment and "environmentalism" (see Chapter 3). The 1970s saw the creation of further responsibilities for EHOs with the passing of the Health and Safety at Work Etc. Act and the

Control of Pollution Act, both in 1974. The Local Government Act 1972 also created Area Health Authorities, meaning that the National Health Service was no longer administered by LAs and, as a result, that EHOs no longer reported to a Medical Officer. It also removed the statutory responsibility for LAs to have a discrete EHD, meaning that in some authorities Environmental Health is now combined with Housing or with Trading Standards.

Whilst no empirical data could be gained on this, there were indications from some of the interviews with officers that the younger generation of EHOs tended to be more eager to define their job in terms of protecting the local environment and, as a result, were possibly more prepared to use formal methods of enforcement. A similar observation was also made by Hawkins (1984a) in relation to Water Authority pollution control officers.

6.5.2 The Organisation of Enforcement

6.5.2.1 The Departmental Hierarchy

LAs are organised along formal bureaucratic lines. EHOs are part of the "professional sector" of the organisation: their job is supported by administrative staff and technicians. The Chief EHO is appointed by the council and his or her main role is to liaise with the elected members, determining departmental policies and allocating departmental resources. The Assistant Chief EHO mediates with the Chief and the rest of the staff, supervising and consulting with the various divisions of the EHD. Middle management comprises Principal or Divisional Officers, who are responsible for running the different divisions of the EHD, and for supervising the District EHOs under their control. The District Officers spend much of their time dealing with the public "in the field", investigating complaints and carrying out the bulk of routine enforcement work. The extent to which the work of officers at the bottom of the hierarchy is supervised by middle and top management varies from authority to authority.

Traditionally EHOs were generalists: each officer employed by the LA dealt with the whole range of environmental health problems. In small rural authorities officers may still work as generalists and noise control will be just one amongst many other responsibilities. The increasing ambit and technicality of the environmental health function has meant that, especially in busy urban authorities, EHDs tend to be divided on a functional basis. Separate divisions typically deal with housing, health and safety, food, pollution control (including noise), and general matters (for example, public health nuisances, pest control, camping/caravan sites). Figure 6.1 shows the structure of a typical urban EHD: the departmental hierarchy is followed through only for 'Environmental Protection', but similar structures exist for both 'Food and Occupational Health' and 'Housing' functions.

6.5.2.2 The Organisation of Neighbourhood Noise Control

Table 6.4 shows the organisation of, and staffing levels for, noise control in the 8 LAs in the survey. Authority 8, a rural LA serving a small population of 40,000, had just three EHOs working as generalists. The other 7 authorities in the survey (and all other authorities visited), however, had specialist sections which dealt with noise and other functions related to pollution control. Table 6.4 lists the number of staff working on noise in each authority. However, this in itself is no indication of the priority afforded to noise control since officers usually had a range of other responsibilities to attend to, depending on the degree of specialisation of the section. For instance, Authority 1 had 10 staff working on noise in its 'Environmental Protection Unit', but officers had to deal in addition with a variety of other functions, such as pest and dog control, environmental hazards, health and safety, public health, water quality and caravan/camping sites. In contrast, Authority 2 had one officer who worked full-time on noise and pollution control, helped by another officer on temporary secondment.

FIGURE 6.1

STRUCTURE OF A TYPICAL URBAN EHD

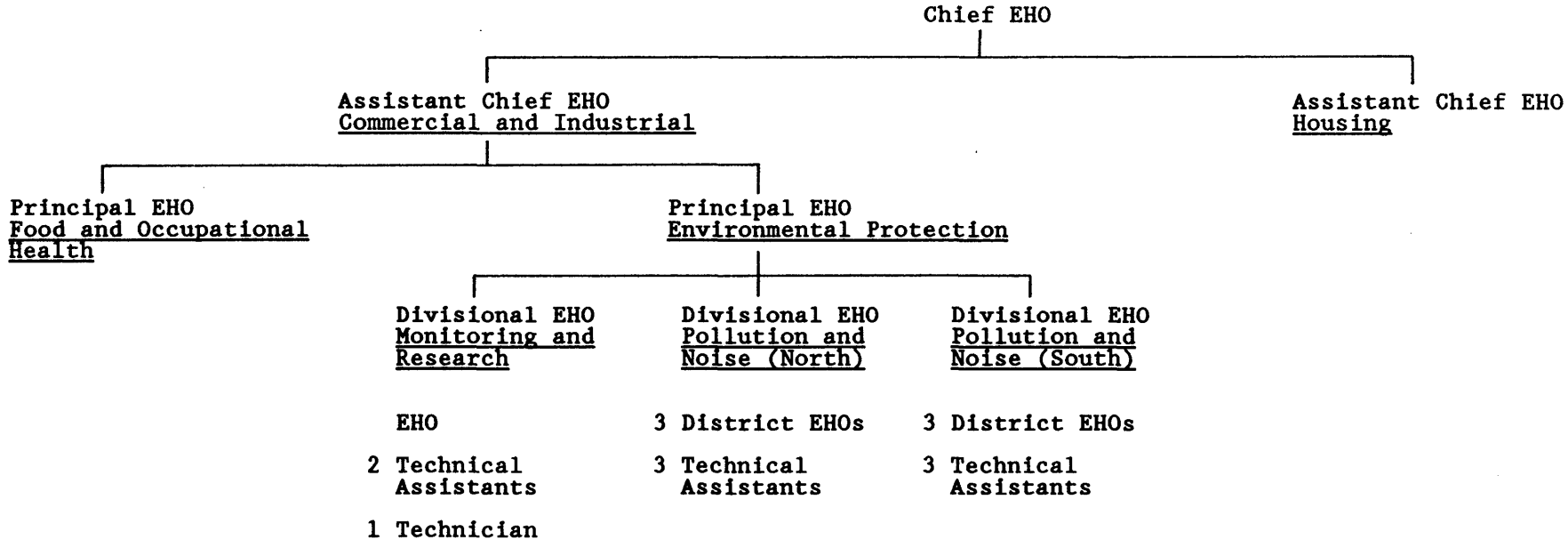


TABLE 6.4

ORGANISATION OF POLLUTION CONTROL AND STAFF WORKING ON NOISE

Authority	Population Served (approximate)	Organisation of Pollution Control	Staff Working on Noise	Complaints Received	
				Annually (1984/85 figures)	For week 27/7/85 - 2/8/85
1 North, urban	500,000	Environmental Protection Unit	10 (1 PEHO; 1 SEHO; 6 Dis EHO 1 Noise Control Officer; 1 Noise Control TA)	671	21
2 Midlands, urban	200,000	Noise and Pollution Section	2 (1 Noise and Pollution Officer 1 EHO on temporary secondment)	ca.500	10
3 London borough Urban	200,000	Pollution Control Section	8 (1 PEHO; 1 SEHO; 2 Dis EHO 4 TA)	1304	38
4 London borough Urban	300,000	Pollution Control Unit	6 (1 PEHO; 2 SEHO; 1 Dis EHO 2 TA)	ca.1000	24
5 South, rural	100,000	Pollution Division	7 (1 Div EHO; 3 Dis EHO; 3 TA)	213	5
6 South-west Urban	400,000	Environmental Protection Division	12 (1 Div EHO; 6 Dis EHO; 4 TA)	976	11
7 South-west Urban	150,000	Pollution and General Division	4 (1 Div EHO; 2 Dis EHO; 1 TA)	539	11
8 South-west Rural	40,000	Generalist EHD	3 (Whole department, ie. 1 Chief EHO; 2 Dis EHO)	ca.150	2

KEY: PEHO = Principal EHO; SEHO = Senior EHO; Div EHO = Divisional EHO; Dis EHO = District EHO; TA = Technical Assistant

In addition to some EHDs dividing work on a specialist basis, the workload is also frequently divided geographically. For instance, the EHD in Figure 6.1 divided the noise and pollution control workload into two divisions, depending on whether cases originated in the northern or southern halves of the LA area. Within these divisions, the workload was divided into a further three subdistricts, with one District Officer assigned to each subdistrict.

6.5.3 Resources for Enforcement

A major constraint on the enforcement of the legal mandate is the resource level which can be devoted to this function. The control of neighbourhood noise is just one among many competing demands placed on the LA budget and the resources assigned to it will depend both on the priority afforded by the council to environmental health and, within this, to noise control itself. The resources for environmental health, in terms of budget, staffing (both level of training and numbers employed) and provision of equipment, are determined by the Chief EHO in conjunction with the council. These are considered in more detail below, in Sections 6.5.3.1 to 6.5.3.6.

6.5.3.1 Training in Environmental Health

To qualify as an EHO it is necessary to complete either a three year course for a Diploma in Environmental Health or a four year degree in Environmental Health. Both courses include periods of training with a LA. The first degree course started in 1964 at the University of Aston, but the major expansion in degree courses occurred in the 1970s (Montgomery, 1986). The Institution of Environmental Health Officers is now committed to the idea of an all-graduate profession in the long run (Rhodes, 1986a), and only two diploma courses presently remain.

The trend is now towards officers being more highly qualified at the start of their career. Another reason for the increasing professionalism of the EHO is the tendency towards specialisation

after completion of the basic training, by gaining further qualifications in specific areas of environmental health, such as housing, health and safety, air pollution or acoustics. The specialist qualification in acoustics is frequently the Diploma in Acoustics initiated in 1978 by the Institute of Acoustics. By 1985, 342 officers had completed this course, and a report by the House of Lords Select Committee on Science and Technology (1985) recommended that all EHDs should employ, or have access to, at least one EHO with a postgraduate qualification in acoustics.

Evidence given to the House of Lords Select Committee on Science and Technology (1985) by the Institution of Environmental Health Officers inferred that money for specialist training was short, although there was no shortage of officers who wished to gain additional specialist qualifications.

6.5.3.2 Staffing Level

A ratio of 1 EHO to each 10,000 population tends to be considered as the norm for staffing levels (Report on Staffing in Environmental Health, 1978). Salary scales are related to the population base of the employing council, so large urban councils tend to offer the best job opportunities. There are in the region of 5,500 EHOs in employment in England and Wales (Annual Reports of the IEHO).

6.5.3.3 Technical Support Staff

Several authorities in the survey employed Technical Assistants (TAs) to assist EHOs in pollution and noise monitoring. Technical support staff were introduced in the 1970s (House of Lords Select Committee on Science and Technology, 1985). TAs have a range of qualifications up to doctorate level. The career structure in the EHD is geared towards the fully-trained EHO, so promotion prospects for TAs tend to be rather limited. In two authorities visited, however, the person in charge of noise control had a technical background in acoustics, rather than an environmental health qualification.

6.5.3.4 Provision of Noise Monitoring Equipment

All authorities visited had a basic set of noise monitoring equipment, including a precision sound level meter, calibrator, tape recorder, integrating meter, and octave or third-octave filter set for frequency analysis. The majority also owned, or had access to, environmental noise analysers, graphic level recorders and spectrum analysers. One large urban authority had a 'Noise Laboratory' which housed a digital computer-based system for noise analysis. This LA was also planning to buy a real-time frequency analyser.

The level of equipment provision in an authority depended on the extent of noise control work undertaken by the authority (including enforcement of neighbourhood noise, planning assessments, noise insulation work and health and safety). Urban authorities were generally better equipped than rural authorities. However, the extent to which individual officers had acoustic training and were interested in the technical side of noise control, also had some bearing on equipment purchasing. For instance, the Principal EHO of the Pollution and General Division of Authority 7 (a seaside resort), recently appointed from a busy metropolitan borough and with a special interest in noise, had brought pressure to bear on the council for the purchase of an environmental noise analyser.

The study of science and technology in local government by the House of Lords Select Committee on Science and Technology (1985) found a wide variation in the level of service for noise control, which ranged from the very good to the very sparse. Nevertheless, in a sample of 100 LAs, more than half had adequate staff and instrumentation for the control of noise (ibid). This was in contrast to the position in 1970, when a survey of 76 LAs (Bickerdike, 1972) reported that 70% had no noise monitoring equipment of any sort.

The variation in the level of technical expertise and of equipment provision between LAs is a reflection of the inherent

diversity of LAs. There are no national standards for the level of provision of scientific and technical equipment in LAs. In evidence to the House of Lords Select Committee on Science and Technology (1985), the DOE said that "Central government, for the most part, has no direct role in ensuring the adequacy of whatever scientific and technical services are provided by, or are available to, individual local authorities; nor could central government properly seek that role".

6.5.3.5 Equipment Sharing

There are economies of scale for equipment purchasing. It generally does not make economic sense for small authorities to purchase expensive monitoring equipment, such as environmental noise analysers, especially if noise is a minor concern. One solution to this problem is for LAs to set up equipment sharing cooperatives, or for large urban authorities to loan out equipment to adjoining rural areas, if necessary. Authorities 7 and 8 were members of the same equipment cooperative, and contributed to the joint fund in proportion to their population base and rating scales. All London boroughs could borrow equipment from the London Scientific Services (previously part of the GLC, and since 1 April 1986 partly funded by grants from the London boroughs).

At present, equipment sharing depends on local initiatives and all such groupings are informal. In addition to equipment sharing, some groups aim to promote the sharing of technical knowledge and the adoption of uniform standards of enforcement. The House of Lords Select Committee on Science and Technology (1985) recommended that central government should encourage the formation of inter-authority groupings, and that a provision to this effect be included in legislation. No such provision has yet been made, however.

6.5.3.6 Dissemination of Technical Information

> "Local government officers individually have a tradition of exchanging information and advice freely with one another, and their professional associations play a significant role in this respect" (House of Lords Select Committee on Science and Technology, 1985).

Where environmental noise is concerned, the relevant professional associations are the Institution of Environmental Health Officers and the Institute of Acoustics. These bodies publish journals and organise seminars, workshops and conferences. Similar work is also undertaken by the National Society for Clean Air. There is some cooperation between LAs and colleges and universities. Private companies and also the London Scientific Services undertake noise consultancy work for LAs.

Central government circulars may provide technical background information to aid the implementation of new legislation (for example, Circular 2/76 contains detailed information on setting up, and monitoring noise levels from NAZs). The Building Research Establishment and the National Physical Laboratory (research stations of the DOE and the Department of Trade and Industry respectively) are prepared to answer technical queries and undertake consultancy work on behalf of LAs (Dr Utley, pers. comm.).

6.5.4 The Process of Enforcement

6.5.4.1 The Reactive Approach to Enforcement

The survey found that EHOs' workload with respect to neighbourhood noise was primarily generated by public complaint: 93% of complaints in the noise complaint questionnaire resulted from the public contacting the EHD, either by letter, phone call or visit. One of these complaints was the result of the secretary of the local Residents' Association contacting the EHD on behalf of three aggrieved residents. 6% of cases were generated by memoranda from other council

departments, such as Planning, Housing or Social Services. Most of these cases were originally the result of public complaint, or of applications for planning permission. A phone call from the local Factory Inspector comprised the remaining 1% of complaints. The DOE/IEHO survey reported that 99% of cases resulted from public complaint (DOE, pers. comm.). A boundary on EHOs' behaviour in respect of neighbourhood noise was therefore set by public demand.

With the exception of two complaints, all complaints recorded in the questionnaire referred to different premises. As a consequence, 'complaint' is used synonymously with 'case' in this Chapter.

Officers treated complaints seriously and tried to respond to every complaint they received. Even if they had no statutory powers to deal with the cause of a particular complaint (for instance, traffic or aircraft noise), officers would forward details to the appropriate authority. Officers considered that they had a responsibility to the local electorate, and feared the possibility of disconsolate complainants referring a particular case to the Ombudsman.

Studies of law enforcement (concerning both police and non-police agencies) refer to the 'mobilisation' of the law. The term was first used by Black (1973) to mean "the process by which a legal system acquires its cases". Cases can enter a legal system from two possible directions: reactively or proactively (Black, ibid.). Reactive mobilisation occurs when an enforcement agency responds to a complaint made by a member of the public. Proactive mobilisation occurs when an enforcement agent acts to enforce the law with no prompting from the public. A reactive enforcement strategy means that the agency must allocate resources according to public complaint. With proactive enforcement, however, the agency can determine its own priorities in terms of matters which it, rather than the local population, consider important (Kagan, 1984).

Officers interviewed in the noise survey said that the reactive strategy was the most efficient: if a noise was a nuisance, they

assumed that people would complain about it to the council. Unlike some forms of pollution, such as radiation or pesticide residues in food, the general public can easily detect noise without recourse to monitoring equipment. A reactive approach, however, depends on the public being cognisant of the fact that the LA has statutory powers to deal with noise, and that the LA is prepared to use these powers. Complainants are not necessarily representative of the whole population, nor is the level of complaint necessarily representative of community annoyance due to noise (see Chapter 5).

Although the decision to establish a noise abatement zone was proactive, subsequent enforcement activity depended either on public complaint (reactive) or on sample monitoring checks by the LA (proactive). As one EHO at a National Society for Clean Air conference said, "The registered noise levels [in a noise abatement zone] must not be forgotten, but should be checked from time to time. It is not suggested that regular, time consuming monitoring takes place, but rather that sample premises are checked or complaints investigated" (Barraclough, 1982).

An enforcement strategy that is primarily reactive in nature is common to both the police and to many regulatory inspectorates: in most enforcement agencies the law is primarily mobilised by complaints from members of the public (Kagan, 1984). Several studies of the police, both in the United States and in Britain, have shown that at least 70% of police activity is originated by members of the public (Banton, 1964; Black, 1971; Reiss, 1971; Steer, 1980). These studies, however, excluded specialist police work such as narcotics, vice and fraud squads and traffic regulation, where a much larger proportion of the work derives from proactive policing.

Hutter (1984) found that across the whole suite of environmental health functions, half the EHOs' workload was generated reactively and half proactively. Food, and health and safety inspections accounted for most of the proactive work. Cranston (1979) in his study of 'consumer agencies' (LA Trading Standards Departments and food and

drug sections of EHDs) found that 64% of his sample of prosecution cases arose from public complaint, and the rest from proactive detection work by officers as a result of their inspection of commercial premises. According to Hawkins (1984a), Water Authority pollution control officers discovered offences half proactively and half as a result of public complaint. Detection of trade effluent offences (illegal discharges to sewers) was generally proactive, however (Richardson, 1982). Macrory and Withers (1985) reported that the majority of waste disposal offences were discovered proactively. Income tax evasion (the Inland Revenue) and health and safety offences (the Factory Inspectorate) were also considered to be discovered mainly proactively, (Black, 1973).

6.5.4.2 The Role of Administrative Personnel

District officers, who undertook the majority of routine inspection work, spent a large proportion of their day in the field. They would generally be out of the office between 10 am and 4 pm, sometimes reporting back at lunchtime. Middle management (Principal or Divisional officers) spent more time in the office attending to paperwork, but would make field investigations several times a week.

Consequently, administrative staff usually received complaints in the first instance. In the noise complaint questionnaire, 80% of complaints were made by telephone, 9% by letter, 6% by internal memoranda, and 5% by members of the public visiting the EHD. Telephone receptionists therefore had to deal with the bulk of the workload. The procedure for recording a complaint was common to all EHDs visited: the receptionist noted the nature of the complaint, the name and address of the complainant and of the person or company complained about (if known), on a 'complaint sheet'. If officers were available, they would occasionally be called on to give advice to a complainant with an unusual or especially difficult problem. Similarly, if the complainant visited the EHD to register a complaint, an officer, rather than administrative staff, would sometimes take the details of the case. Usually, however, the receptionist passed the completed

complaint sheet to the appropriate District Officer for attention at a later date.

Administrative staff were therefore responsible for directing complaints through the appropriate channels. In some authorities they were also responsible for sending out standard letters and forms in response to certain sorts of common complaint, such as barking dogs and amplified music (see Section 6.5.5.1), before the complaint had even reached the appropriate officer.

6.5.4.3 Departmental Records

District Officers recorded all action taken and visits made as a result of a complaint on a 'progress sheet'. Many also had personal diaries or notebooks in which they recorded the most important details of a case at the time of a visit, and later transcribed this information onto the progress sheet. In some authorities complaint sheets and progress sheets had been combined into one form, known as an 'action report form'.

Files were held under the address of the premises complained about, and contained:

1. The progress sheet (or action report form);
2. Copies of all correspondence concerning the case, sent to and from the complainant, complainee, Legal Department, and other interested parties;
3. Copies of any formal notices served;
4. Copies of any witness statements made;
5. Prosecution details (if any).

Three EHDs had put their records on computer, and one on microfiche. Some of the London boroughs and large urban authorities additionally held central files containing a record of all prosecutions undertaken.

Record keeping was important to all the LAs, since the possibility

that a case would ultimately go to court, or that a case would be referred to the Ombudsman, was always at the back of officers' minds.

When a complaint sheet was received, the District Officer checked the files to see if there had been any previous complaints about the premises in question. In the noise complaint questionnaire, 72% were 'new' complaints: the premises concerned had not been the subject of any previous complaints about noise. In the other 28% of cases, there had been previous complaints (and in all but one of these, the new complaint concerned a similar noise problem to the old complaint).

6.5.4.4 The Types of Noise Complained About

Table 6.5 provides a breakdown of the types of noise complaints received by the 8 authorities in the noise complaint questionnaire for the week 27 July - 2 August 1985. Figure 6.2 shows this information as a histogram for the total sample.

Amplified music in the home was the most frequent source of complaint (24%) recorded by the noise complaint questionnaire. A recent survey in Scotland (Craik and Stirling, 1986) found that a similar percentage (25%) of noise complaints were about amplified music, while the survey of 2624 domestic noise complaints by Utley and Buller (1987) found that 34% concerned music or amplified music. General noisy behaviour in the home accounted for a further 17% of complaints in the noise complaint questionnaire, followed by noisy parties (12%) and barking dogs or other noisy domestic animals (12%).

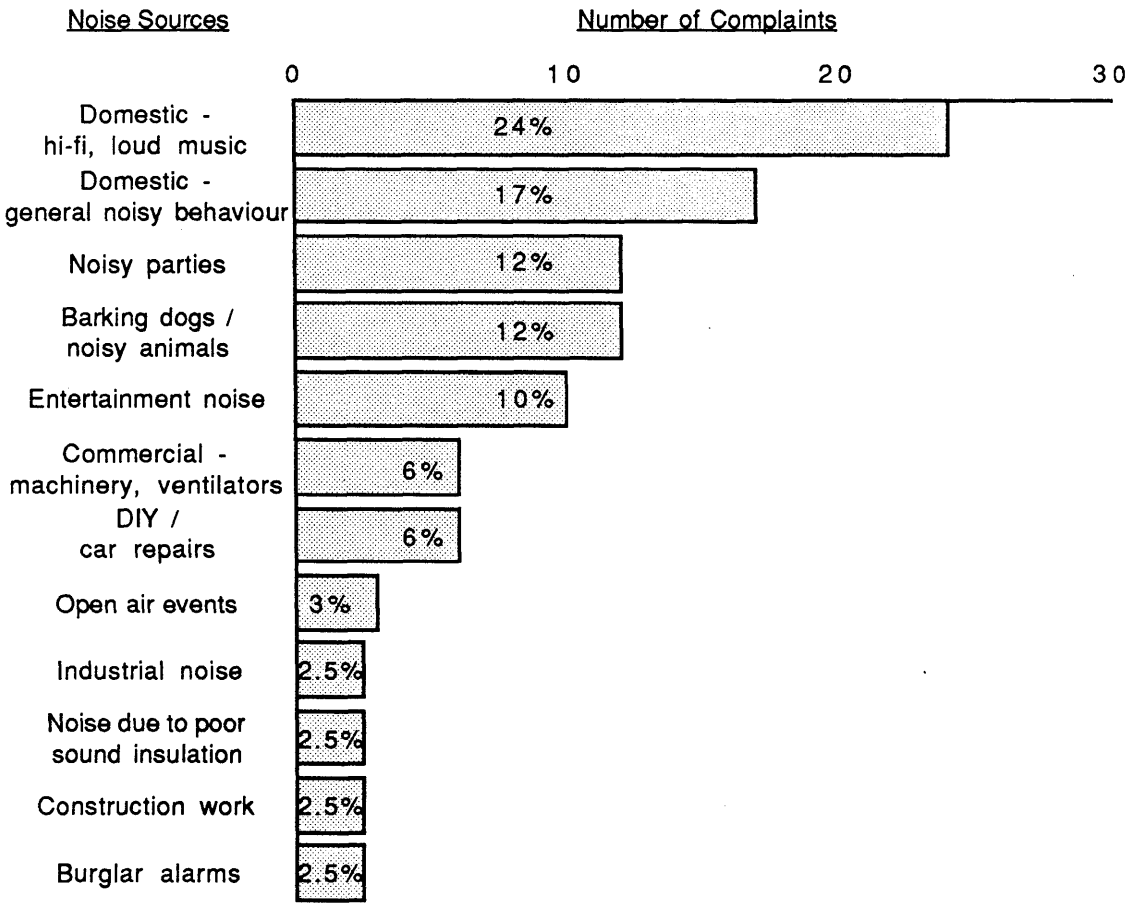
In total, domestic noise (consisting of amplified music, general noisy behaviour, noisy parties, noisy animals, car repairs and DIY) accounted for 71% of the sample. Commercial noise (consisting of entertainment noise, commercial machinery and ventilators, and open-air events) comprised a further 19%, while industrial noise, construction noise, noise as a result of poor sound insulation, and burglar alarms were responsible for 2.5% each of the complaints

TABLE 6.5

BREAKDOWN OF NOISE COMPLAINTS RECEIVED IN THE NOISE COMPLAINT QUESTIONNAIRE

	AUTHORITY									
	1	2	3	4	5	6	7	8	TOTALS	%
Noise Source										
Domestic - hi-fi, loud music	1	4	16	1	3	3	1	-	29	24
Domestic - general noisy behaviour	7	6	4	-	-	3	1	-	21	17
Noisy parties	-	-	7	8	-	-	-	-	15	12
Barking dogs, noisy animals	6	-	-	3	-	2	4	-	15	12
Entertainment noise	2	-	3	5	-	-	2	-	12	10
Commercial - machinery, ventilators	-	-	1	3	-	1	1	1	7	6
DIY, car repairs	2	-	1	-	-	2	1	1	7	6
Open air events	-	-	2	1	1	-	-	-	4	3
Industrial noise	2	-	-	-	-	-	1	-	3	2.5
Noise due to poor sound insulation	-	-	2	1	-	-	-	-	3	2.5
Construction work	-	-	1	1	1	-	-	-	3	2.5
Burglar alarms	1	-	1	1	-	-	-	-	3	2.5
TOTAL	21	10	38	24	5	11	11	2	122	100

FIGURE 6.2
TYPES OF NOISE COMPLAINTS RECEIVED BY THE 8 AUTHORITIES IN THE NOISE COMPLAINT QUESTIONNAIRE



respectively.

Whilst it is inappropriate to make wide inferences from a small sample of 122 complaints, the high proportion of complaints about domestic sources seems significant. Statistics from the IEHO annual report for 1985/86 (Institution of Environmental Health Officers, 1986) reveal that domestic sources constituted 60% of the total number of noise complaints received by EHDs in England and Wales. Commercial and industrial sources accounted for 28%, construction noise for 5%, noise in streets (s.62 of COPA) for 2% and noise from sources exempt from control under COPA for 5%. The IEHO statistics do not provide any further breakdown of sources of complaint.

Figures 6.3 and 6.4 show the national trend in complaints since 1971. Figure 6.3 reveals a progressive 5% annual increase in complaints for all sources of noise, with complaints about domestic sources increasing at a rate of 10% per annum. Figure 6.4 shows that when COPA was implemented in 1976, noise from industrial and commercial premises was the major source of complaint. The situation has now reversed: domestic noise now constitutes the largest proportion of complaints.

Reasons for this drastic increase in domestic noise complaints are easy to propose, but much harder to substantiate. One authority's annual report in 1981 explained the problem in rather emotive terms:

> "No doubt this is a reflection of a community where the majority of householders appear to have high-powered stereos, where "do-it-yourself" with noisy powered tools is the norm, especially in the evenings and at weekends, the family dog barks because nobody is at home to stop it, and many people feel no obligation to think of their neighbours. I pray that the cases dealt with in this Department are not a true reflection of the whole community because if they are, then community spirit, where neighbours give and take over such matters and generally try to help each other, is dead."

The more widespread ownership of white goods coupled with the increasing power of such equipment, especially hifi, means there are now more sources of noise in the home than existed twenty years ago.

FIGURE 6.3

NOISE COMPLAINTS RECEIVED BY ENVIRONMENTAL HEALTH OFFICERS ABOUT NOISE SOURCES CONTROLLED BY NOISE ABATEMENT ACT 1960 AND CONTROL OF POLLUTION ACT 1974

(Source: DOE Digest of Environmental Protection and Water Statistics, 1986, using data from Annual Reports of the Institution of Environmental Health Officers)

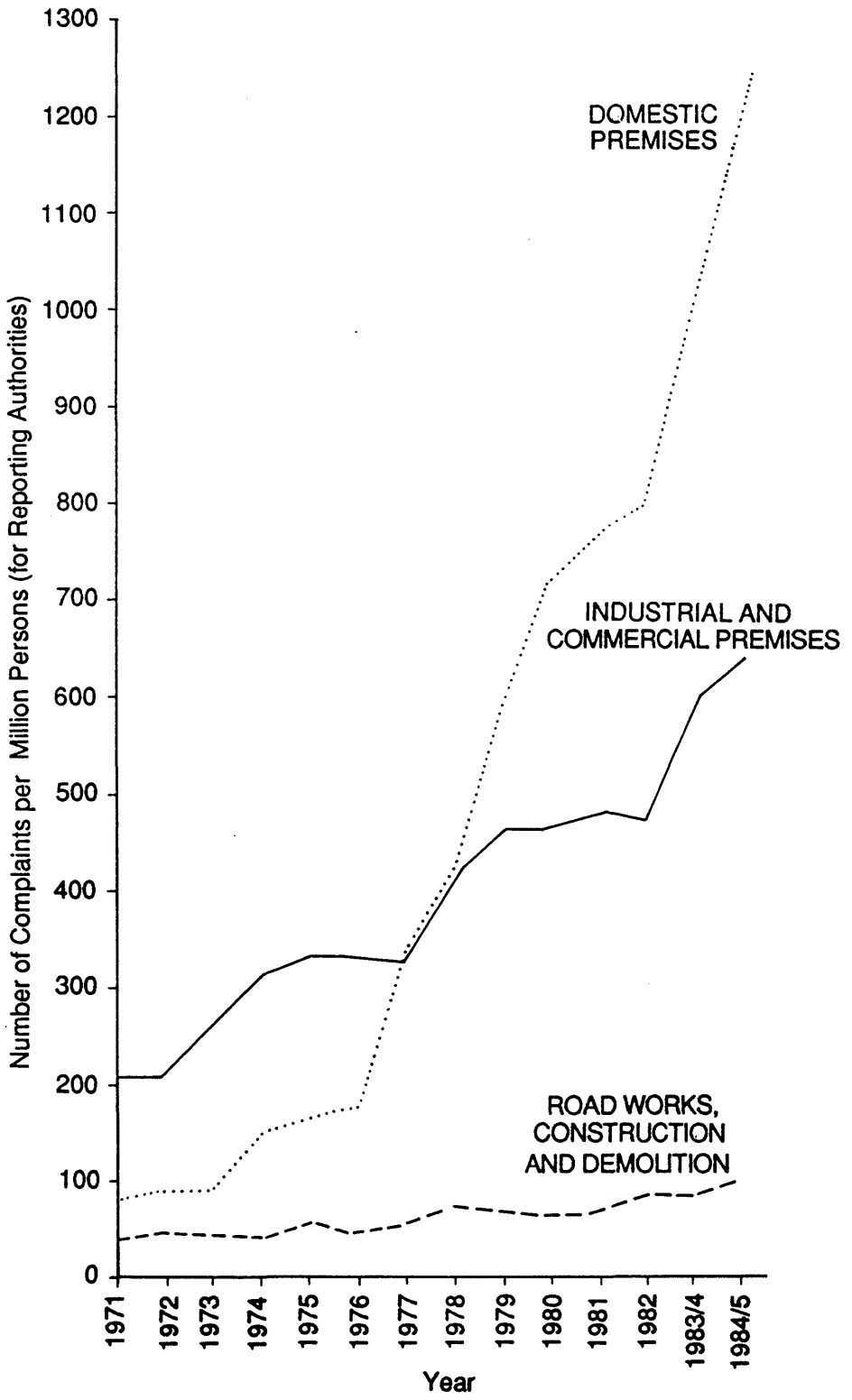
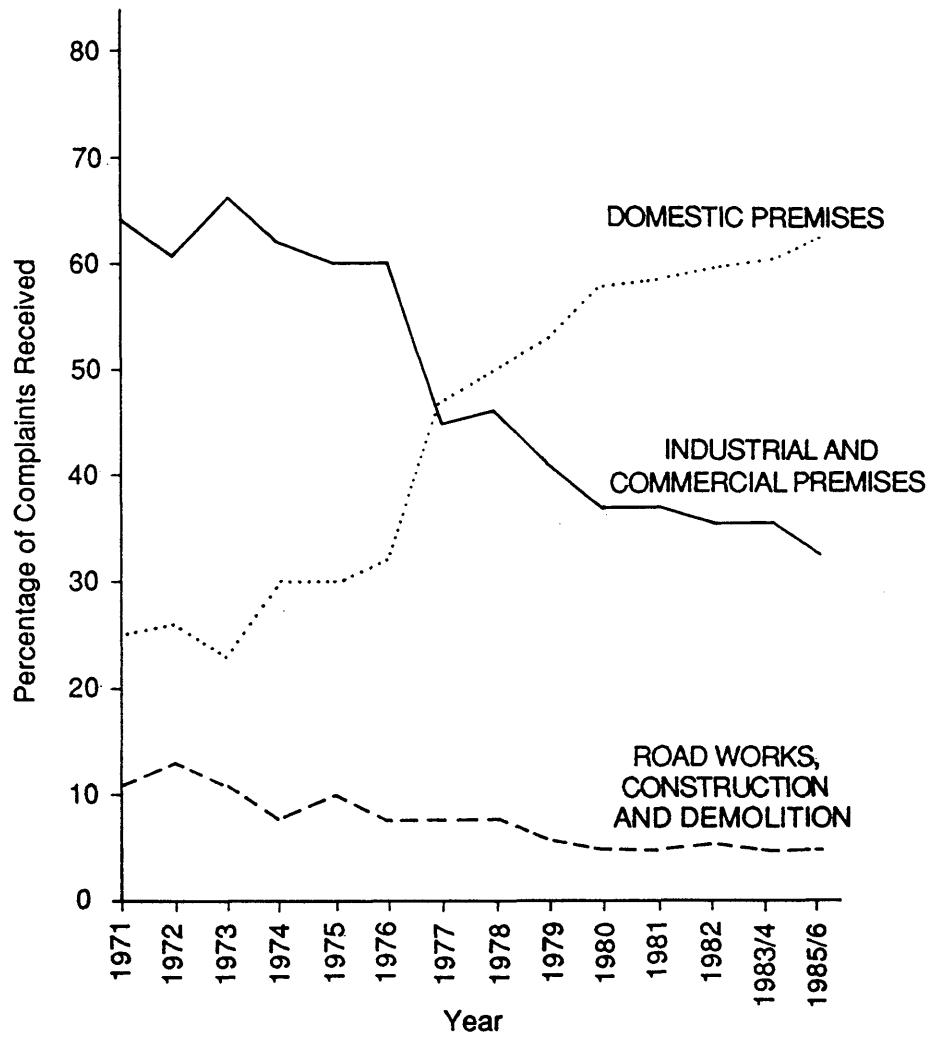


FIGURE 6.4
PERCENTAGES BY SOURCE OF NOISE COMPLAINTS RECEIVED BY ENVIRONMENTAL HEALTH OFFICERS

(Source: DOE Digest of Environmental Protection and Water Statistics 1986, using data from the Annual Reports of the Institution of Environmental Health Officers)



The sound insulation performance of modern dwellings leaves much to be desired: evidence from the Building Research Establishment (Sewell et al., 1980) showed that 64% of party walls, when tested under field conditions, failed to satisfy the requirements of the Building Regulations. Local government reorganisation in 1974 and the implementation of COPA in 1976 produced a better defined procedure for reporting and obtaining action on complaints, and may also have helped to create a climate which encouraged complaints to be made about sources which otherwise would have gone unnoticed (Bickerdike, 1981). A higher percentage of complaints now concern matters which are not confirmed as nuisances by LAs. Figure 6.5 shows that in the 1960s approximately 55% of complaints were confirmed as nuisances by the LA, whereas by the 1980s the percentage had gone down to about 40%. How much this is the result of people complaining about noises which EHOs do not consider to be nuisances, or how much the result of EHOs failing to investigate complaints fully in order to establish whether or not a nuisance exists, is a matter for further research.

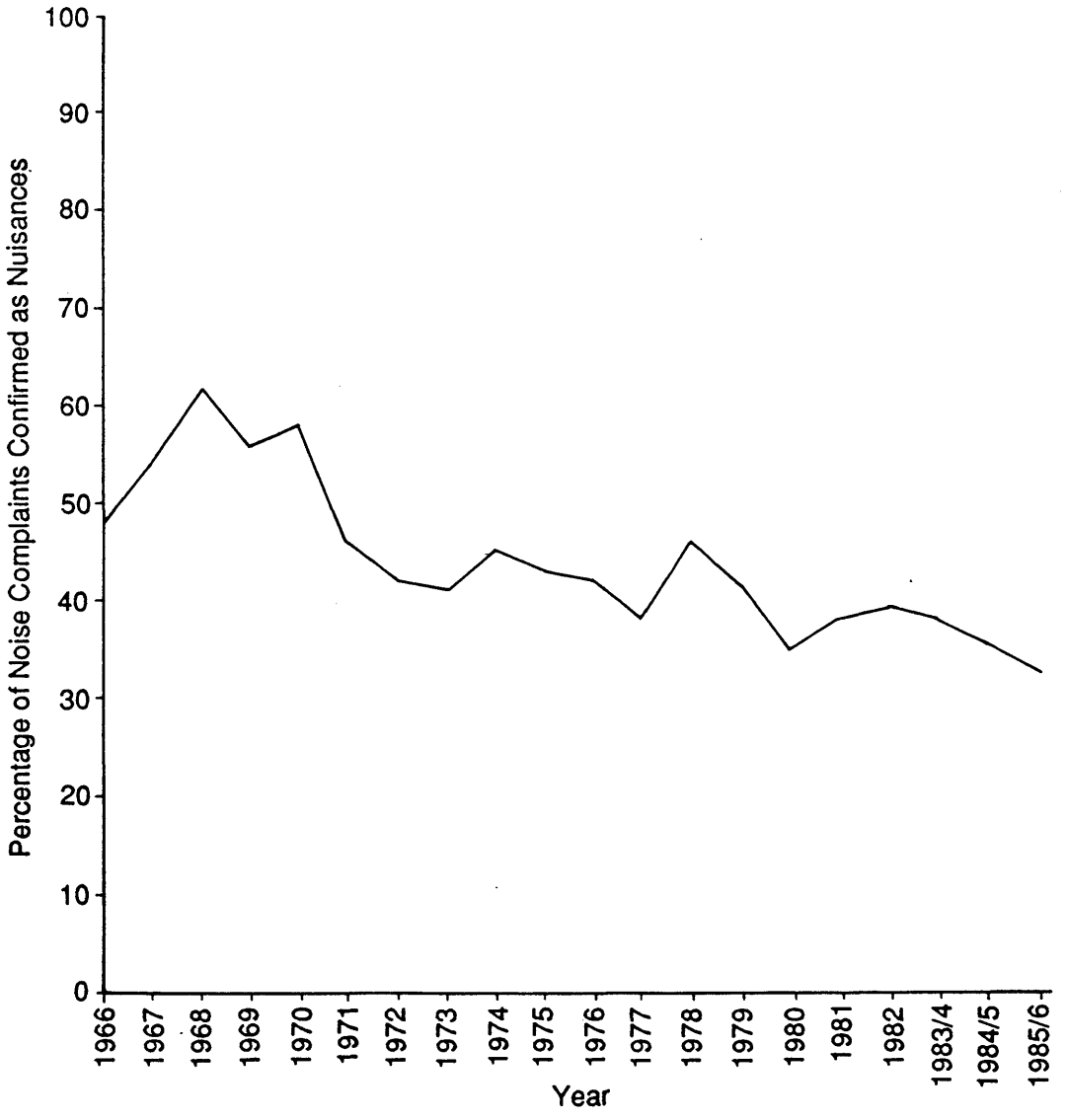
In contrast to domestic noise, the IEHO reported that "Noise control from industrial sources does not seem to represent a major problem at present but this may be a result of the general cut back in the manufacturing and engineering industries" (Institution of Environmental Health Officers, 1984). This was very different from the situation which prevailed in the 1960s, when the basic text on environmental health commented that "....apart from aircraft...., the most serious noise nuisances arise usually in connexion with industry..." (Clay's Public Health Inspector's Handbook, 1968). Several EHOs in the survey mentioned a lessening of traditional heavy industry in their areas, and its replacement with service-oriented businesses.

6.5.4.5 The System of Extended Cautioning

From the perspective of the Legal Model, EHOs have available to them two devices for enforcing Part III of COPA. Firstly, the statutory notice or consent (an 'administrative sanction') and secondly, the

FIGURE 6.5
PERCENTAGE OF NOISE COMPLAINTS RECEIVED BY ENVIRONMENTAL HEALTH OFFICERS WHICH ARE CONFIRMED AS NUISANCES

(Excluding noise in streets and noise from construction sites)
(Source: Annual Reports of the Institution of Environmental Health Officers)



initiation of prosecution proceedings (a 'criminal sanction') for failure to comply with the terms of the notice. These are described as 'formal' methods by the officers themselves.

Whilst the statutory notice procedure in itself could be considered to encourage a conciliatory approach to enforcement, by supporting a policy of prosecution as a last resort to achieve compliance with the law (Lidstone et al., 1980), the Operational Model reveals that informal methods short of administrative sanctions are actually used much more frequently than formal methods. Data from the annual reports of the IEHO indicate that only about 10% of nuisances confirmed by EHOs are remedied formally, whilst 90% are remedied via informal means (Figure 6.6). Very few cases ever get as far as prosecution: the IEHO data reveal that between 1-2% of confirmed noise nuisances are the subject of prosecution proceedings.

Informal methods of enforcement range from giving advice and informing the public of their legal obligations, through bargaining, persuasion and negotiation to threatening the use of administrative and ultimately criminal sanctions. Enforcement activity can be visualised as a spectrum ranging from informal to formal procedures. It is similar to the system of "extended cautioning" (Carson, 1970b) adopted by the Factory Inspectorate, where a sequence of informal letters, warnings and statutory notices are used in the armoury of enforcement action prior to prosecution.

How far and how fast a case progresses along the spectrum depends on a number of case-specific factors. Cases can leave the spectrum at any point. Hutter (1984) considered that five factors were particularly influential in determining how a complaint to an EHD was processed:

1. Nature of the complaint;
2. Motivation of the complainant;
3. Seriousness of the offence;
4. Persistence of the offence;
5. Character of the offender.

FIGURE 6.6
PROPORTION OF NOISE NUISANCES CONFIRMED BY ENVIRONMENTAL HEALTH OFFICERS WHICH ARE:
(A) REMEDIED INFORMALLY
(B) REMEDIED FORMALLY
(Source: Annual reports of the Institution of Environmental Health Officers)

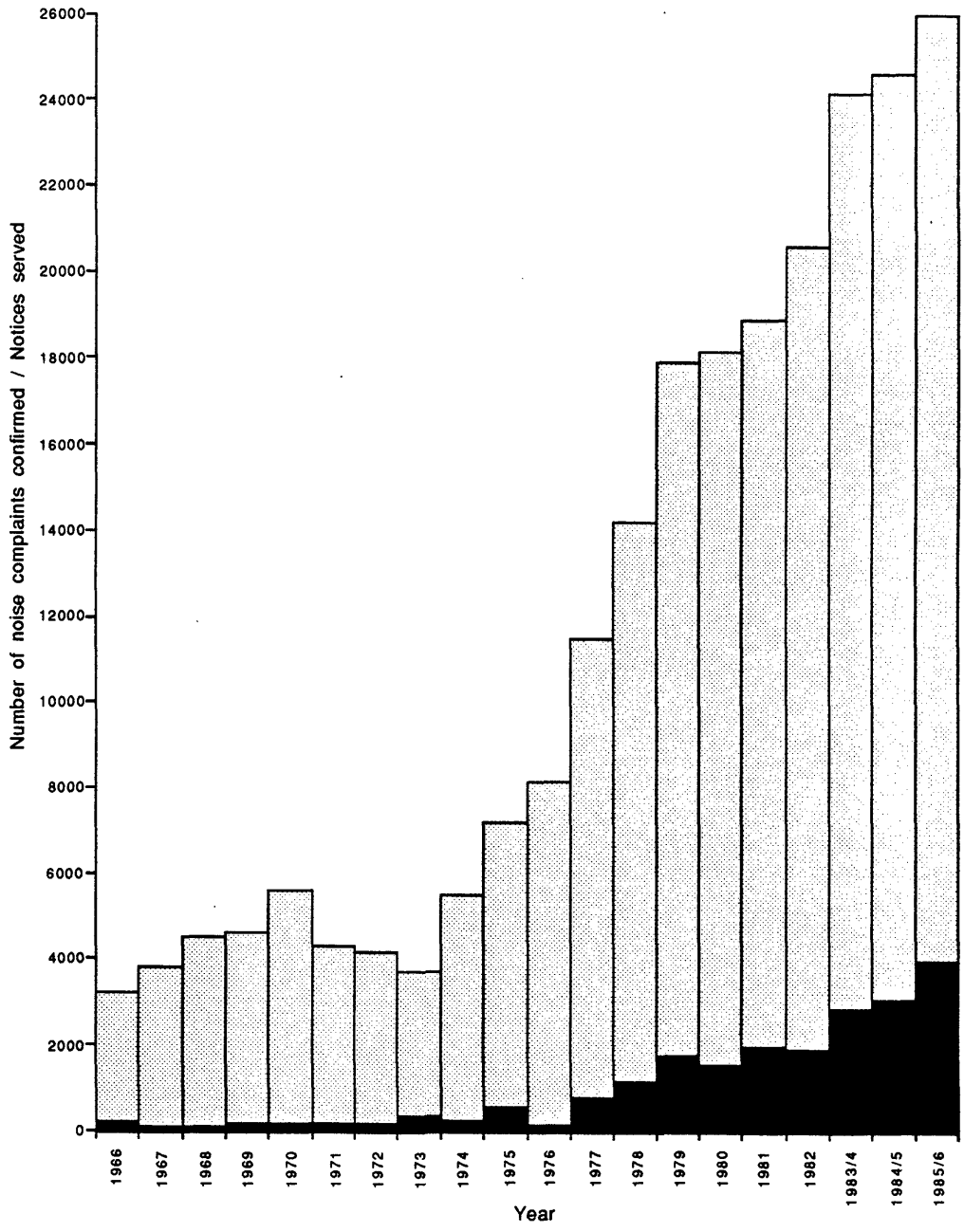


Table 6.6 shows how far the complaints in the noise complaint questionnaire had progressed along the enforcement spectrum after the six months of the survey. Not all cases were closed by this stage: several were still subject to continued complaint and investigation. About a quarter of the complaints (23.5%) had not been subject to further investigation after the complainants had failed to reply to standard letters sent to them by the EHD (see Section 6.5.5.1). Informal tactics started off with phone calls or visits to the complainant, complainee or to both parties, sometimes followed by letters to remind the person of what was discussed or of the problems which needed attention. 36% of complaints had reached this stage. 14% of complaints had caused the EHD to take more coercive action by sending a warning letter to the complainee, saying that formal action would be resorted to if the nuisance continued. 8% of complaints had resulted in formal action: 5% had received statutory notices and 3% had been the subject of prosecution proceedings.

6.5.4.6 Visiting

A visit by the appropriate District Officer to the complainant, complainee or to both was the normal response to a complaint about neighbourhood noise.

Table 6.7 shows the initial response to noise complaints by the 8 authorities. In 48% of complaints (59 out of 122) a visit - either to the complainant, complainee or both, and generally within a week of the complaint being received - was the first form of action taken by the EHO. "Monitoring of event" refers to the 2.5% of cases where officers were present to monitor sound levels from open-air events (a youth festival, a motor sports event and a CND rally) about which complaints had been received beforehand. The 2.5% of complaints where no response by officers was reported, consisted of one anonymous complaint and two where the appropriate District Officer was on leave.

32% of complainants (39 out of 122) received standard letters and 2% personalised letters from the EHD in the first instance. In 14% of

TABLE 6.6

HOW FAR THE COMPLAINTS PROGRESSED ALONG THE SPECTRUM OF ENFORCEMENT ACTIVITY AFTER 6 MONTHS

	AUTHORITY									
	1	2	3	4	5	6	7	8	TOTAL	%
No reported action	1	-	2	-	-	-	-	-	3	2.5
Standard letter sent to complainant giving details of S.59 COPA	11	-	4	-	-	-	1	-	16	13
Standard letter and noise record sheet sent to complainant; further action only if forms returned	-	9	-	-	-	-	-	-	9	7.5
Standard letter and byelaw forms sent to complainant	-	-	-	-	-	-	4	-	4	3
Phone call (to complainant, complainee or both)	1	-	1	3	-	1	-	1	7	6
Responsibility handed to other LA department eg. Planning, Housing, Social Services	2	-	5	2	-	-	-	-	9	7.5
Visit (to complainant, complainee or both)	5	1	16	5	4	8	5	-	44	36
Monitoring of open air event	-	-	2	-	1	-	-	-	3	2.5
Warning letter threatening formal action sent to complainee	-	-	6	8	-	1	1	1	17	14
Service of statutory notice or byelaw notice	1	-	1	3	-	1	-	-	6	5
Prosecution	-	-	1	3	-	-	-	-	4	3
TOTAL	21	10	38	24	5	11	11	2	122	100

TABLE 6.7

INITIAL RESPONSE TO COMPLAINT

Initial Response to Complaint	AUTHORITY									
	1	2	3	4	5	6	7	8	TOTAL	%
Visit (to complainant, complainee or both)	8	-	20	16	4	4	5	2	59	48
Complainants lodge complaint at EHD	-	-	-	-	-	1	1	-	2	2
Monitoring of event	-	-	2	-	1	-	-	-	3	2.5
Phone call (to complainant, complainee or both)	1	-	4	8	-	-	1	-	14	11
Personal letter (to complainant)	-	-	2	-	-	-	-	-	2	2
Standard letter (to complainant)	11	10	8	-	-	6	4	-	39	32
No reported action (eg. anonymous complaint)	1	-	2	-	-	-	-	-	3	2.5
TOTAL	21	10	38	24	5	11	11	2	122	100

cases, a phone call, either to the complainant, complainee or to both, was the initial response by the EHD. Subsequent enforcement activity, following letters or phone calls, depended on the reaction from the complainant or complainee, but frequently comprised a visit from the EHO. The use of standard letters in response to a complaint is considered in more detail in Section 6.5.5.1.

EHOs have the right at any reasonable time to enter upon any land in the performance of their duties under COPA (s.91), and to obtain any information which they consider they need for the purposes of any function under the Act (although s.94 protects companies and others from unofficial disclosure of any information relating to trade secrets). EHOs' powers of entry into private premises and of access to information are greater than those of the police, since the latter can normally only enter private premises on complaint or with a warrant. Regulatory agents frequently have greater powers of entry into premises and of access to information than the police (Kagan, 1984).

It was usual for the EHO to visit the complainant first, in order to assess whether or not the noise amounted to a nuisance. Depending on the outcome of this encounter, officers then used their discretion to decide whether or not to visit, write to, or exceptionally to serve an abatement notice on, the person(s) complained of. The complainant was typically asked about:

1. The duration, times and frequency of occurrence of the noise;
2. The extent to which the noise interfered with normal activities, such as sleep, conversation, watching television or listening to the radio;
3. The location of the noise source;
4. Whether any requests to abate the noise had been made to the complainee and, if so, how successful they had been.

Officers tried to assess whether or not the complainant had a genuine grievance. Some complainants, especially the elderly, were thought to

be unduly sensitive to noise, lodging complaints about noises that fell far short of designation as nuisances at law. Other complaints were sometimes the result of neighbour disputes, where noise was not so much the problem as a complete breakdown in inter-neighbour relationships. A recent study from Aston University (Tebay et al., 1986) found that when people made serious complaints about their neighbours, the majority related to noise. Hutter (1984) considered that complaints to the EHD could be divided into five categories, according to the motivation of the complainant:

1. Genuine;
2. Financial (for example, obtaining a rent reduction in council owned property);
3. Due to intolerance or increased sensitivity;
4. Psychological (for example, neurotic or lonely people);
5. Due to neighbours' disputes.

6.5.4.7 The Need to Witness the Noise

Officers wanted to hear the noise for themselves, otherwise it was difficult to determine whether or not the complaint was due to a genuine grievance. Until they had witnessed the noise personally, officers were usually only prepared to take informal action. There was a general reluctance to take any sort of formal action - which could end up in court - on the unsupported evidence of a member of the public. The policy in some EHDs was to accept the evidence of the police or of other council officers (such as housing officers), in addition to that of the EHOs themselves. In only two authorities, however, were officers prepared to serve a noise abatement notice based entirely on evidence from the public and, in one of these authorities, officers said they would never go to court unless they had, in addition, obtained their own corroborative evidence.

Witnessing a continuous or predictable noise is straightforward enough. Examples of continuous noise include noise due to fans or ventilators, or from machinery which is in use throughout a work-

shift. Entertainment events are often held on a regular basis, or else their occurrence can be predicted as a result of advertising. The occurrence of other sources of noise, particularly those of a domestic nature, may be very difficult to predict and therefore to witness. One case concerning domestic noise from Authority 6, for example, required 17 visits before officers witnessed a nuisance. In only 36% of the initial visits in the noise complaint questionnaire was the noise occurring at the time of the visit. In 68% of these cases, the noise was assessed as a nuisance.

Officers asked complainants to indicate as best they could when a noise was most likely to occur, so that a subsequent visit could be arranged. Alternatively, complainants were requested to phone the EHD as soon as the noise occurred - as long as this was within working hours - so that an officer could witness it. Except for a couple of EHOs, officers in general did not give complainants their personal phone numbers.

6.5.4.8 Out-of-Hours Arrangements

Many noises only become nuisances at night when the background noise level decreases. Noisy sporting and entertainment events are frequently held at the weekend. Consequently visits may need to be made out of working hours in order to assess whether or not a noise is a nuisance. The survey found that 42% of initial visits were made out of working hours.

The willingness of officers to work overtime was therefore relevant to the question of witnessing noise nuisances. In several authorities officers had a requirement for out-of-hours visiting written into their contracts of employment. Only two authorities (3 and 6) taking part in the noise complaint questionnaire actually gave overtime payments for evening and weekend visits. In the other six authorities officers were given time off in lieu of payment.

6.5.4.9 The Noisy Party Patrol

Several of the London boroughs visited (including Authority 3) had organised weekend noise patrols to deal specifically with noisy parties. The idea had originated in the 1970s from one of the London boroughs in response to public complaints about noisy parties, and in particular pay parties or 'shebeens'. The practice had then been adopted by several other London boroughs and by some urban LAs in other parts of the country. There was concern, however, that some complaints about parties were racially motivated (for example, the Evening Standard, 1987) and officers on the patrol were asked to bear this in mind. Authority 6 had ceased to run its noisy party patrol since the 1981 inner city riots.

The weekend noise patrols operated on Friday and Saturday nights from about 10 pm until 4 or 5 am, and consisted of either two EHOs or one EHO accompanied by a police officer. The police have limited powers with respect to noise: they can prosecute rowdy behaviour if it amounts to a 'breach of the peace', and can enforce some byelaws (see Chapter 3). Their function on the noise patrols was primarily to provide support to the EHOs. Generally only the more experienced EHOs (Seniors and Principals) undertook patrol work on a rota basis, and payments for overtime were made.

A list was drawn up of premises which had been the subject of previous complaint, or which had already been served with abatement notices. The patrols drove round the neighbourhood and checked on each of these premises in turn. Other complaints were received on the night itself either by the authority's 24-hour emergency switchboard, or else by the police. The patrol car usually had two-way radio contact with the council switchboard (although in one authority the patrol had to telephone the switchboard every hour) and those with a police officer present had additional radio contact with the local police station.

Patrols either visited the complainant's premises to assess the intrusiveness of the party there, or they made a judgement about the

noisiness of the party in the street outside. For parties to be a nuisance, officers maintained that they would either have to be held on a regular basis, or else be an extremely rowdy, one-off event. Officers were more likely to assess a party as a nuisance the longer after midnight the noise went on. The number of people likely to be disturbed by the noise was another important factor: a party in a flat on a densely populated housing estate, for example, could disrupt the sleep of many other residents.

What action was taken to control noise nuisance from a party depended on the propensity of the patrol to visit the party premises. Although some were more willing to intervene than others, no patrol would enter a party without a police escort. Several EHO-staffed patrols could co-opt support from the local police if they needed to visit a party. EHOs based their decision on whether or not to visit a noisy party on the general policy of their patrol, and on their own assessment of the situation at the time. If they considered they might be endangering their own safety by trying to enter a party, patrols would note the address of the premises and then leave the area. Patrols which were loath to enter premises generally sent informal warning letters the following week, and entered the address of the premises on their 'hit-list' for a subsequent visit the following weekend. If the premises were noisy enough to be a nuisance on a subsequent visit, the LA would serve a noise abatement notice on the owner or occupier.

When a patrol decided to enter a party, they first tried to find the person responsible for it and requested that the music be turned down to a reasonable level. If this request was complied with, the patrol left the party, returning after about an hour to check on the noise levels. If the party-givers refused to cooperate, an immediate-effect noise abatement notice might be served. Some patrols were prepared to prosecute on the same night if the terms of the notice were contravened.

It was often very difficult to identify whose party it was, so notices were generally served on the owner or occupier of the premises. This

information was found by referring to copies of council tenancy records, rating lists and even the electoral role, which were kept in the patrol car.

6.5.4.10 Automatic Noise Monitoring

It could be proposed that the use of automatic monitoring equipment is one way of alleviating the problem of witnessing unpredictable noises or noises which occur at unsociable hours. However, monitoring equipment was used in connection with only 9 of the 122 complaints (7%) in the noise complaint questionnaire (Table 6.8). Of these, 4 used automatic monitoring equipment: in three cases an environmental noise analyser was set up to record noise levels from open air events, while in the fourth case a tape recorder was set up overnight in a complainant's home to measure early morning noise from a nearby shop.

The Principal Officer of one large urban authority visited (which was not part of the noise complaint questionnaire) encouraged the use of automatic monitoring equipment. In this LA, tape recorders were set up in complainants' homes to monitor noise levels overnight. An environmental noise analyser linked to a tape recorder was also used. On occasions, the analyser was programmed to trip a switch on the tape recorder when a threshold noise level was exceeded, enabling automatic recording of a noise event. Technicians in the same authority had built a time clock for use with a tape recorder. The clock automatically put a short signal on the tape every 30 minutes, irrespective of whether or not the unit was recording. The time clock could switch on the recorder automatically at a pre-set time. Alternatively, arrangements could be made with the complainant to switch on the recorder whenever the noise occurred. The time of occurrence of the noise could then be calculated accurately from the signals, without having to rely on the word of the complainant. A standard tone of known sound level was always recorded on the tape prior to any monitoring. This enabled the tape to be played back at the correct sound level.

TABLE 6.8

USE OF MONITORING EQUIPMENT

Complaint	Equipment Used	Criteria for Determining Nuisance
1. Poor sound proofing between converted flats	Impact and airborne sound transmission equipment	Building Regulations: sound insulation requirements
2. CND rally with live bands, stores and sideshows	Environmental noise analyser	GLC guidelines for pop concerts: "any 15 minute Leq measured during the performance....should not exceed the background Leq measured during a comparative period by more than 10 dB(A) between 0700 and 2000 hours".
3. Open air youth festival with live music and discos	Environmental noise analyser	
4. Motor sports event	Environmental noise analyser and tape recorder upwind from event; tape recorder and control amplifier downwind. Hand-held sound level meter for spot measurements.	BS 4142
5. Noise from shop	Tape recorder set up overnight	To witness noise (with a view to subsequent visit)
6. Amplified music from wine bar	Hand-held sound level meter	BS 4142
7. Extractor fan at small factory	Hand-held sound level meter	BS 4142
8. Live music from working mens' club	Hand-held sound level meter	BS 4142
9. Extractor fan	Sound level meter and chart recorder	BS 4142

Unfortunately, automatic monitoring cannot determine unequivocally the location of the noise. It is reasonable to conclude that noises of an industrial or commercial nature originate outside the complainant's home. In a recording of amplified music, however, it is no easy task to determine whether the noise came from a neighbour - and if so which one - or from the complainant's own stereo. In any case it is unlikely that such evidence on its own would stand up in court.

6.5.5 Procedures for Domestic Noise

The survey revealed a spectrum of departmental policies for dealing with complaints about domestic noise, ranging from active investigation of every single complaint to administrative procedures which effectively by-passed any investigation by officers of certain sorts of domestic complaint. The noise complaint questionnaire showed that adherence to the departmental policy was more rigid in some authorities than in others.

6.5.5.1 Departmental Policies for Domestic Noise

In Authority 1, "domestic noise" had a narrower meaning than usual: a complaint was classified as "domestic" if it consisted of one person complaining about a noisy neighbour. Cases involving several complainants where noise nuisance was widespread, such as noisy parties, were treated in the same way as traditional industrial noise, and received a full investigation. So-called 'domestic' complaints were not investigated by officers. Instead, a standard letter was sent to the complainant containing instructions for taking a private action under s.59, including keeping a diary of noise events, writing letters to the complainees in an attempt at conciliation, and ultimately seeking corroborative evidence from neighbours and laying an information with the clerk to the local magistrates' court. The letter said that this policy was the result of the inability of staffing levels in the EHD to keep pace with the increase in level of complaint. Complainants were requested to contact

the EHD, however, if for any reason they felt unable to take private action and wanted further help or advice.

Individual officers adhered closely to this policy. The format of the letter had been agreed with the local magistrates, and the policy had been formally adopted by the council since 1981. When the Principal Officer of Authority 1 was questioned about the legality of this approach in relation to the statutory duty to investigate complaints under s.57 (see Chapter 4), he countered with the following argument. He maintained that even if officers investigated every complaint, it was very unlikely that they could be of much assistance, owing to the difficulty of witnessing domestic nuisances and hence of serving abatement notices. However, the fact that most enforcement action is conciliatory in character, and consequently does not depend on officers actually witnessing an alleged nuisance, tends to detract from the substance of this argument.

Authority 3 had resorted to a sifting technique to deal with domestic noise complaints. When the first visit was made to this EHD, during the pilot survey of London boroughs, officers were trying to investigate every noise complaint. By the time the noise complaint questionnaire was undertaken, a new policy had been devised by the Principal Officer in charge of the Pollution Control Section, and adopted by the council. This policy was in response to the increased workload produced by the rising level of complaint. The new approach was to send a standard letter containing details of s.59, and requesting the complainant to contact the Pollution Control Section during the week, or the Party Patrol at the weekend, if the noise recurred. A visit would only be made on the basis of a second complaint. The noise complaint questionnaire, however, showed that individual officers were still trying to investigate as many cases as possible on the basis of the initial complaint, depending on their workload.

Authorities 2 and 6 had also adopted sifting techniques for domestic noise, but differed widely in the extent to which officers used their discretion to adhere to the policy. Unless the problem seemed unusually severe, these authorities required the complainant to return a completed noise record sheet to the EHD before any visits would be made (Figure 6.7). Whilst Authority 2 followed this procedure very closely, officers in Authority 6 undertook several visits on the basis of the initial complaint.

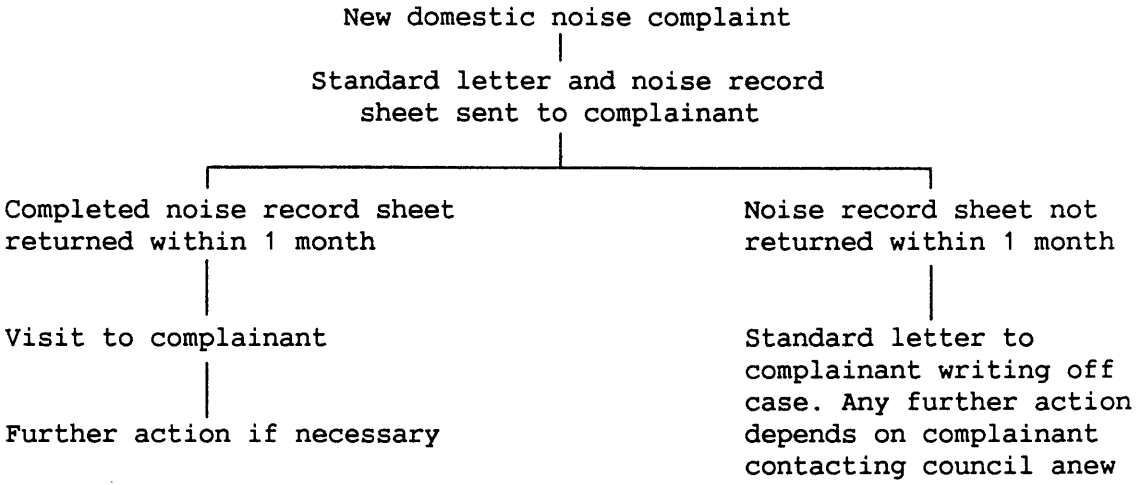
For no obvious reason other than historical precedent, Authority 7 preferred to use byelaws, rather than COPA, to deal with noisy animals and noise from amplified equipment (hi-fi, radio and television). People who made complaints about these sorts of noise were sent a standard letter and three copies of the appropriate byelaw form. The complainant was asked to sign all three copies of the form, and then obtain signatures from two other householders who also considered the noise to be a nuisance. The completed forms were to be returned to the EHD. This procedure also forestalled the need to visit immediately, since officers often waited for the forms to be returned, or else for another complaint to be made, before arranging a visit to the complainant. Other sorts of domestic noise were dealt with under the COPA provisions, and usually resulted in an immediate visit from an officer.

In contrast, Authorities 4, 5 and 8 investigated all cases of domestic noise on the basis of the initial complaint, either by phone call or by a visit. These authorities, however, differed in the extent to which they were prepared to pursue an investigation of a domestic complaint before they would recommend that the complainant take private action under s.59. Authority 5's Chief EHO considered that recourse to s.59 was indicative of failure on the part of the authority to fulfil its statutory duty to investigate noise nuisances under s.57. Consequently EHOs in this authority tried to remedy all noise nuisances under s.58. In contrast, Authorities 4 and 8 were really only prepared to pursue a lengthy investigation of a domestic

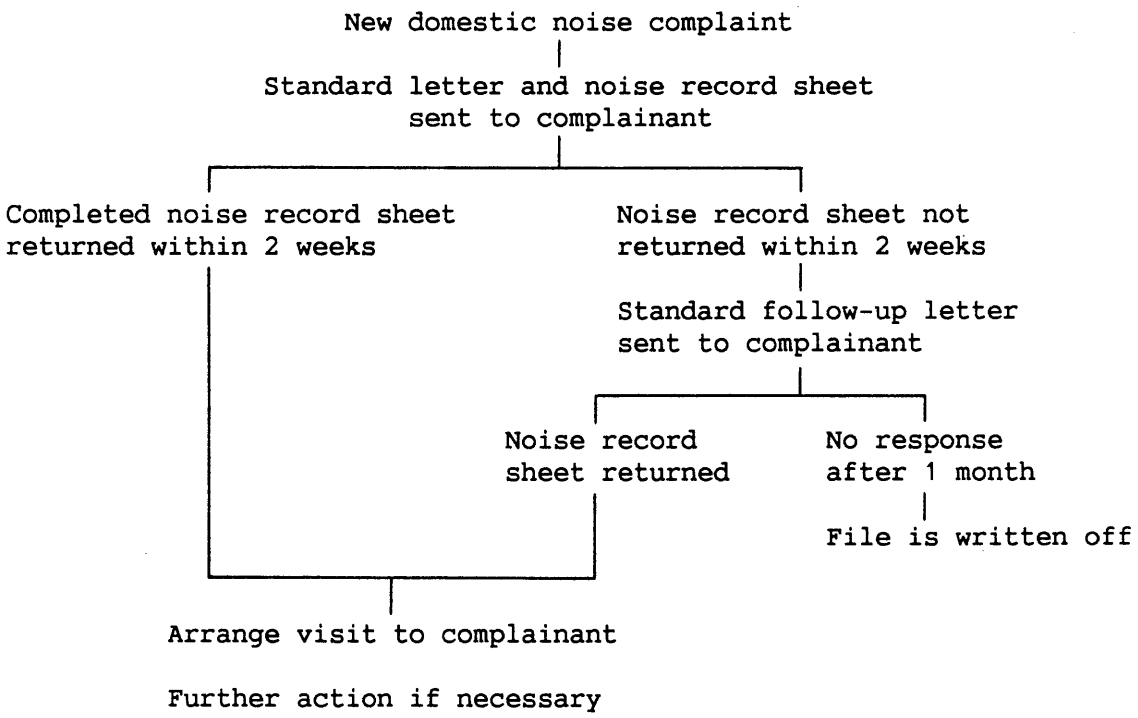
FIGURE 6.7

PROCEDURES FOR A NEW DOMESTIC NOISE COMPLAINT

a) Authority 2



b) Authority 6



case if more than one household was affected by the nuisance, otherwise s.59 was recommended. Although this was official council policy in Authority 8, officers declared they would intervene in some cases with a single complainant, if the person was old, infirm or otherwise incapable of taking an action themselves.

6.5.5.2 Actions by Occupiers

Complaints where s.59 had been recommended were effectively written off by the LA, and it was uncertain whether officers would ever discover if a complainant had actually taken a private action. Of those cases which had come to their attention, officers thought that most had been successful, but the rate of uptake was very low. Reasons proffered included fear of appearing in court (even on the side of the prosecution) and of reprisals from neighbours, and concern about the cost involved in taking a case to court. The Legal Aid Scheme does not cover s.59 cases, and some court clerks contacted by the Avon, Gloucestershire and Somerset Monitoring Committee (1988) were of the opinion that a complainant should be represented by a solicitor in the preparation and conduct of the proceedings. Officers in the noise survey considered that most people preferred the LA to act on their behalf under s.58, when there was no necessity for complainants to appear in court, unless they had agreed to act as witnesses.

6.5.5.3 Use of Byelaws

Although Authority 7 was the only EHD visited where byelaws were used for noisy amplified equipment, several LAs used them to deal with complaints about barking dogs and other noisy animals. The byelaws used were the appropriate models under s.249 of the Local Government Act 1933 (updated by the Local Government Act 1972). Barking dogs were a frequent cause for complaint to the EHDs in the survey, comprising 12% of the sample (Table 6.5). Officers often found the investigation of such complaints frustrating, since witnessing a nuisance depended not only on hearing a dog bark, but also on determining the duration and frequency of occurrence of barking

episodes. Recourse to the appropriate byelaw was a convenient way of deferring any investigation until the byelaw forms had been returned. Officers in Authority 7 considered that between 30-40% of the forms were returned.

Once the three copies of the byelaw form had been returned to the EHD, one was filed away, another sent to the Legal Department and the third sent by recorded delivery to the person responsible for the noise. The byelaw notice gave the complainee 14 days to abate the nuisance, otherwise proceedings could be taken by the LA in the local magistrates' court on behalf of the complainants. None of the officers could recall a case that had got this far, however.

The tendency to use byelaws, which date back at least to the Local Government Act 1933, is a good example of the role which historical precedent plays in shaping the procedures used by a LA. Strictly speaking, use of these byelaws is probably repugnant to the COPA provisions (see Chapter 4). Several months after the first visit to Authority 7, a new Principal Officer was appointed to head the Pollution and General Division. He was very critical of the use of byelaws and was planning to phase out the procedure over a period of time.

6.5.5.4 Routinisation

As domestic noise, and in particular noise from amplified music, was the most frequent source of noise complaint to the LAs, the procedures adopted to respond to these sorts of complaint showed a higher degree of routinisation than for other sorts of noise. As Section 6.5.5.1 describes, much use was made of standard letters as the initial response to a domestic noise complaint. These were generally sent out by administrative staff, often before a complaint sheet had reached the appropriate officer. In Authority 7, for example, administrative staff automatically sent out byelaw forms to people who made complaints about amplified music and noisy animals.

In the urban authorities, routinisation had been carried a stage further by the development of a series of standard letters, dealing with nuisance from amplified music, parties and noisy animals. These covered the whole system of extended cautioning right from the initial response to a complaint, through letters informing complainees of their obligations under COPA and warning them of possible sanctions, to letters accompanying a statutory notice and finally notifying complainees of impending prosecution. They provided a good example of a spectrum of increasingly coercive enforcement behaviour.

6.5.5.5 Assessing Domestic Noise Nuisance

Apart from a case of poor sound proofing between converted flats, none of the cases of domestic noise in the Noise Complaint Questionnaire were monitored as an aid to establishing nuisance. Although some officers maintained that they would monitor noise levels from domestic premises, the prevailing opinion expressed by EHOs was that it was impractical and unnecessary to use a sound level meter in these circumstances. The best way of assessing nuisance was considered to be for an officer to hear the noise personally. Reasons given by officers for this reticence to use technology included the following:

1. The subjective nature of the concept of noise nuisance, and the fact that nuisance depends not only on the noise level but also on the duration, frequency and time of occurrence of the noise;
2. Lack of time to calibrate instruments and obtain background levels. This applied especially to noisy party patrols where many premises had to be checked on in the course of one evening;
3. Magistrates responded more positively to subjective assessments of noise nuisance than to readings in decibels.

Unlike BS 4142 and industrial noise, no noise ratings have been developed for general use which deal specifically with domestic noise or with the commonest source of domestic noise - amplified music. BS 4142 has been used to rate entertainment noise (Craik and Stirling,

1986), but strictly speaking this use is outside its ambit. ISO 1996 can be used to rate any sort of environmental noise, but unlike the earlier Recommendation from ISO (ISO R1996), it does not specify acceptable limits. Noise rating curves are another means of assessment, but again there are no standards stating what an acceptable NR value would be. The Wilson Committee (Committee on the Problem of Noise, 1963) gave tentative levels of acceptability for noise in dwellings, which have been used by some LAs as guidelines in nuisance assessment (Craik and Stirling, 1986). In its capacity as entertainment licensing authority, the Greater London Council developed guidelines for acceptable noise levels from pop concerts and discos (Greater London Council, undated). These had no formal bearing in terms of nuisance assessment, however, and their use was not extended to amplified music in general.

The perception of amplified music as a noise nuisance was investigated by Craik and Stirling (1986), using an analysis of past records from one LA, and experiments where disco music was played at different levels above background to 40 subjects in their own homes. The recording of the music had been filtered to simulate the attenuation that occurs when sound is transmitted through walls and floors, giving rise to a characteristic low frequency 'thump'. They found that when the music level was equal to the background noise level (measured in Leq), so that the total noise level increased by 3 dB(A), between 60-90% of the subjects rated the noise as unacceptable. This means that the criterion used in BS 4142, where complaints are considered likely if the difference between the noise level and the background level is 10 dB(A) or more, will seriously underestimate the response to amplified music, even if a tonal correction is applied. Moreover, it also implies that it is very difficult to achieve any meaningful measurement of nuisance due to amplified music.

The lack of any suitable noise rating must detract from EHOs willingness to monitor instances of domestic noise nuisance. Whether a suitable rating will ever be developed is another matter: one eminent acoustician commented that "domestic noise is not for the acoustic

scientist" (Professor Robinson, pers. comm.). Another important factor is that, unlike industrial noise, it is unusual for there to be any need to monitor domestic noise in order to recommend possible abatement methods. Industrial noise often contains particular tonal characteristics. These sorts of industrial nuisance can best be abated by first reducing the contribution to the overall sound level from these tones, which are identified from a frequency analysis of the sound spectrum. Those parts of the machinery which have similar tonal characteristics can then be located and methods of abatement proposed. In contrast, to abate nuisance from amplified music, it is necessary to reduce the contribution to the overall sound level from all the component frequencies: in other words, by turning down the volume.

A third factor was that officers considered magistrates were more convinced by subjective evidence of a noise nuisance than by presentation of noise levels in decibels or other more complex ratings (see Section 6.5.11.7). If noise disrupted sleep, or if levels of amplified music were such that individual notes or the words of a song could be discerned in neighbours' dwellings, then this was thought to be convincing evidence of a nuisance. The following extracts from witness statements prepared by officers for noise nuisance proceedings illustrate this point:

> "The noise was so loud that individual notes could be clearly heard. In my opinion the level of noise was so loud as to constitute a nuisance to occupiers of neighbouring properties."
>
> "The clarity of the music [in the complainant's house] was excellent and I was able to distinguish without difficulty the words of the songs that were being played. ....the overall effect was equivalent to that which would be achieved by playing a radio at normal volume within the room and I have no doubt at all that the noise was of a level sufficient to constitute a nuisance to the persons on whom it was inflicted."

6.5.5.6 A More Sanctioning Style of Enforcement for Domestic Noise

Several officers inferred that there was a tendency to adopt a sticter, or more 'sanctioning', approach to domestic noise nuisances than to industrial noise nuisances. The IEHO statistics were examined to determine whether any quantitative evidence could be adduced in support of this opinion. Table 6.9 gives the percentages of confirmed nuisances which are prosecuted for industrial/commercial and domestic noise. Since 1979 there has been a higher prosecution rate for domestic noise than for industrial/commercial noise nuisances. However, before 1979 no such pattern can be seen in the data.

A possible explanation for this difference is firstly that at the time of the noise survey, LAs were tending to take a more lenient approach to industry as a result of the recession. In several urban LAs the employment question was crucial, and there was a general reluctance to enforce statutory notices where this could lead to employees being made redundant.

A second reason was to be found in the observation by some officers that most domestic noise problems tended to be of a "behavioural" nature, while most industrial noise problems were of a "technical" nature. A behavioural nuisance was one whose abatement did not require expenditure on remedial work, but merely required the offender to refrain from doing something (such as playing loud music or holding noisy parties). In contrast, a technical nuisance was one whose abatement involved expenditure on acoustic insulation or on the installation of quieter equipment. Such work could take several months to complete and in some cases there was no guarantee that the suggested abatement method would be sucessful.

Officers considered that the goal of enforcement was to abate the nuisance, and not simply to punish the offender. As a consequence, the prosecution of technical breaches was thought to be futile, unless those responsible had been dilatory or negligent. A failure to remedy a behavioural nuisance after informal warnings or the service of a

TABLE 6.9

PROSECUTION RATES FOR CONFIRMED NUISANCES
(Source: Annual Reports of the IEHO)

Year	% of confirmed nuisances which are prosecuted	
	Industrial and Commercial	Domestic
1985/86	0.86	1.03
1984/85	0.70	1.58
1983/84	1.06	2.08
1982	0.93	1.11
1981	0.60	1.31
1980	0.89	1.05
1979	0.56	1.54
1978	0.68	0.38
1977	0.43	0.66
1976	2.50	1.32
1975	0.88	0.26
1974	0.59	0.15
1973	0.40	0.10
1972	0.38	0.38
1971	0.30	0.86

NB. Annual reports do not record prosecution data before 1971.

statutory notice, however, was in itself evidence of an anti-social attitude. In these cases, officers thought that prosecution might provide an incentive to abate the nuisance, where persuasion and negotiation had failed. Hawkins (1984a) found that Water Authority pollution control officers also adopted a conciliatory approach if technical problems had prevented compliance with discharge consents, but resorted to more penal methods if a lack of cooperation or negligence was shown by an offender.

This distinction between offences resulting from behavioural and technical problems was related to officers' perceptions of the character of the offender. Other studies of enforcement agents (for example, Cranston, 1979; Richardson, 1982; Hawkins, 1984a; Hutter, 1984) found that agents tended to develop a typology of offenders. The majority of offenders were considered to be basically honest and reasonable people, who did not intentionally break the law but did so through their own negligence, ignorance or misfortune. Only a minority fitted the category of unscrupulous, persistent or flagrant offenders. Conciliation and persuasion were found to be ineffectual for this minority of offenders, so agents resorted to more sanctioning styles of enforcement in these cases.

Officers interviewed in the noise survey considered that while most businesses were basically law-abiding, domestic offenders tended to fall into the unscrupulous category, since failure to remedy a behavioural problem after informal warnings or service of a statutory notice was indicative of an uncooperative attitude. One officer maintained that behavioural offenders often had a court record in relation to other minor criminal offences.

Several studies of the police have found that the demeanour of the offender was influential in determining whether or not a charge was made. Banton (1964) and Skolnick (1966) found that offenders who were abusive or violent were more likely to be charged than those who were polite and deferential to the police. Studies of juvenile offenders (Piliavin and Briar, 1964; and Sullivan and Siegel, 1972) also found

that the attitude of the offender was a critical determinant of whether or not an arrest was made.

6.5.6 Procedures for Industrial and Commercial Noise

6.5.6.1 Monitoring Industrial and Commercial Noise

Authorities showed much more uniformity of approach in their procedures for investigating complaints about industrial and commercial noise than for domestic noise. In all authorities officers investigated these sorts of complaint as soon as possible, without recourse to deferral tactics, sifting techniques or administrative responses. In addition, all the officers interviewed said they monitored industrial and commercial noises of a mechanical nature (such as compressors and generators) using the method laid out in BS 4142. Some also used BS 4142 to rate entertainment noise. Although it was felt that the standard was a useful guide, most officers said that monitoring as such did not establish the existence of a nuisance (as increases in noise levels less than 10 dB(A) above ambient could still amount to a nuisance, depending on the frequency characteristics of the noise), so ultimately their decision was based on subjective judgement. Officers in one authority, however, said they would not prosecute if BS 4142 did not support their case.

Opinions about BS 4142 varied. On the positive side were such comments as "it's the first bit of decent objectivity concerning noise nuisance", "for all its faults it is something written down which you can refer to", and "not perfect by a long way, but it is a useful rule of thumb". Less favourable comments ranged from "the 50 dB(A) criterion is much too high, especially for rural areas, but the 10 dB(A) difference between background level and noise level is a good indicator", to BS 4142 being "a very lenient standard" and even "pathetic".

Uncertainty in the scientific basis of a legal provision could act as a disincentive to its use, since the uncertainty will provide considerable scope for controversy during the enforcement process, particularly if a case is contested in court. Nevertheless, however dubious the scientific basis, it is possible that once a 'scientific' method becomes established as part of the legal mandate, it will be used in practice simply because it has some objectivity (even if it is only an approximation) and makes for easier decision-making than if an enforcement agent has to rely on unlimited discretion. For instance, although several EHOs in the noise survey were critical of BS 4142, and most said that ultimately their decisions concerning industrial noise nuisance relied to an extent on subjective judgement, in all eight authorities in the noise complaint questionnaire, officers continued to use the standard to rate industrial noise. As mentioned in Chapter 2, a precise rule such as a quantitative standard provides a decision-maker with an 'objective shield' to 'hide behind': if the law has been correctly applied, then the decision-maker cannot be blamed personally for any decision that is made.

Although BS 4142 states that measurements must be made out-of-doors, several authorities found that in some cases, such as where the complainant lived in a flat, measurements had to be taken indoors. Apart from the Wilson Committee guidelines (Committee on the Problem of Noise, 1963), there are no standards for acceptable noise levels inside dwellings.

Several authorities used noise rating curves to identify annoying tonal components in the noise spectrum. Recommendations for abating the nuisance, contained either in informal letters or statutory notices, sometimes expressed acceptable noise limits as NR values.

6.5.6.2 Best Practicable Means

Several EHOs considered that the defence of best practicable means (BPM) for noise nuisance caused by trade or industry, favoured the noise-maker. If a company pleaded lack of finance as a reason for

failure to carry out remedial works, it was often difficult for officers to assess whether this was merely an excuse or a legitimate reason for non-compliance. Several EHOs said they would search company records to obtain details of profits or annual financial turnover, in order to determine whether the costs of abatement measures could be carried by a firm. Records of this nature were sometimes produced as evidence in court. Indeed, the courts may increasingly ask to see company accounts when the BPM question is raised, as case law referred to in Chapter 4 infers (Section 4.4.2.1). In one authority, officers considered they could reasonably ask a firm to spend between 10-15% of the total cost of any installation on noise abatement: for instance, if compressor noise was a nuisance, then the authority could demand up to 10-15% of the total cost of the compressor to be spent on abatement work.

An interesting perspective on the flexible nature of BPM was provided by one officer, who said that the BPM of abating a nuisance sometimes varied according to the level of company personnel he was dealing with. Site managers, for example, having to operate within a tight budget, might tell the officer they were unable to carry out certain abatement work which Head Office personnel would subsequently say was affordable. The utility of serving an abatement notice, in cases such as these, was that one copy of the notice was always sent to the company secretary at Head Office, meaning that top management heard about the problem.

6.5.6.3 Consultancy

The amount of technical advice which EHOs could give to companies with noise problems depended on the level of acoustic expertise which the officers possessed, and also on the time which officers could afford to devote to any particular case. If a problem was complex, and its solution likely to be expensive, officers generally advised companies to hire the services of an acoustic consultant. EHOs had lists of reputable consultants and abatement equipment manufacturers to send to companies if required. Solutions to simpler problems, however, were

often suggested by the officers themselves. Several officers with qualifications in acoustics commented that they would like to undertake more work of a consultancy nature, if only time permitted. Richardson (1982) and Hawkins (1984a) reported that Water Authority officers also provided advice and consultancy services to the industries whose aqueous discharges they policed.

6.5.7 Alternative Statutory Arrangements

Alternative tools for neighbourhood noise control consist in the main of preventive measures, such as planning control, licensing laws and regulations concerning the sound insulation of buildings. EHOs can act only as consultative agents for both planning and licensing provisions, but their recommendations are, nevertheless, frequently adopted owing to the recognition by other parties (such as Planning Departments) of their greater experience in matters of noise control.

6.5.7.1 Sound Insulation Requirements

Legal provisions concerning the sound insulation of buildings consist of sound transmission standards for party walls and floors under the Building Regulations (most recently consolidated in 1985 under s.14(3) of the Building Act 1984), and various noise insulation schemes directed at providing acoustic insulation against noise from external sources, such as road traffic (the Noise Insulation Regulations 1973, SI 1973 No.1363, amended 1975) and civil aircraft (various schemes at major airports in Britain, the earliest being the London (Heathrow) Airport Noise Insulation Grants Scheme, SI 1966 No.424). Some EHDs carry out work on an agency basis for the appropriate authorities in relation to these noise insulation schemes.

EHOs have no direct role in the enforcement of the Building Regulations (which are the responsibility of local authority Building Inspectors), but investigations of noise complaints in relation to COPA may reveal instances where party walls or floors fall short of sound insulation requirements. In relation to the

three complaints in the noise complaint questionnaire where the source of the nuisance was attributed to inadequate sound insulation in council-owned property, EHOs handed responsibility for subsequent action over to the Housing Department. Case law referred to in Chapter 4 (Section 4.4.2.1), however, revealed that at least one London borough has taken successful actions under COPA against the landlord of rented property, as the "person responsible", where the noise nuisance originated from indequate interfloor sound insulation.

6.5.7.2 Planning Control

Both the Wilson Committee (Committee on the Problem of Noise, 1963) and the Scott Committee (Noise Advisory Council, 1971) urged increased liaison between LA planning departments and EHDs in order to control potential noise problems from proposed developments. This advice was reiterated by the Government in Circular 10/73, but no steps to make such liaison a statutory duty (as recommended by the Scott Committee) were taken.

All the EHDs in the noise survey had made consultative arrangements with their respective Planning Departments. In some authorities EHOs scanned all planning applications for noise problems, whilst in others only those earmarked by the Planning Department as potential problem cases were vetted.

If a proposed new development is liable to create a noise problem, then the LA may refuse planning permission on this ground, or else grant it subject to certain conditions. Circular 10/73 provides some quantitative criteria to guide LAs in determining the acceptability of any proposed development in relation to noise levels. The Town and Country Planning Act 1971 allowed a LA to make such conditions 'as they think fit' (s.29(1)). This rather vague phrase has been clarified by Circular 1/85. A condition can only be imposed if it is:

1. necessary, and
2. relevant to planning, and

3. relevant to the development to be permitted, and
4. enforceable, and
5. precise, and
6. reasonable in all other respects.

Circular 10/73 provides some model conditions for use in relation to noise. Most authorities in the noise survey had developed their own, fairly standardised, requirements for planning control of noise. These were more specific than just saying that a new development should not cause a nuisance. A common condition was that noise levels from a new development should not exceed the ambient level monitored at the site boundary. Other conditions limited working hours from industrial and commercial premises, or specified plant design or methods of noise abatement. Most requirements concerning noise were included in informatives (letters sent with the planning consent), rather than as conditions as such.

Enforcement of planning laws is the responsibility of the Planning Department. An enforcement notice can be served in response to a breach of planning controls - and this includes failure to comply with any conditions. An offence is only committed after failure to comply with an enforcement notice. The process of planning law enforcement is considered to be slow and cumbersome, mostly involving recourse to informal tactics (Jowell and Millichap, 1983 and 1986), and in 1980 the Government advised LAs that enforcement action against breaches of planning legislation should only be taken as a last resort (Circular 22/80). The COPA controls are probably speedier if a nuisance exists as a result of breach of planning law (Penn, 1979).

6.5.7.3 Entertainment Licensing

The liquor and entertainment licensing laws provide a useful alternative to COPA for controlling noise nuisance from entertainment premises, and were made frequent use of by EHOs in the survey. Licences for the sale of intoxicating liquor in public houses and clubs are issued on an annual basis by local magistrates in their role

as licensing Justices (under the Licensing Act 1964). Additional "entertainment licences" are required for premises providing public entertainment (other than that provided by radio or television, by recorded music, or by not more than two performers). LAs, rather than the local magistrates, now have responsibility for issuing annual entertainment licences (under the Local Government (Miscellaneous Provisions) Act 1982 and some local enactments such as the West Yorkshire Act 1980).

Both the Justices and the LA licensing committees have a broad discretion to attach any conditions they deem appropriate to the licences. The EHD's role is purely consultative, making recommendations for noise control to the appropriate licensing authority. However, it was common practice for the licensing committees, at least, to generally take up the EHDs' suggestions.

Conditions inserted in entertainment licences included a general requirement that "no nuisance [was to] be caused by noise or vibration emanating from the premises", that specific noise limits in decibels were not to be exceeded, or even that certain noise abatement work should be carried out in order to prevent nuisance. One authority used a condition requiring the use of an electronic limiting device preventing levels of amplified music from exceeding a pre-set limit in decibels. Licensing conditions could also apply to noise from patrons entering and leaving entertainment premises: a source of noise over which the COPA provisions have no control.

Failure to comply with the terms of the licence provided grounds for refusal to renew. Threatening to suspend a licence gave officers a good bargaining chip in their armoury of enforcement tactics, since loss of a licence was effectively a bigger financial penalty than a fine under COPA. Although few officers could personally relate instances where licences had been withdrawn for failing to comply with noise conditions, some cases have been reported by the Middlesex Officer Liaison Group on Noise Control (1982).

A consultation paper issued by the Enterprise and Deregulation Unit at the Department of Employment (1986) inferred that entertainment licensing controls might be subject to deregulation. The subsequent White Paper (HMSO, 1986b), however, said only that the field of environmental protection legislation was "being assessed to determine opportunities for rationalising and simplifying existing regulations".

6.5.8 Construction Site Noise

The IEHO reported that "Legislation to control noise from construction and demolition sites has been little used" (Institution of Environmental Health Officers, 1983).

From interviews with officers during the noise survey it became apparent that most EHDs preferred to proceed informally rather than to issue formal notices and consents to contractors and developers. Section 60 notices were generally used, if at all, only for major developments or in response to complaints. The two London boroughs provided an exception to this, by making frequent use of s.60 notices for all forms of construction work, including housing rehabilitation and 'do-it-yourself'.

Officers reported that the powers of prior approval under s.61 were rarely made use of by contractors or developers, except by local government itself and statutory undertakers. The IEHO/DOE survey (DOE, pers. comm.) also found this to be the case. In the first place, there was no financial incentive for contractors or developers to seek prior approval from the LA. Additionally, several EHOs said they actively discouraged applications for s.61, since the considerable time required to determine reliable consent conditions, and to ensure they were complied with for the duration of the work, could better be spent on investigating complaints.

Rather than using s.61, several officers said that both their authority and the county council incorporated noise control criteria (using BS 5228) in their contract documents for construction

projects. If the terms of the contract were broken - and this included terms relating to noise - then they could order the contractor to stop work, until contract compliance had been achieved. Alternatively, contractors who consistently failed to comply with noise control specifications might not be invited to tender for future council projects. These provided good financial incentives for compliance with noise control requirements.

Compliance with the terms of a s.60 notice or a s.61 consent means that the LA effectively forfeits its power to take an action in nuisance under s.58 (although private action under s.59 is still available). Several officers said they were wary of serving notices under s.60 or consents under s.61 because, if they made an error of judgement in any of the conditions, compliance with the notice or consent could result in a nuisance being caused which the LA was powerless to abate. The IEHO commented that:

> "It is, perhaps, unfortunate that conditions imposed before work begins cannot be made more restrictive at a later date if undue disturbance is caused. The effect of this is that requirements tend to be overprotective. It is understandable that a contractor does not want to price a job only to find that his operations may later be restricted. It is equally reasonable for the local authority not to become party to an agreement unless they are sure that they have covered every eventuality." (Institution of Environmental Health Officers, 1983).

6.5.9 Ice Cream Chimes and Burglar Alarms

Officers found the COPA codes of practice useful in controlling noise from ice cream chimes and burglar alarms, both because the codes provided information to operators to help them comply with the law, and also because they provided officers with criteria to determine when burglar alarms were a nuisance, or when ice-cream chimes were a "reasonable cause for annoyance to persons in the vicinity".

In several authorities officers sent copies of the code of practice to all ice-cream vendors in the area as a matter of course. Some officers could recall cases when their authority had prosecuted ice-cream

vendors under s.62. Most complaints about chimes, however, were dealt with informally: complainees were sent a warning letter and a copy of the code of practice.

Officers said the police often received complaints about burglar alarms in the first instance, and subsequently forwarded them to the EHD. Some officers, especially those in the London boroughs, adopted a strict approach to prolonged ringing from alarms. If ringing continued for more than twenty minutes, the alarm-holder was served with an abatement notice specifying that an automatic cut-out device should be fitted.

6.5.10 Noise Abatement Zones

6.5.10.1 The National Picture

At the national level the noise abatement zone (NAZ) policy has not been very successful: the IEHO report for 1985/86 (Institution of Environmental Health Officers, 1986) listed only 54 NAZs in operation (out of a total of 402 district and borough councils in England and Wales). The IEHO annual statistics have recorded only 7 prosecutions for exceeding registered levels in NAZs (s.65) - resulting in 2 convictions - and only 4 noise reduction notices (s.66) served, since the policy was implemented. The IEHO, who devised the concept in the first place (see Chapter 3), appears to have lost faith in it, commenting that "Although the idea seemed good it appears to be a luxury which can no longer be afforded" (Institution of Environmental Health Officers, 1985) and has called the policy "bureaucratic and unworkable..." (Institution of Environmental Health Officers, 1984).

In 1977, only one year after the policy was implemented, a Chief EHO speaking at a National Society for Clean Air technical seminar suggested that the time-consuming and resource-intensive monitoring of noise at many locations around the perimeter of each classified premises in a zone was beyond the resources of most LAs, both technically and financially speaking (Reynolds, 1977). Another speaker

also considered that the technical and administrative problems involved in establishing a zone were complex, and that LAs would have to weigh very carefully the benefits of adopting a NAZ against their other responsibilities (Penn, 1977). Strong disagreement with these sentiments, however, was expressed by another EHO at the seminar whose authority had already established a zone. He thought that NAZs were not beyond the resources of any local authority where they and their staff were genuinely interested in controlling and reducing noise (Cresswell, reported by Birch, 1977).

The findings of the present survey confirmed the impression that only a minority of authorities considered NAZs a viable noise control policy. Three of the 18 authorities visited had NAZs in operation; two others had designated a zone, but had not yet undertaken a noise survey. In the other 13 authorities there was no policy to establish a zone in the forseeable future: the main reason given by officers for this decision was lack of resources. A survey in 1982 of 94 LAs, including 34 which at that stage had implemented zones, also concluded that shortages of staff and finance were the major causes of lack of zones (Wright, 1982).

The difficulty with NAZs was found to lie not in the provision of monitoring equipment, or in technical problems as such. Utley and Salvidge (1980), in a survey of 14 LAs where noise abatement orders had been confirmed, found that from a technical point of view progress with NAZs had been generally satisfactory, with no major problems encountered. The 1982 survey also reported that the technical complexity of the procedure for measuring registered levels in zones was not the overriding problem, although it possibly deterred EHOs in authorities which had not established zones from embarking on such a project (Wright, 1982).

Officers interviewed in the noise survey considered the major constraint to setting up a zone was that staffing levels were insufficient to enable the time-consuming duties associated with implementing a NAZ to be carried out. Officers said that a minimum of

two officers with the necessary technical expertise was required to undertake noise measurements from classified premises. Wright (1982) found that 60% of zones took between 13-24 months to set up. Other estimates of the time taken to set up zones varied between 100 officer-hours to one officer-year, depending on the size of the zone (Mulholland, 1979).

As no extra resources were made available by Government for LAs to set up zones (Circular 2/76), NAZs must be established within the existing financial framework of the authority (Barraclough, 1982). An additional burden on staff time has meanwhile been caused by the rising level of complaint about neighbourhood noise (Section 6.5.4.4) meaning that, depending on how LAs interpret their responsibilities under s.57, officer time will increasingly be taken up with investigating complaints. Several officers thought that NAZs were not cost-effective: the money could better be spent on investigating complaints.

The other main difficulties with implementing NAZs were as follows:

1. Some council members feared that a NAZ would act as a disincentive to industry; firms would not locate in an area subject to additional noise controls.
2. The cost thought to be involved in upkeep of an established zone. However, officers in the three authorities with operational NAZs used complaints, rather than time-consuming proactive monitoring of the zone, as indicators that registered levels were being exceeded.
3. Where zones had been set up, noise from road traffic was often reported as the dominant source, much in excess of the contribution from sources amenable to NAZ control.
4. Measuring levels of noise from multi-occupancy industrial premises within a zone had provided Authority 1 with severe technical problems.

6.5.10.2 Authority 1's Noise Abatement Zones

Authority 1 had established two large zones. A grant from the Department of the Environment's Inner Urban Programme (for inner city renewal) had enabled the authority to employ two staff to establish the zones. Although this funding had ceased in 1984, the council had decided to carry on with its NAZ programme, and had consequently retained the two staff, although they were increasingly deployed on other projects.

Both the zones contained a mixture of industry, commercial premises and old and new housing. One zone covered an area of 54 hectares and contained 60 classified premises, whilst the second was an area of 72 hectares with 150 classified premises. Levels of noise from classified premises were measured as 15 minute Leqs and, in some instances, peak levels. Occupiers of premises were asked to undertake processes which were fairly typical of their production cycle when the registered levels were being determined. Noise emissions from night shifts were also monitored.

Although these large zones were extremely time consuming to set up, officers in this authority were convinced of the benefits of the NAZ approach. Complaints about noise from several factories had decreased since they had been subject to NAZ controls. This was attributed to the replacement of the 'nuisance' concept with a specific noise standard: "The extra pressure placed upon [a] firm to comply with the standard increases their awareness of noise emitted and leads to prompt action where levels are found to be excessive" (Bird and Wright, 1983).

Officers in Authority 1 were planning to continue with the NAZ policy, but thought that in future small zones, applying to one or two premises with a long history of noise problems, would be more cost-effective.

6.5.10.3 'Alternative' Noise Abatement Zones

The consensus of opinion amongst those who consider there is still some mileage in the NAZ concept is that for zones to be useful, they must follow from a well thought out council policy. Unlike Smoke Control Areas, NAZs will never be of any use as part of a programme intended to achieve blanket coverage of the whole area of a LA. Bird and Wright (1983) considered they can be used successfully either:

1. In areas where other council policies have brought, or will bring, industry and housing together in a mixed development (such as inner city renewal schemes). In these circumstances, NAZs can be used as a preventive tool, in conjunction with planning controls; or
2. To solve a recurring noise problem; either where noise levels are annoying but not sufficient to constitute a nuisance or, where noise is a nuisance, without the need to constantly change noise abatement notices or re-establish nuisance.

Reducing the number of measurement points around the noise boundary of a zone has been proposed as one way of diminishing the resource implications of a NAZ. Guidance concerning the number of measurement points needed around a zone is given in the 'Memorandum on measurement and calculation of noise levels' in the Schedule of the Control of Noise (Measurement and Registers) Regulations 1976, but in many cases this level of control is unnecessary (Romaine, 1986).

There is nothing in the regulations covering NAZs to prevent a zone being composed of a single premises. Single premises NAZs or 'minizones' are another way of utilising these provisions cheaply, and can be used to control recurring noise problems of the type described above (Bird and Wright, 1983; Romaine, 1986). Using this technique, a legally enforceable noise limit from an industrial premises can be established, and ultimately reduced via a noise reduction notice (as long as this is practicable and of public benefit: COPA s.66(1)).

6.5.11 'Going Formal'

6.5.11.1 Delegated Powers

District officers had discretion to handle complaints in any way they deemed appropriate, until such time as they wanted to invoke formal procedures. The decision to 'go formal', however, often led to the involvement of departmental management, the elected members and the Legal Department in the decision making process.

The extent to which powers to serve statutory notices and to initiate prosecution proceedings were delegated to individual officers varied from authority to authority (Table 6.10). In general there was a positive correlation between the extent of delegated powers and the degree of urbanisation of the LA. In some authorities district officers were authorised to serve statutory notices, whilst in others approval from departmental management and sometimes also from the Chair of the Environmental Health Committee was required.

In general, district officers who considered that a particular case merited prosecution had to have their decision ratified by departmental management, by the Environmental Health Committee and by the Legal Department. The exceptions were some urban authorities (for example, Authorities 1, 3 and 4) where the requirement to obtain committee approval before prosecuting had been by-passed, on the condition that officers referred any 'controversial' cases to the Committee prior to taking action in the courts.

If any of these parties vetoed the initiation of prosecution proceedings, then the case was dropped. This approach is typical of non-police agencies (Sanders, 1985a and b), where the decision to prosecute is made by a process of upward referral to management. The decision not to prosecute, however, rests with individual officers. This is the converse of the organisational framework for prosecution in the police (Sanders, 1985a), where any one police officer (from inspector level upwards) can authorise a summons, but more than one

TABLE 6.10

LEVEL OF DELEGATED POWERS IN THE EIGHT AUTHORITIES

Authority		Level of Delegated Powers For:	
		Service of Statutory Notices	Initiation of Prosecution Proceedings
1	Metropolitan borough	District Officer	Chief Officer
2	City council	District Officer	Council Committee
3	London borough	District Officer	Principal Officer
4	London borough	District Officer	Principal Officer
5	District council	Chief Officer	Council Committee
6	City council	Officers have emergency powers to serve notices, otherwise committee approval required	Council Committee
7	City council	District Officer	Council Committee
8	District council	Council Committee	Council Committee

have to ratify the decision if there is not to be a summons.

The tone of a department's enforcement policy was set primarily by the Chief Officer, in conjunction with the Environmental Health Committee. The process of upward referral meant that conformity was achieved between officers concerning the stringency of their approach to enforcement.

6.5.11.2 The Political Setting of Local Authorities

Council officers work in a political setting and are responsible for executing the policies devised by the elected members. A large proportion of time in council committees is spent hearing and reacting to reports by Chief Officers. Environmental health functions, and noise control in particular, however, are not very politicised issues as they tend to be fairly low down the list of priorities for local government: environmental health and trading standards together account for less than 1.5% of the annual rate fund expenditure of local authorities and an even smaller proportion of capital expenditure (Rhodes, 1986b).

Rhodes (1986a) comments that functions such as housing and social services, which command a much larger share of the council budget, tend to attract more councillor concern than environmental health, with the result that more explicit policies are mapped out for the former than for the latter. Priorities for environmental health work may thus depend much more on professional, rather than political, views. One Chief EHO complained to Rhodes that his authority's Environmental Health Committee tended to accept more or less without question what he proposed, whereas the Chief Housing Officer had no doubt that his committee had a clear view of priorities for the officers to follow. In addition, because of their complexity, technical matters such as noise control are more suited to decision-making at officer level.

To a greater or lesser extent councillors did, however, exert some influence on the EHDs' enforcement policy. Officers referred all petitions, and letters from MPs lodging complaints on behalf of local residents, to them. These were the sort of high profile complaint where it was important that the authority was seen to be taking action. In several urban LAs the employment question was critical and councillors were reluctant to enforce statutory notices on businesses if this could ultimately lead to redundancies. Richardson (1982) and Hawkins (1984a) reported that Water Authority officers also sometimes took a more lenient line with offenders who were financially insecure and where enforcement could lead to redundancies.

In addition to councillor pressure to take a conciliatory approach with industry, officers in some LAs were also urged to adopt gentle tactics to deal with any complaints where there could be racial undertones, such as pay parties.

In the case of Authority 1, which had set up two noise abatement zones, full council approval was required before a noise abatement order could be made. The establishment of the first zone required the input of additional resources to the EHD (in this case the employment of two technical staff) and this needed council approval. However, the proposal for the zone originated from the officers themselves.

Cranston (1979), in his study of consumer agencies, found that the political complexion of a local authority affected the division between enforcement and advice work, with local authorities controlled by the Labour Party favouring advice. The present study found that where noise was concerned, the political persuasion of the LA seemed to have no perceptible effect on the enforcement procedures employed (and any effect it might have had was imperceptible in comparison with other factors). Byrne (1983) maintains that ".... in local government generally it is worth repeating that a great deal of business is not transacted on party lines".

6.5.11.3 Service of Statutory Notices

Two copies of a statutory notice were usually prepared: one was delivered by hand, the other sent by registered mail. In some authorities police support could be obtained for delivering notices to premises where officers considered there could be a risk to their own safety.

The problem of determining accurately the names of those responsible for a noise nuisance has already been discussed in relation to noisy party patrols (Section 6.5.4.9), but it was a difficulty common to all areas of neighbourhood noise enforcement. If it proved impossible to identify the person responsible, notices were served on the owner or occupier of noisy premises. Much use was made of tenancy records, rating lists and the register of electors to trace owners or occupiers. At all costs, officers wanted to avoid an appeal against a notice based on the grounds that the notice had been served on the wrong person (Regulations 4(2) g and h of the Control of Noise (Appeals) Regulations 1975: SI 1975 No.2116). Consequently several authorities would serve a notice requiring the recipient to supply ownership details, or details of all partners in a company for instance, to the LA (under s.16 of the Local Government (Miscellaneous Provisions) Act 1976 or, alternatively, s.93 of COPA) prior to serving a noise abatement notice. Failure to supply this information without reasonable excuse is an offence, and several officers said their authorities had taken recipients to court under these provisions.

6.5.11.4 Content of Statutory Notices

Although statutory notices were usually stamped with the signature of the Chief EHO, the officer responsible for the case drafted the terms of the notice. Notices concerned with domestic noise nuisances generally requested the recipient to desist from doing whatever it was which caused the nuisance, such as not holding noisy parties or not playing loud music "so as to cause a nuisance". For commercial or industrial noise, where work needed to be carried out to remedy the

nuisance, officers considered it was necessary to do more than just stipulate that the nuisance must be abated. Officers went to some lengths to provide the recipient of a notice with advice on how to remedy the problem or, in the case of complex technical matters, where to obtain the services of a reputable acoustic consultant. This information was often included in a covering letter or schedule sent with the notice, rather than in the notice itself. Alternatively if an abatement method was included in the actual notice, the following phrase was commonly used:

> "....the use of.....is recommended or any suitable method to be agreed with the Environmental Health Department."

By these means officers avoided providing the recipient of a notice with possible grounds for appeal (under Regulation 4(2) c of the Control of Noise (Appeals) Regulations 1975) on the basis that the notice was unreasonable, because the LA had failed to recognise alternative methods of successfully abating the nuisance.

Officers tried to tailor the terms of the notice to match the technical expertise (with respect to acoustics) of the recipient. If the notice was addressed to a large company or to a firm which was going to call in acoustic consultants, then officers often specified noise limits in decibels. Otherwise, technical terms were generally avoided.

With regards to s.60 notices, limits on the hours during which noisy activities could be carried out on site, and on the type of equipment which could, or could not be used, were more commonly specified in notices than decibel limits. Noise emission limits were generally only set for large contracts, or for building sites very close to offices or residential premises. One authority set limits for pile driving (a 5 minute Leq of 85 dB(A) measured at a distance of 10-15 metres from the piling rig), but otherwise tried to avoid using noise limits: as one officer explained, using decibels was rather like "talking Greek" to most site workers. On large projects, engineers who were conversant with acoustics were present on site, but this did not

necessarily apply to smaller construction sites.

When a notice had been served, officers checked that it was being complied with, either by site visits or by asking complainants to contact the EHD if the nuisance had not diminished. Notices were usually only suspended, pending an appeal, if the nuisance was of a "technical" nature and required expenditure on abatement work. As a rule notices relating to "behavioural" nuisances were not suspended.

6.5.11.5 Taking Cases to Court

Once the decision had been made to prosecute for contravention of a statutory notice, a letter was sent to the defendants informing them of the LA's intention to initiate proceedings. If officers witnessed further contraventions of the notice, these counted as separate offences.

Except for some health and safety legislation where EHOs themselves handle cases in court, environmental health cases are generally handled by the LA Legal Department with EHOs called on to give evidence in court as necessary. The officers who had witnessed the offence drafted witness statements, which included details of when the notice was served, when the alleged offence occurred and a description of the nuisance. A report of the case, containing the witness statements, filtered through the EHD hierarchy and, if approved for prosecution, was then passed to the LA Legal Department. Complainants were asked to give evidence, if they were willing to appear in court, and also any police officers who might have witnessed the offence (such as on a party patrol).

If the LA solicitors considered there was sufficient evidence to make a prima facie case or that there were no deficiencies in the legal argument, an application was made to the local magistrates court for a summons to be served and a court date fixed. The witness statements were returned to the EHD to be signed by the appropriate officers. Sometimes the Legal Department referred a case back to the

EHD, saying there was insufficient evidence to take proceedings.

Officers' opinions about their authority's Legal Department varied. A few were quite satisfied with relations between the EHD and the Legal Department. Several officers commented, however, that although LA solicitors generally did not intervene in the EHD's decision to prosecute (unless there were deficiencies in the evidence or the legal argument), the Legal Department was much too cautious in its approach. Officers said that the Legal Department only agreed to handle 'watertight' cases that in all probability the LA would win, and was not prepared to take test cases. Officers thought that few resources were assigned to pollution cases, as pollution control was low down the list of priorities in LA litigation. In addition, some officers thought there was insufficient consultation between the EHD and the LA solicitors before a court case.

6.5.11.6 The Magistrates Court

As summary offences, neighbourhood noise offences are triable in the lowest tier of the criminal courts - the magistrates' courts. The vast majority of magistrates are 'lay' magistrates, that is they have no legal background (although since 1966, appointees have undertaken basic training courses), are unpaid and sit part-time, usually in benches of three. In London and some other large cities there are, in addition, a number of full-time stipendiary magistrates, who are trained lawyers and sit in court on their own. There are approximately 600 magistrates courts, 26,000 lay magistrates and 50 stipendiaries in England and Wales (Magistrates Association, pers. comm.). 98% of all criminal cases are handled by the magistrates' courts (Central Office of Information, 1976).

No formal qualifications are required to become a lay magistrate. Appointments are made on the grounds of integrity, and each bench should be broadly representative of all sections of the community which it serves (Central Office of Information, 1976). However, an analysis of the social status of 538 magistrates in the mid-1960s

found that over half the sample had a "managerial or other professional" background, whilst another 21% were high professionals (Hood, 1972).

In the criminal courts the prosecution must prove its case "beyond all reasonable doubt". Magistrates decide on both questions of fact and law, and are advised on the latter by a full-time legally qualified Clerk to the Justices. As magistrates have neither legal, nor (in all probability) technical backgrounds, the prosecution and defence must try to present their case in a manner which is intelligible to a lay audience.

6.5.11.7 Technical Evidence in Court

Part III of COPA can result in technical matters coming before the magistrates' courts in the following instances:

1. Contravention of, or appeal against, a s.58 notice;
2. Drafting a court order under s.59, or proceedings for contravention of the order;
3. Contravention of, or appeal against, a s.60 notice;
4. Contravention of conditions in a s.61 consent, or appeal against a LA's refusal or failure to give a consent, or against a LA's conditions in a consent;
5. Offence under s.62;
6. Offence against a registered noise level in a noise abatement zone (s.65), or drafting terms of a court order if any works are necessary to prevent the offence recurring (s.65(6));
7. Contravention of, or appeal against, a noise reduction notice relating to premises in a noise abatement zone (s.66).

In considering appeals against notices, magistrates may have to evaluate technical evidence concerning issues such as whether or not the noise is a nuisance, whether the terms of the notice are reasonable, or whether BPM have been used to minimise the noise (Chapter 4, Section 4.4.2.1). According to the decision of the

Divisional Court in A Lambert Flat Management Ltd v Lomas ((1981) 2 All ER 280), the question of whether or not the noise amounts to a nuisance is a question to be raised in appeal proceedings against a notice, rather than as a defence against a prosecution for contravention of a notice where the grounds provided in COPA are strictly limited. Technical evidence may also be submitted in proceedings for offences under COPA concerning the defence of BPM (s.s 58(5), 59(5), 66(9)). In addition, magistrates may need to incorporate technical details into the terms of court orders to abate noise nuisance.

All the EHOs shared the opinion that results of monitoring were used in court as a back-up to the subjective appraisal of a noise nuisance. Although some magistrates asked to be given readings of noise levels in decibels, officers considered that magistrates were more convinced by evidence couched in subjective terms than by any assessment using BS 4142, for example. This is hardly surprising since BS 4142 (or any other noise rating) does not provide unequivocal proof that a noise is a nuisance. The nuisance concept does not deal in absolutes: the standard varies from place to place, from one bench of magistrates to another and, according to some EHOs, on how well the LA presents its case in court.

Some officers said they took measurements "to prove a case to themselves", but concentrated on the subjective impression in court. They were concerned not to "bamboozle" magistrates with technicalities: if technical evidence was presented, they tried "to keep it simple". It was acknowledged that graphs were a good way of contrasting the frequency spectrum of a noise source with that of the background noise. The use of tape recordings to demonstrate the loudness of a noise was avoided, since the defence could claim that the noise level had been "rigged". Recordings were used on occasions, however, to illustrate particularly annoying tonal characteristics of a noise.

Planning inquiries, cases in the higher courts and cases involving consultants tended to become more technical. According to some EHOs, acoustic consultants employed by the defence in industrial or commercial cases sometimes tried to confound the magistrates with technicalities. An example is provided by an industrial noise nuisance case reported by the Middlesex Officer Liaison Group on Noise Control (1982). In this case, EHOs used BS 4142 in support of their contention that the noise amounted to a nuisance, since the corrected noise level exceeded the measured background level by more than 10 dB(A). Acoustic consultants, giving evidence on behalf of the defence, however, stated that BS 4142 in fact supported their claim (that the noise did not amount to a nuisance) if the notional, rather than the measured background level, was used. This was in spite of the fact that BS 4142 states that "Whenever possible, the background level should be measured directly", and that the notional level of 50 dB(A) is acknowledged to be on the high side for most locations. Although the magistrates eventually found in favour of the LA, the report indicates there was a certain amount of confusion on the justices' part.

In an attempt to avoid situations like this from arising, officers in some authorities tried to convene a meeting with consultants to agree the facts of a case before going to court. Differences of opinion might still remain concerning the significance of the facts, or suitable methods of abatement, but at least agreement could be reached on methods of rating the noise, decibel levels, frequency spectra and so on.

The question of whether EHOs were satisfied with the presentation and comprehension of technical evidence in court was difficult to assess. All thought it was a problem they could cope with adequately as another facet of the EHO's "health education role". Officers were used to meeting the public and dealing with a lay audience as part of their daily routine and they tended to view giving evidence in court in much the same light. In the words of one officer, "It's no different from dealing with Joe Bloggs in the street". On the whole they seemed

confident they could explain technical details in terms readily comprehensible to a lay audience.

Despite the technical complexity of the regulations specifying the method for measuring registered levels in noise abatement zones (The Control of Noise (Measurement and Registers) Regulations 1976), proceedings for exceeding a registered level (s.65) should, in theory at least, be quite straightforward. As long as evidence is provided to show that instruments have been correctly calibrated, and that measurement procedures have been followed precisely, then proof of exceeding a registered level should not involve anything much different from proof of exceeding a speed limit (Taylor, 1981): there is no defence of BPM for s.65. Whether the reality is as straightforward as the theory, however, has yet to be put to the test as, in the two reported cases of successful prosecution for breach of registered noise levels, the defendants pleaded guilty (Macrory, 1985).

6.5.11.8 Sentencing and Costs

Sentencing is at the discretion of the magistrates subject to maximum sentences specified in the legislation (for Part III of COPA, currently £2000 plus £50 per day for every day the offence continues after conviction). However, magistrates have a statutory duty to have regard, amongst everything else, to the defendant's means as they are known or appear to the court.

Typical fines for offences under Part III of COPA are shown in Table 6.11. Although maximum fines under COPA are presently £2000, the highest recorded fines were in the order of £500. Larger fines have been awarded for noise pollution cases taken by LAs to the higher courts: a company was fined £50,000 by the High Court for contempt of court, for failing to comply with an injunction obtained by the LA (under s.222 of the Local Government Act 1972) to enforce the terms of a s.60 notice (Environmental Health, 1986). Fines for industrial and commercial cases tended to be higher than for domestic cases.

TABLE 6.11

TYPICAL FINES FOR OFFENCES UNDER PART III OF THE CONTROL OF POLLUTION ACT 1974

Sources: - Home Office Criminal Statistics 1978 - 1983, obtained from the Home Office Statistical Division.
- Macrory, 1985.

Section	Range of Fines (£)	
58	5 - 500	
59	5 - 100	
60/61	50 - 150	
62	5 - 75	
65	20 - 175	(2 cases reported in Macrory, 1985)
66	75	(1 reported case only)

Examination of Authority 3's "Legal Proceedings Instituted" book gave levels of costs awarded to the LA in neighbourhood noise cases of between £25-150. Officers in general said that the level of costs imposed by the courts rarely reflected the actual costs incurred by the LA in bringing a case to court.

Officers considered the levels of fines and costs awarded for neighbourhood noise offences were very low, even derisory in some cases. Although the goal of enforcement was compliance rather than punishment as such, officers felt that the level of fines was too low to provide a deterrent to other potential offenders, particularly businesses. Although the adverse publicity associated with appearing in the criminal courts dissuaded some firms from breaking the law, others found it cheaper to pay a fine than to comply with abatement notices. Officers in Authority 1 had gone so far as to express their dissatisfaction with the levels of fines for pollution offences to the local magistrates and, as a result, were pleased to report that fines were higher than they used to be.

Other studies of non-police enforcement agencies have frequently reported dissatisfaction on the part of agents regarding the level of fines and costs imposed by magistrates (for example, Cranston, 1979; Richardson, 1982; Hawkins, 1984a; Hutter, 1984; Macrory and Withers, 1985) A recent article in "The Magistrate" (Horsman, 1985) stated that the editor had received a steady flow of complaints, over the past 15 years from boards, statutory undertakings, local authorities and other bodies responsible for the enforcement of legislation, that penalties imposed by magistrates' courts were frequently inappropriately low.

Officers in the noise survey also complained about the variation between benches in level of fines. Hutter (1984) with respect to EHOs, and Cranston (1979) with respect to consumer agents, also reported that variable fining was a problem. The Magistrates' Association issues guidance notes on appropriate sentencing criteria for road traffic offences (Macrory and Withers, 1985) but nothing of this kind exists for pollution offences. There is therefore no means

of achieving uniformity of sentencing for pollution offences.

In several authorities, noise cases took a long time to get to court: officers reported delays of 3-6 months and exceptionally up to one year, to obtain a date for a hearing.

6.5.11.9 EHOs' Perceptions of Magistrates' Courts

Most officers considered that Magistrates had a fairly good opinion of EHOs and respected their professional judgement and expertise. This contrasts with some other studies of local authority enforcement agencies (for example, Cranston, 1979; Hutter, 1984), where enforcement officers considered their status in the eyes of magistrates to be below that of the police.

Most officers interviewed in the survey gave evidence in court infrequently (usually only a few times a year). However, as they used neighbourhood noise provisions on a day-to-day basis, they considered their knowledge of legal procedures in this area to be far superior to that of the magistrates. As neighbourhood noise cases (and pollution cases in general) so rarely come to court, magistrates have little opportunity to gain a working familiarity with COPA, in the way that they do with motoring offences, for instance. Some officers preferred taking cases before stipendiary magistrates, who were better versed in the legal aspects, but others expressed a preference for lay benches, since officers thought they were less officious than stipendiaries. Where the presentation of technical evidence was concerned, however, officers had no preference regarding lay or stipendiary magistrates.

6.5.11.10 Pre-empting the Courts

The accommodative approach means that for the vast majority of cases the courts are effectively cut out of the system of law enforcement, and enforcement discretion remains in the hands of the LA. However, the possibility that a case may eventually go to court remains in the background and substantially influences procedures in

the EHD. Officers' reluctance to serve statutory notices unless they had personally witnessed the noise was a precautionary measure both against becoming unwittingly involved in a neighbour dispute, and also against embarking on a course of action which could end up in court, without a solid foundation of evidence. Record keeping was also designed for evidentiary purposes: both in the event of going to court or if the LA was referred to the Ombudsman.

If officers considered that a business was employing the BPM to control noise, they seldom served a notice. Councillors intervened in cases where enforcement of a notice could result in redundancies. According to the Legal Model, in both these instances the courts should make the final decision in relation to the question of BPM: instead the LAs have effectively pre-empted the courts.

The very high conviction rates in noise prosecutions (as shown by statistics in the annual reports of the IEHO) are probably due to the fact that LAs are reluctant to institute legal proceedings unless they are fairly certain that the outcome will be successful. In many cases it may also be true that defendants plead guilty. Although there are no national statistics for the proportion of not-guilty to guilty pleas for neighbourhood noise cases, a recent study of prosecutions initiated by non-police agencies reported that, "The overall picture that one derives of plea, outcome and representation in non-police cases is....one of agency employees or solicitors prosecuting unrepresented defendants, who almost invariably plead guilty - but who when they do plead not guilty, are nevertheless usually found guilty - and are usually fined £50 or less" (Lidstone et al., 1980).

Skolnick (1966) points out that guilty pleas effectively mean justice without trial. Not only do very few neighbourhood noise cases come to court (the IEHO data suggest only about 1-2% of confirmed noise nuisances), but if those that do mostly result in pleas of guilty, then there are very few opportunities for magistrates to become familiar with the legal provisions, or for the law to receive judicial

interpretation in the higher courts.

6.5.11.11 Efficiency of EHDs

It is nearly impossible to derive indicators of efficiency with respect to enforcement work. For instance, Banton (1964) and Laurie (1970) noted with respect to the police that there were no straightforward indicators of efficiency. The police themselves may use the "clearance rate" as a measure of efficiency (Skolnick, 1966), which is the percentage of crimes known to the police which are solved. But Banton (1964) comments that if a force solved more crimes but treated suspects with undue severity, it would in one sense be more efficient, but not in any acceptable sense. In one EHD, the number of statutory notices served was considered to be an efficiency indicator, but in other authorities this approach was eschewed as it was considered superficial.

This general problem is also compounded where noise control is concerned as it is very difficult to monitor noise levels to give any meaningful indications of the trend in average or ambient levels (Cresswell, 1979).

6.6 CONCLUSIONS

The main operational constraints on the enforcement of the legal mandate for neighbourhood noise which have been identified in this Chapter can be classified under six broad headings:

1. the role of the enforcement agent;
2. resources for enforcement;
3. the organisation of enforcement;
4. the process of enforcement;
5. the environment of enforcement;
6. case-specific factors.

These are considered in more depth in Sections 6.6.1 to 6.6.6.

6.6.1 The Role of the Enforcement Agent

The way in which enforcement agents perceive their role will influence their attitude towards the stringency with which the law should be enforced. The enforcement function is only one aspect of a job that encompasses regulatory, advisory and educational functions. EHOs' primary role in protecting and promoting human health has a long historical precedent going back to the 1840s. The major change in empahsis of the job over the years has been the broadening perception of the extent to which environmental factors influence health. The noise survey found indications that the younger generation of EHOs were more eager to define their job in terms of protecting the local environment and, as a result, were possibly more willing to resort to formal methods of enforcement. Whether the attitudes of the younger generation of officers will remain unchanged, or will become more conservative as they reach more senior positions in the environmental health profession is a matter for conjecture.

6.6.2 The Organisation of Enforcement

The manner in which an enforcement agency is organised will influence the procedures adopted for enforcing the legal mandate. EHDs, as part of local government, are organised on formal bureaucratic lines. The survey found that decisions were made on the basis of referral up the office hierarchy. The extent to which officers could make decisions independently from elected members varied from authority to authority. In some authorities, committee approval had to be sought before formal notices could be served or prosecution proceedings initiated. There appeared to be a positive correlation between the extent to which these decision-making powers had been delegated to individual officers and the degree of urbanisation of the LA. Informal enforcement actions, however, were at the discretion of the District Officers: only if the decision to 'go formal' was made, did cases need to be referred to senior officers, to the Legal Department and to council members.

EHOs were traditionally generalists, but the increasing ambit and technicality of the environmental health function has led to increasing specialisation and to the division of the workload on a functional basis, particularly in urban authorities. In comparision to housing and social services, environmental health is not a very politicised issue at local government level. Policies for environmental health may thus depend much more on professional, rather than political views. Technical matters, such as noise, are, in addition, more suited to decision-making at officer level.

6.6.3 Resources for Enforcement

A major constraint on enforcement is the level of resources - in terms of budget, staffing (both level of training and numbers employed) and provision of equipment - which can be devoted to this function. Resource constraints mean that not all the law can be enforced all the time, and decisions have to be made concerning priorities of enforcement.

The noise survey demonstrated the variation in resource base between LAs, itself a reflection of the inherent diversity of local government.

The control of noise is just one of many competing demands placed on the LA budget. The increase in the level of complaint about neighbourhood noise has occurred at a time when Central Government controls over local authority spending are stricter than ever before (Macrory, 1986a). The noise survey found that several EHDs had adopted administrative procedures which effectively by-passed any investigation of domestic noise complaints, or which provided a "sifting" technique to defer investigation until the complainant contacted the EHD for a second time. In at least two authorities, the reason given for the adoption of these procedures was the lack of resources to enable full investigation of the rising number of domestic complaints. However, in other authorities a partial, if not complete, explanation was that these procedures amounted to deferral

tactics enabling the investigation of domestic noise cases to be delayed. Officers generally considered the investigation of these cases to be frustrating and unrewarding, because of reasons such as the possibility of becoming involved in a neighbour dispute and the difficulty of witnessing the noise. In contrast, in all authorities visited, complaints about industrial or commercial noise received an immediate response from officers.

Thirteen of the eighteen authorities visited had no policy to establish a NAZ in the forseeable future, the major reason being that the LAs did not consider zones to be cost-effective.

6.6.4 The Process of Enforcement

The characteristic features of the process of enforcement will also, in effect, impose further constraints on the practical expression of the legal mandate. These included the following:

a. The reactive approach to enforcement, which meant that resources were allocated according to public complaint;
b. The conciliatory enforcement strategy and the system of extended cautioning;
c. Procedural requirements, such as the necessity for EHOs to witness a noise nuisance before taking any formal action;
d. Recourse to alternative statutory arrangements, such as licensing laws and planning provisions;
e. Routine procedures developed for common sources of complaint;
f. Historical precedents and possible inertia to policy change, for example, the LA where a byelaw system was used to deal with noise from amplified music and noisy animals;
g. Pre-empting the courts.

6.6.5 The Environment of Enforcement

The "environment" of enforcement refers to the influence of other participants, aside from the enforcement agency itself, in the

enforcement process. These included other council department (such as the Legal Department and the Planning Department), the appropriate council committee and the local magistrates' court.

The reactive approach to the enforcement of neighbourhood noise legislation means that the public creates the initial demand for enforcement action by mobilising the law in the first instance. The pattern of enforcement behaviour is therefore influenced by who complains and why. Questions then arise as to what factors influence the nature and level of complaint. The local characteristics and requirements of the area served by the LA are influential factors: urban authorities receiving substantially more complaints about noise than rural areas. However, the national increase in complaints to EHDs about noise, and in particular the rapid increase in domestic complaints, is a problem facing all authorities. 71% of complaints in the noise complaint questionnaire concerned domestic noise, and the consensus of opinion amongst the officers interviewed was that the COPA provisions rarely provided an effective remedy for these sorts of noise problem.

The response of the LA can itself influence the level of complaint. For instance, if an authority has a noisy party patrol and advertises the fact to the local community, then people will complain to the LA (rather than to the police or not at all) if they are disturbed by a party. In addition, the local democratic process - whereby councillors are elected by the local community - may in turn influence the level of resources that is assigned to, and the policies adopted by, the EHD.

6.6.6 Case Specific Factors

Case specific factors are covered by Hutter's (1984) typology:

a. The nature of the complaint;
b. The motivation of the complainant;
c. The seriousness of the offence;
d. The persistence of the offence;
e. The character of the offender.

The Chapter has described how authorities tended to adopt different enforcement procedures depending on whether the complaint concerned domestic or industrial/commercial noise. The motivation of the complainant also influenced enforcement tactics, officers being particularly reluctant to become involved in neighbour disputes. Officers were more likely to consider a noise to be a nuisance if it was a very serious one-off incident, or if it occurred repeatedly. The character of the offender was an influential factor in the differential treatment afforded to "behavioural" and "technical" nuisances. Officers reported that they tended to adopt a more sanctioning approach for behavioural (typically domestic) nuisance than for technical (typically industrial or commercial) nuisances. This was because officers more rapidly came to typify behavioural offenders as negligent or anti-social, hence deserving of stricter treatment than technical offenders, whose failure to comply was often due to technical or economic problems rather than unwillingness or negligence as such. The noisy party patrols operated by some of the London boroughs were an example of a more sanctioning, interventionist approach which had been adopted to deal with nuisances which typically were behavioural.

6.6.7 Use of Technology

This Chapter has demonstrated the difference between domestic and industrial/commercial noise concerning the use by EHOs of technology in monitoring and assessment of nuisance. Apart from a case of poor sound proofing between converted flats, none of the cases of domestic noise in the noise complaint questionnaire were monitored as an aid to establishing nuisance. In contrast, all EHOs in the survey said that they monitored industrial or commercial noises of a mechanical nature using the BS 4142 procedure. There were two main reasons for officers' reluctance to use technology for domestic noise investigations:

a. The lack of any appropriate noise rating for domestic noise;
b. Unless the nuisance was caused by poor sound insulation, there was

generally no need to monitor domestic noise in order to propose suitable methods of abatement - unlike industrial or commercial noises of a mechanical nature.

Although BS 4142 does not provide unequivocal evidence of a nuisance, its use by officers for industrial and commercial nuisance assessments appeared to fulfil some sort of role as an 'objective shield'.

CHAPTER 7

THEMES, RECOMMENDATIONS AND CONCLUSIONS FROM INTEGRATING THE THREE MODELS

7.1 INTRODUCTION

This Chapter deals with the integration of the three conceptual models. Conclusions specifically relating to each of the three models have already been presented at the end of each of the relevant Chapters. This material is not repeated here, but provides the basis for the integration of the models, and for the generation of themes, recommendations and conclusions concerning the use of science in neighbourhood noise legislation and the implications for legislative design, enforcement and for the future of neighbourhood noise regulation. The discussion is broadened by considering examples from other areas of pollution regulation and also from areas of 'automated justice'.

A further objective of the Chapter is to consider whether the novel interdisciplinary approach used in the thesis has fulfilled its aim of uncovering new insights into the policy process, which cannot be discerned from single disciplinary studies. The Chapter concludes with a critique of the interdisciplinary approach, and considers its applicability to other policy sectors.

The three conceptual models used in the thesis focus on neighbourhood noise, but each one has a broader conceptual basis. Each model provides a complementary perspective of the neighbourhood noise policy process. An overall picture of the policy process is gained by considering all three models and their integration.

To reiterate, in the Legal Model the organising concept is the formal structure of the law. Chapter 3 dealt with the first part of the Legal Model - the history of neighbourhood noise legislation and associated policy - and showed that the legal mandate for neighbourhood noise has

become more technically specific with time. It traced the origins of this trend and identified several factors which have encouraged the incorporation of scientific and technical terms and criteria into the legal mandate.

Chapter 4 comprised the second part of the Legal Model. It examined the extent to which the substantive provisions of the legal mandate for neighbourhood noise constrain enforcement discretion, and predicted that, from the perspective of the Legal Model, increasing technical input to legislation would be expected to lead to the adoption by enforcement agents of a more sanctioning enforcement strategy.

The Technical Model examines the scientific process of quantifying the relationship between a pollutant and its effects on people or the environment, as the basis for the determination of acceptability criteria and regulatory standards for pollution control. Chapter 5, by tracing the history of noise measurement and rating, examined the key characteristics which underlie this process with respect to environmental noise.

In contrast to the Legal Model, the Operational Model is concerned with the practical expression of legislation and the behaviour of the enforcement agency. In Chapter 6 the operational constraints on the enforcement of neighbourhood noise legislation were identified from a questionnaire and interview survey of a sample of EHDs. The extent to which noise measuring equipment is used in the enforcement process was examined.

General themes concerned with the use of scientific and technical criteria in the legal mandate, and the implications for the design of legislation, for enforcement, and for the future of neighbourhood noise regulation are developed from a consideration of the interfaces - the areas of overlap - of the three models, and finally from drawing all three models together. The interfaces are considered in the

following order:

1. Legal model with operational model
2. Technical model with legal model
3. Technical model with operational model
4. Technical, legal and operational models

7.2 LEGAL WITH OPERATIONAL MODELS

7.2.1. Will Technical Specificity Lead to a More Sanctioning Style of Enforcement?

Chapter 4 - the second part of the Legal Model - showed that increasing technical specificity in the legal mandate reduces discretion to determine unlawful behaviour. The incorporation of scientific and technical criteria tends to make legislation more rule-bound. The provisions in Part III of COPA contain a spectrum of technical specificity, from nuisance at one end to the NAZ regulations at the other. The discretion involved in assessing whether a registered noise level in a NAZ has been exceeded is very much less than the discretion involved in determining whether a noise is a nuisance. The discretion involved in the determination of the former is minimal. Provided the measurement procedure has been followed correctly (for example, readings have been made with correctly calibrated meters at the correct locations and in suitable weather conditions), then, if the meter reading is above the registered level, strictly speaking this is an offence for which no statutory defences are available.

By contrast, the legal mandate affords considerable discretion to EHOs to determine what is a noise nuisance. Chapter 4 made the point that an offence under s.s 58/59 of COPA is committed not when a noise nuisance occurs, but when the terms of a noise abatement notice or order are contravened without a reasonable excuse. The terms of a notice or order can be very specific, for example providing decibel limits which must not be exceeded. However, as the service of a notice

or the making of an order is a response to the existence of a noise nuisance, the determination of unlawful behaviour ultimately hinges on the question of what is a noise nuisance.

Although the statutory provisions (particularly grounds for appeal and statutory defences) and judicial precedents (such as the High Court judgement in L.B. Tower Hamlets v Manzoni and Walder ((1984) 148 JP 123) that a noise nuisance must emanate from 'premises') place some bounds on the definition of noise nuisance, substantial discretion remains within these bounds.

This discretion is circumscribed to some extent for industrial and commercial noise by the use by EHOs of BS 4142. This provides a set of technical "rules" by which to quantify the likelihood of noise from factories, industrial premises and other fixed installations giving rise to public complaint and, by implication, constituting a nuisance. The standard does not, however, have legal status nor does it set out to provide incontrovertible evidence of a nuisance. The Operational Model found that, although most officers considered BS 4142 to be a useful guide, in the final analysis their decisions concerning industrial noise nuisance still relied to an extent on subjective judgement (as increases in noise levels less than 10 dB(A) above the ambient could amount to a nuisance, depending on the characteristics of the noise).

Unlike BS 4142 and industrial noise, no noise ratings have been developed for general use which deal specifically with domestic noise or with the commonest source of domestic noise - amplified music. For these sorts of noise, officers relied completely on their personal judgement. The Operational Model found some congruence between officers' methods of assessing the nuisance-value of these types of noise. For example, several officers said they were more likely to assess amplified music as a nuisance if the words of a song could be heard clearly in the complainants' premises, and noisy parties were more likely to be considered as nuisances if they continued after midnight. In effect, officers had developed certain unwritten

'operational norms', based on experience and on a common-sense approach, as an aid to their assessment of noise nuisance.

By providing specific criteria which must be taken into account where noise from construction works, ice-cream chimes, burglar alarms and model aircraft is concerned, the codes of practice approved for use under s.71 of COPA also reduce the discretion inherent in the determination of nuisance or best practicable means for these sorts of noise (or, in the case of ice-cream chimes in s.62(3)c, 'reasonable cause for annoyance to persons in the vicinity'). The codes additionally provide detailed information to potential transgressors to help them comply with the law (for example, compare the information contained in BS 5228 - and summarised in Chapter 4 - with the general requirement of notices served under s. 60 of COPA to use the 'best practicable means' for controlling noise on construction sites). The codes do not in themselves create offences or mandatory legal requirements, however. Although the provisions of any relevant code of practice must be taken into account in determining BPM (s.72(6)), they do not have any formal legal status where the assessment of nuisance is concerned. From an operational perspective, however, the codes are used as reference standards for both BPM and nuisance.

Although what has been described in this thesis as a broad 'sanctioning' discretion (see Section 1.4) applies in British law, from the perspective of the Legal Model, it is arguable that a more technically explicit style of legislation should lead to the adoption of a stricter style of enforcement. This is because a decision not to prosecute a breach of a quantitative limit is more 'visible' than a decision not to prosecute in instances where the criterion of legality is vague or broadly drawn. A precise mandate also makes prosecution an easier path to take, since there will tend to be fewer points for dispute in court.

The Legal Model acknowledges two factors which may dilute the predicted effect of increasing technical specificity in legislation. One is that official advice to authorities tends to advocate a

reasonably conciliatory approach to enforcement. For example, although the offence of exceeding a registered level in a NAZ is one where EHOs have minimal discretion to determine unlawful behaviour, official advice to authorities in Circular 2/76 encourages officers to use their sanctioning discretion in deciding whether or not to prosecute a breach of the provisions. The circular states that "There will naturally be some variations of level about the values recorded [in the noise level register]. This is inevitable and it is not intended that individual measurements should lead to the prosecution of those responsible. But where monitoring shows that there is a consistently measurable increase in noise levels, even if small, of a more permanent nature the person responsible will be liable to prosecution for an offence".

The second factor concerns the effect of procedural provisions. Although the substantive law may define an unlawful act in precise, quantitative terms, procedural provisions such as statutory defences and grounds for appeal against statutory notices and consents (which use phrases such as 'best practicable means' and 'reasonable excuse') add further elements to the establishment of criminal liability which increase the scope for the exercise of discretion by enforcement agents and by the judiciary. The procedural law can therefore 'dilute' to some extent the precision of technically explicit substantive provisions. Although there are no statutory defences to the offence of exceeding a registered level in a NAZ (s.65 COPA), the defence of best practicable means is available for the offence of failing to comply with a noise reduction notice served under s.66.

However, once the problem is viewed from the perspective of the Operational Model, the influence of operational constraints, in particular the predominantly conciliatory approach described in Chapter 6, may well counteract the trend towards the more sanctioning enforcement style predicted by the Legal Model. In practice, EHOs tended to use formal sanctions as a last resort, after informal methods had been tried - and had failed - or if, in their estimation,

informal methods would be ineffective against particularly recalcitrant offenders. Officers' major objectives were to abate noise nuisances, and to placate complainants, and these ends, they argued, could be achieved more effectively by employing a predominantly conciliatory approach.

Chapter 6 identified the following operational constraints acting on the exercise of enforcement discretion by EHOs in relation to neighbourhood noise legislation:

1. The perceived role of the enforcement agent
2. Resources for enforcement
3. The organisation of enforcement
4. The process of enforcement
5. The environment of enforcement
6. Case specific factors

The specific influences at work under these broad headings were discussed in Chapter 6 and will not be rehearsed here, other than to reassert that they all play a part in influencing the practical expression of the legal mandate. Two examples are given below which highlight the significance of operational factors in the enforcement process.

The first example concerns the different approaches adopted by some EHOs with regard to domestic noise nuisances and industrial/commercial nuisances. Table 6.9 in Chapter 6 showed that prosecution rates for domestic noise nuisance have increased slightly since the start of the present decade and are now higher than for industrial or commercial noise, although the rate of increase is so small that it is difficult to tell whether the trend is significant. Nevertheless, several officers inferred that they tended to adopt a more sanctioning approach to domestic noise nuisances than to industrial or commercial noise nuisances. Explanations for this were proposed in Chapter 6. One reason was that officers adopted a 'lenient' approach to industry, particularly in several urban authorities where unemployment was a major local issue. These councils were particularly keen to promote local employment prospects, and there was a general reluctance to

enforce statutory notices where it was thought that this might lead to employees being made redundant.

The other explanation was found in the observation by some officers that most domestic problems tended to be of a 'behavioural' nature, while most industrial/commercial problems were of a 'technical' nature. A 'behavioural' nuisance was one whose abatement did not require expenditure on remedial work, but merely required the offender to refrain from doing something (such as playing loud music or holding noisy parties). In constrast, a 'technical' nuisance was one whose abatement involved expenditure on acoustic insulation or on the installation of quieter equipment. Such work could take several months to complete and in some cases there was no guarantee that the suggested abatement method would be successful.

Not all noise nuisances fitted neatly into the behavioural and technical categories. A noise nuisance caused by a factory starting to work a night-shift was 'behavioural' in as much as the nuisance could be abated by stopping the night-shift. It was also 'technical' because an economic interest was involved: stopping the night-shift would cause the company to lose money. Officers were inclined to treat cases such as these as 'technical' since the economic aspect was of overriding significance and had to be considered in relation to the defence of best practicable means. Noise nuisance resulting from pay parties also fitted both categories. However, officers considered these to be more behavioural than technical as the economic interests at stake were in any case illegal ones.

As mentioned in Chapter 2, previous work on the enforcement of legislation dealing with water pollution (Hawkins, 1984a), trade effluent control (Richardson, 1982) and the whole range of environmental health matters (Hutter, 1984), considered that 'moral fault' was a major factor influencing agencies' prosecution policies. By 'moral fault', it was meant that, although from a legal perspective the offences were ones of strict liability, in practice officers would only prosecute as a last resort, when cooperation and negotiation had

failed to gain compliance with the law, or if a breach of the law had caused harm, had been intentional or the result of gross negligence. It was as if officers reintroduced at the operational level the concept of 'mens rea', which, to all intents and purposes, had been abandoned at the legal level.

Although the present study did not examine the question of moral fault in any great depth, the division between behavioural and technical nuisances is of relevance here. Behavioural nuisances were those which could be abated without financial outlay. Officers considered that 'reasonable' people should be prepared to abate a behavioural nuisance as soon as they had been informed of the fact that they were causing one. Officers rapidly came to characterise a failure to comply with the LA's demands for remedying a behavioural nuisance as 'unreasonable' (and hence more likely to carry the stigma of 'moral fault'), so meriting a more stringent response from the authority. Even the most reasonable and diligent of people could, however, fail to abate a technical nuisance if faced with technical or economic problems. But if those responsible for a technical nuisance exaggerated the extent of their problems, or were dilatory in their attempts to comply with the LA's requirements, then this prompted officers to adopt a stricter approach.

The second example concerns the observation in Chaper 6 that the younger generation of EHOs were more eager to define their role in terms of protecting the local environment and, as a consequence, were possibly less reluctant to resort to formal action than their predecessors. No empirical data were gained on this point, so it remains a supposition. Any overall effect on prosecution rates will depend on the extent to which powers to serve abatement notices and to initiate prosecution proceedings are delegated to the younger - and more junior - officers. Although these powers varied from authority to authority (the London and metropolitan boroughs tended to delegate more powers to officers than the rural authorities), in all the authorities surveyed any decision to initiate prosecution proceedings required approval from departmental management at least, if not

additionally from the relevant council committee. This process of upward referral meant that conformity was achieved between officers with regard to their stringency of approach to enforcement, and tended to act as a check on younger officers who may have been more zealous in their propensity to resort to formal methods. Whether the attitudes of the younger generation of EHOs will stay the same or become more conservative as they reach more senior positions is a matter for conjecture.

Some critics of regulatory enforcement argue that, by leaving little room for enforcement discretion, precise legislation with clear, unambiguous goals should produce a stricter enforcement of the law, and hence more effective regulatory control, than vague legislation with a lack of clear, stated objectives (for example, Noll, 1971). This, in effect, is the same as the assertion of the Legal Model, concerning the implications of technical specificity on enforcement. But the Operational Model, by highlighting the importance of operational constraints, shows that the question of stringency of enforcement practice cannot be considered solely in relation to the legal constraints operating on the enforcement system. It is asserted that whether legal or operational constraints will play the most influential role cannot be determined without due consideration of both sets of factors. Kagan (1978) makes this point well:

> "Legal scholars have always tended to explain legal decision making by reference to authoritative legal sources - statutes and legislative reports, court opinions, and the arguments of counsel. Social scientists, on the other hand, have tended to picture legal institutions as responsive primarily to non-legal factors."
>
> "I see no reason to choose between these various approaches and every reason not to. It should be obvious that regulatory agencies, like all legal institutions, are simultaneously influenced by both legal and non-legal factors."

The implementation by LAs of noise abatement zones provides a good example of the difficulties of disentangling the relative effects of legal and operational constraints on the process of enforcement, or, in Kagan's words (1978), the "dialectic between legal and non-

legal factors". The Legal Model pointed out that exceeding the registered noise level from classified premises within a NAZ provides EHOs with little discretion to determine unlawful behaviour, and so, it could be asserted, will lead to the adoption by EHDs of a more stringent enforcement policy. The situation is somewhat complicated both by official advice to LAs advocating a fairly conciliatory use of sanctioning discretion and by the fact that, unlike the mandatory duty on LAs to investigate noise nuisances (s.57 of COPA), the decision to establish a NAZ is at the discretion of the LA ("A local authority may by order.....designate all or any part of its area a noise abatement zone" (s.63(1))).

As a preventive measure, and one which escapes from the limitations inherent in the nuisance approach to neighbourhood noise control, the concept of a NAZ appears sound. However, the IEHO consider that the policy has failed. Chapter 6 mentioned that the IEHO annual report for 1985/86 listed only 54 zones in operation (out of a total of 402 district councils and London boroughs in England and Wales).

The Operational Model found the major problem with NAZs was that many LAs considered they were not cost-effective. No extra resources were made available to LAs to set up zones (Circular 2/76) and so, from the outset, critics were suggesting that the time-consuming and resource-intensive monitoring associated with establishing zones was beyond the resources of many LAs (eg. Reynolds, 1977). Judging by the results of the present survey, and also from Wright (1982), these early criticisms have proved to be correct. Thirteen of the eighteen authorities visited had no policy to establish a zone in the forseeable future, two had designated a zone but had not undertaken a noise survey, and three had NAZs in operation. The major reason provided by officers for not setting up zones was that their authorities had insufficient resources to take on adequately trained staff, or to release staff from other noise control responsibilities, in order to enable the time-consuming duties associated with implementing a NAZ to be carried out. The rising level of noise complaints has meant that, depending on how LAs interpret their

responsibilities under s.57, officer time is increasingly taken up with investigating complaints.

Under the heading of 'alternative' NAZs, Chapter 6 also discussed suggestions raised in the literature to make the implementation of zones more cost-effective, either by reducing the number of measurement points around the noise boundary of a zone, or by reducing the size of a zone. These may be of use to some authorities in the control of specific noise problems, but it is unlikely whether recommendations such as these will be sufficient to prompt a revival of local authority interest in NAZs, since the IEHO have already written off zones as "bureaucratic and unworkable" (Institution of Environmental Health Officers, 1984, p.25).

In addition, the Operational Model did not find any evidence to suggest that, in those authorities with zones, officers were necessarily taking a stricter approach to prosecuting a failure to comply with the registered levels in a NAZ, than they were regarding failure to comply with the terms of an abatement notice or consent.

7.2.2. The Appropriateness of Criminal Sanctions

Chapter 2 described how the use of the criminal sanction for regulatory purposes has given rise to a body of literature in relation to what Kadish (1963) described as the "problem of moral neutrality", by which he meant the consequences of applying the criminal law to control types of behaviour which in everyday terms are not considered to be 'crimes'. Tench (1981), for example, commented:

> "It surely is ridiculous for Parliament to go on legislating to make things crimes which no civilised individual really regards as criminal. It makes the law look silly. It debases the coinage of the criminal law. It adds greatly to the expense and bureaucracy of enforcing the law."

In addition to the moral neutrality of regulatory offences, Chapter 2 also pointed out that they are usually offences of strict liability, meaning that the establishment of criminal liability does

not depend on proving "mens rea" (usually some sort of intention or recklessness). Some writers assert that both these factors mean that enforcement agencies are disinclined to prosecute and magistrates and juries to convict for behaviour they equate with socially acceptable business practice (for example, Kadish, 1963).

In order to get round the problem of moral neutrality, Tench (1981) proposed a 'middle system of law' to regulate some matters without making them criminal. In this system sanctions would take the form of civil penalties, which could be imposed directly by the appropriate enforcement agency without the need to go to court. Provision could be made for appeals to the court if the parties could not agree either as to liability (which would be strict) or to the amount of the penalty. A two-tier system could operate, with civil penalties for minor infringements of regulatory legislation, and criminal prosecution for serious, flagrant or wilful infringements. Tench's middle system of law was based on the civil penalties found in many regulatory laws in the United States and West Germany, and also on the precedent established by British tax laws and the fixed penalty system already operating in this country for various minor traffic offences.

Aside from offering a solution to the problem of moral neutrality, Tench also considered that civil penalties were cheaper than prosecution, both in terms of the time and expense saved by the enforcement agency in not having to take a case to court, and also in terms of the saving to the public from relieving the burden on the courts. Several studies of enforcement agencies have also commented on the cost incurred by the agency in mounting a prosecution (for example, Carson, 1970a; Cranston, 1979; Kelman, 1984; Veljanovski, 1983 and 1984). Veljanovski (1983), for instance, maintained that a prosecution was from eight to ten times more time-consuming to the Factory Inspectorate than the average factory visit.

The question of whether a civil penalty would provide a more effective sanction than criminal prosecution for a breach of neighbourhood noise legislation is one which demands further research. The present study

can offer no more than an informed guess in answer to this question, based on the following explanations from the Operational Model as to why EHOs tended to use prosecution, in most cases at least, as a last resort:

1. Officers considered that in most cases conciliation was sufficient to achieve the objective of enforcement, which was to gain compliance with the law rather than to punish a breach. Officers employed a range of techniques to try to gain compliance, described in Chapter 6 as the 'system of extended cautioning'. The use of the criminal sanction was the ultimate weapon in their armoury of enforcement tactics, and was often preceded by threats that it would be used if the alleged offence continued.

2. Officers were generally unwilling to adopt formal enforcement measures unless they had witnessed a noise for themselves. This was a precaution both against becoming unwittingly involved in a neighbour dispute, and also against embarking on a course of action which could end up in court without a solid foundation of evidence. Officers found it particularly difficult to witness domestic noise, owing to its unpredictable nature and its tendency to occur outside working hours. Although automatic noise monitoring and recording can indicate that there may be a problem, it does not provide unequivocal evidence of a nuisance, especially of a domestic noise nuisance. This is because it cannot identify the source of the noise. It is reasonable to conclude that noises of an industrial or commercial nature originate outside the complainant's home. In a recording of amplified music, however, it is difficult to determine whether the noise actually came from a neighbour or had been fabricated on the complainant's own stereo.

3. If officers considered that a case merited prosecution, their decision had to be ratified by departmental management, by the Legal Department and, in some authorities, by the relevant council committee. The issues raised by this process of referral have been mentioned in Chapter 6, but it is worth repeating here that officers

in some authorities complained that the Legal Department was only prepared to handle watertight cases, for fear of the costs involved in losing a case, as local authority costs are not paid out of central funds. Although there is a general correlation between the level of costs, the level of fines and the financial standing of the party ordered to pay costs, the specific rationale behind the allocation of costs varies from court to court (Macrory, pers. comm.). Some courts do not award costs; some only refund the cost of court attendance; and some pay full costs covering preparation time, attendance time, expert assistance and legal costs.

4. Owing to the fact that EHDs dispose of most neighbourhood noise cases without going to court, the courts themselves have little opportunity to gain familiarity with the relevant legislation. An officer from one of the London boroughs in the pilot survey recounted a s.59 case he had heard about, where the magistrates had misunderstood that the plaintiff was taking action under COPA and had bound the defendant over to keep the peace.

5. As EHOs use neighbourhood noise law in a practical sense every day, they considered that their knowledge of it was superior to that of the magistrates. Consequently it sometimes appeared that officers were reluctant to prosecute, as they thereby had to relinquish control of a case and leave its fate in the hands of other actors - staff in the Legal Department, court clerks and magistrates - who, they considered, had inadequate knowledge of the law and of the seriousness of infringements. Most officers thought that the level of fines awarded by the courts was low.

6. Officers considered that taking a case to court was expensive in terms of time and money. In order to mount a prosecution, EHOs needed to obtain evidence (and if this involved noise monitoring, officers had to ensure that they had followed the stated procedures rigorously), draft witness statements, liaise with management and legal staff, possibly wait for the council committee to approve the initiation of proceedings and finally give evidence in court.

In practice, moral neutrality did not seem to pose a problem for EHOs. Criminal sanctions were seen as a last resort, not because officers considered it unfair to brand someone a criminal for failing to comply with a notice or for exceeding a registered level in a NAZ, but because conciliation (for the reasons given above) was usually more effective than prosecution. In one sense the distinction between technical and behavioural offenders was one of moral fault, but from a purely practical perspective it was simply one of the difference between noise nuisances where prosecution might induce their abatement, given that conciliation had failed (ie. behavioural nuisances) and noise nuisances where it was considered unlikely whether anything was to be gained by prosecution (ie. technical nuisances).

Hawkins (1984a) considered that the term 'moral neutrality' missed the point: rather than regulatory crimes being 'morally neutral', he considered that 'morally problematic' was a more appropriate epithet. This stems from the moral and political ambivalence surrounding the regulation of business and industrial interests, where the enforcement agency is caught in the middle between the two opposing interests of public welfare and industry, the latter being considered to be responsible for the material well-being of the community. The defence of 'best practicable means' for noise nuisances caused by trade or industry, for instance, captures the essence of this ambivalence. So too does the 'lenient' attitude displayed by some LAs towards industry in a time of recession, described in the preceding section and in Chapter 6.

Civil penalties may indeed be a less expensive solution than criminal prosecutions, as, unless the facts of a case are disputed, the courts do not need to become involved. EHOs would still have to obtain evidence of a breach, and for domestic noise in particular this was often the most time-consuming factor. Although some officers considered that the stigma of a criminal prosecution was a good deterrent, this must be off-set against the generally low level of

fines awarded by magistrates' courts.

Several officers reported that the threat of removing an entertainment licence was a good enforcement tactic, since loss of a licence was effectively a bigger financial penalty than a fine under COPA. Similarly with the contractual arrangements used by some councils in preference to s.61 to control construction noise from their own developments. On this basis, provided that civil penalties were pitched high enough, they should afford a better financial incentive to comply than do the present fines awarded under Part III of COPA.

7.3 TECHNICAL WITH LEGAL MODELS

7.3.1 The Acoustic Instrumentation Industry is Regulation-Led

Chapter 5 revealed that many developments in noise measurement instrumentation are consequent upon the formation of standards, particularly legal, or quasi-legal standards such as codes of practice. The Managing Director of an acoustic instrumentation firm considered that the industry was 'regulation-led' (Campbell, pers. comm.). To justify substantial research and development costs, there has to be an actual or a potential market for a product, and that market is generally created by regulatory moves. As Mr Campbell remarked, "Nobody measures noise unless they have to".

The acoustic instrumentation industry has representatives on the relevant technical committees of the national (BSI) and international (ISO and IEC) standardising bodies. Consultation between the British government and BSI and between the European Commission and ISO or IEC, prior to new regulatory developments, means that the policy process is not simply a top-down affair. The phrase 'regulation-led' may be rather misleading. It is not used here in the sense of 'technology forcing', as is the case with certain EEC noise Directives which specify product standards unattainable with present technology, that industry must try to comply with in future (see Chapter 3). It is rather that the acoustic instrumentation industry

responds to, and effectively co-evolves with, developments in noise regulation.

The basic potential of acoustic instrumentation, and consequently the technical design of regulatory standards, are limited by technical feasibility. The use of microprocessors has revolutionised the industry, in as much as the potential now exists to develop portable instrumentation which can compute automatically virtually any noise rating desired, even such complex measures of loudness as the Zwicker phon (see Chapter 5). Although the development of such instrumentation is not now limited by technical feasibility, the question still remains of whether or not a more complex rating scale really affords any practical benefit. Zwicker's method provides a more faithful measure of loudness than does the A-weighting scale. But, as noise-induced annoyance may depend on several factors in addition to loudness (see Chapter 5), the increase in the accuracy of the loudness estimate obtained by the use of Zwicker's method may be off-set completely by the uncertainty remaining in estimating the influence of these other factors. Whilst international standards for environmental noise (apart from some aircraft noise ratings) continue to make use of the A-weighting, it is unlikely that there will be much demand for a Zwicker-phon meter. Standards produced by ISO or IEC represent a technical consensus reached after rounds of draft-writing, commenting and voting by representatives of the member bodies (Robinson, 1980). Although their adoption is voluntary, there is nevertheless considerable commercial pressure for member bodies to conform with these instrumentation standards.

7.3.2. Science in Court

As discussed earlier (Section 7.2.1), technical specificity in the legal mandate tends to reduce enforcement discretion. It also tends to reduce the scope for judicial discretion by decreasing the number of points for dispute in court. The use of a quantitative standard should facilitate the production of unequivocal evidence on behalf of

the prosecution. There is little discretion involved in deciding whether a meter reading is above the critical level at which the behaviour in question becomes unlawful. For instance, proof of exceeding a registered noise level in a NAZ does not involve anything much different from proof of exceeding a speed limit.

Nevertheless, the capacity of scientific and technical criteria to confound a lay magistracy should not be omitted from the argument. This problem was highlighted by a court case involving BS 4142, described in Chapter 6, where acoustic consultants hired by the defence managed to confuse the magistrates. The consultants had used the notional background level in their assessment according to BS 4142, instead of the measured background level used by the Environmental Health Department. BS 4142, however, is a poor example of scientific certainty: it does not provide unequivocal proof of a nuisance, nor does it claim to do so. Added to this, it has no legal status, although after years of use in planning inquiries and nuisance cases, it has now achieved a 'quasi-legal' status.

But even when a technical method produces results which, from a scientific perspective, are unequivocal, defence lawyers and consultants may still be able to find pitfalls in both the process and substance of the law where unwary enforcement agents may unwittingly tread or where the magistracy may become thoroughly confused. This can be a problem, especially when a procedure is new and the higher courts have not yet had the opportunity to pass judgement on it. Although outside the sphere of pollution regulation, an example which clearly illustrates this point was the introduction by the police in 1983 of the Lion Intoximeter 3000 - a device which automatically measures alcohol levels in samples of breath - for use in drink-driving cases. The case of Gaimster v. Marlow ((1984) 2 WLR 16) nearly caused the police to withdraw the Intoximeter from routine use, had the High Court not overturned the initial finding by magistrates (Guardian, 1983). In this case, the defence based their argument on the contention that the print-out slip from the Intoximeter was not admissible evidence. They maintained that the part of the slip giving

readings of the amount of alcohol in the defendant's breath (in microgrammes per 100 millilitres of breath) was not comprehensible to an ordinary person. Therefore, it was not a proper statement under the terms of the Transport Act 1981. The magistrates were convinced by the force of this argument and dismissed the information against the defendant.

The prosecution appealed to the High Court. Pending the outcome of the appeal, many other cases where the Intoximeter had been used to determine alcohol levels were adjourned. The magistrates' ruling was eventually overturned by the High Court, thereby effectively giving a judicial seal of approval to the use of the Intoximeter. The reasoning behind the High Court's decision was that the magistrates should have looked at the print-out slip as a whole, not just that part of it which listed the readings. Taken as a whole, the document was plainly intelligible to an ordinary person, since an explanation of the readings was given at the bottom of the slip.

7.3.3 Automated Justice

Chapter 3 mentioned how the use of technology in law enforcement could ultimately lead to a situation where enforcement agents effectively hand over their discretion to a machine: in other words, 'automated justice', a term attributable to Skolnick (1966). Most applications of automated justice have been in the field of traffic regulation where the use of technology enables the rapid processing of strict liability offences. The oldest and simplest example is provided by the parking meter. Other examples are tachographs, speed guns, intoximeters and, more recently, automatic cameras at traffic lights which photograph cars which fail to stop at a red light.

Automated justice provides an objective record: it does not lie (unless the machine malfunctions). Automated justice is thus suited to a control system where enforcement agents can apply fixed penalty sanctions, without fear of biased law enforcement and without the need to go to court (unless the offender has grounds for appeal as to

liability or level of fine). This system already operates for minor traffic offences.

Automated justice also gives potential offenders more information, so increasing the scope for self-regulation via automatic monitoring. A good example of this from the neighbourhood noise sphere is the use of electronic limiting devices to regulate entertainment noise. With these devices a warning light flashes when a certain pre-set noise limit in decibels is exceeded, and an additional feature enables power to the stage to be automatically cut off, until the noise level falls back below the threshold level.

Potential 'offenders' require more specific guidance than just that they should not cause a nuisance. Although noise abatement notices often give specific advice concerning what must be done or not done, or what noise level must not be exceeded in order to abate the nuisance, there is a need for this sort of advice one stage further back; in other words to provide people with sufficient information in the first place so that they do not cause a nuisance. Codes of practice, for example, have been useful in this respect, in helping to define what is a nuisance for particular sources of noise.

Registered levels in NAZs, on the other hand, provide much more explicit information to potential offenders. In an ideal world, relaxing for the moment all economic and technical constraints, all noisy industrial and commercial premises would have to comply with such specific noise emission standards. These would be enforced automatically by positioning noise monitoring devices at key points on the boundary of the site. The monitors would send signals to a central computing facility, which would provide a daily printout of noise levels, in terms of the preferred noise rating. (Although such systems are used for airport noise monitoring, it would not at present be economically feasible for any other than the very largest and noisiest industrial installations.) Each year the enforcement agency would inspect the noise data and would then impose civil penalties - or some form of 'noise tax' - proportionate to the number of days in

the year when the emission standard was exceeded.

The problem of exceeding the standard as a result of interference from extraneous sources of noise, such as traffic and aircraft, could be overcome by employing a noise rating which utilised pattern recognition (that is, a 'noise fingerprint'), based on the particular intensity and frequency characteristics of the noise in question. Although real-time frequency analysers can presently provide an instantaneous trace of the frequency spectrum of a noise, a pattern recognition system such as this is not yet technically feasible.

Interestingly, the Netherlands have imposed a 'noise tax' on particularly noisy industries, the revenue being used to finance research and development on quiet vehicles, noise abatement work by local authorities, soundproofing of buildings and educational campaigns (OECD, 1986). Certain industrial premises regarded as noisy must apply for a licence to carry out their activities, for which a charge is levied. The charge is based on a 'noise factor', derived from measurements or estimations of the intensity and duration of the noise.

7.4 OPERATIONAL WITH TECHNICAL MODELS

7.4.1 Appropriate Levels of Technical Specification?

This Section examines the premise raised in Chapter 1, that the level of technical specification in pollution control legislation should be suited to the operational requirements of the enforcement process, rather than necessarily reflecting the 'state of the art' of pollution monitoring and assessment. The Section considers whether this 'appropriate' level of technical specificity has been met by the present legislative arrangements for neighbourhood noise control, and considers the implications, if any, for the future.

The enforceability of scientifically-complex provisions is one of the factors taken into account by policy makers. Chapter 3, for example,

described how the Wilson Committee specifically commissioned the Building Research Station to develop a procedure for assessing reaction to industrial noise (the precursor to BS 4142) which was simple enough to be used by Public Health Inspectors who had "...neither the training, experience and equipment nor, probably the time..." to perform more complex analyses (Committee on the Problem of Noise, 1963). The concept of the NAZ originated from the representative body of those who would ultimately be responsible for implementing and enforcing the policy - the Association of Public Health Inspectors (Noise Advisory Council, 1971). The technical procedure for monitoring noise emissions from classified premises within zones (Schedule 1 of the Control of Noise (Measurement and Registers) Regulations 1976) was developed by the Building Research Station, after consultation with several LAs (Jenkins et al., 1976).

Despite consultation with representatives of the enforcement agency and due consideration given to the question of enforceability by policy-makers described by the Legal Model, the Operational Model nevertheless found that the technical specificity of some parts of the legal mandate effectively deterred some EHOs from implementing these provisions. Although there is a large variation between LAs concerning the level of technical expertise, the explanation proffered by EHOs for this problem was not so much that they considered they were unable to cope with the technical complexity of the provisions, but rather that the detailed, precise and, in some cases, inflexible nature of the specifications meant that officers found them too time-consuming and labour-intensive to implement. Some EHDs could not justify assigning resources to the more technical aspects of the job, when they were faced with an increasing number of domestic noise complainants, to whom they had a statutory duty to make at least a token response.

The usual reason given by officers for their authority's decision not to establish a NAZ was that the lengthy and detailed procedures for designating a zone and for undertaking a noise survey meant that zones were not considered to be cost-effective. Similarly, several

EHOs said they actively discouraged applications from contractors or developers for a notice of prior consent for construction work (s.61), because the considerable time required to determine reliable consent conditions, in accordance with the noise prediction method detailed in BS 5228, could better be spent investigating complaints.

An example from outside the neighbourhood noise sphere concerns the enforceability of provisions specifying maximum sound levels for motor vehicles in use, which first appeared in Regulation 89 of the 1969 Motor Vehicles (Construction and Use) Regulations. Schedule 10 of the Regulations gave a method to be used by police officers for measuring the noise emitted by individual vehicles on the road. The instructions were as detailed and specific as those describing the measurement of noise emitted by registered premises in a NAZ. The Noise Advisory Council, reporting in 1972, considered that Regulation 89 had become, for all practical purposes, a dead letter. The Council stated that the procedure could only be used in conditions infrequently met with on British roads, made considerable demands on officers' time and offered scope for challenge in the courts on a number of technical grounds (Noise Advisory Council, 1972). The most recent edition of the vehicle regulations (Road Vehicles (Construction and Use) Regulations 1986) has omitted this particular provision, leaving the assessment of noise from vehicles in use to the subjective assessment of police officers (in terms of whether the vehicle is used "in such manner as to cause excessive noise" (R.97)).

The technical specificity of the legal mandate must be commensurate with the technical capabilities of enforcement agents. Chapter 3 described how the Government responded to a Wilson Committee recommendation that training in the basics of noise measurement and control should be available to all officers who had to deal with noise problems as part of their job. A variety of training courses in acoustics are now available, such as the Diploma in Acoustics run by the Institute of Acoustics. The Noise Council has recently acknowledged that "Only rarely would a shortage of equipment or expertise now be a limiting factor, unlike the situation ten years ago

when much less was known, or done about, the problems of noise...." (Noise Council, 1986). Indeed, the level of acoustic expertise possessed by some officers in the survey was such that they wished they could devote more time to using their technical skills, such as by developing the noise consultancy aspects of the job, instead of having to deal with what they considered the more mundane - and less rewarding - matters of investigating neighbour disputes, barking dogs, loud music and noisy parties.

Aside from the question of enforceability of technically complex controls, there is also the question of compliance: those bound by the legal mandate also need to be able to understand it. For example, EHOs tailored the terms of statutory notices to meet the level of technical expertise of the recipient. As one officer said, using decibels was a bit like "talking Greek" to most construction site workers. The recently-formed Noise Council maintained that "simplification of much of the existing legislation will result in not only fairer application to all, but a much higher level of compliance" (Noise Council, 1986). The same report also concluded that "Scientific pedantry is not helpful and can prevent the achievement of practicable noise control legislation and defeat the objective of controlling noise pollution".

The complexity of the neighbourhood noise provisions fortunately have a long way to go before they match the highly detailed nature of regulations establishing safety standards for occupational hazards, which were adopted by the United States' Occupational Safety and Health Administration in the early 1970s (Jasanoff, 1982; Kelman, 1984). Referring to these standards, Kelman stated that:

> "Perhaps the most unfortunate results come when legal requirements actually interfere with compliance because they make regulations so hard to understand. There have been numerous complaints about the incomprehensibility of OSHA regulations, but one OSHA official pointed out that "there is a limit as to how far we can go in paraphrasing or simplifying the language of the standards because...the standards are a legal document in addition to an engineering document" ".

7.4.2 Other Aspects of the Technical/Operational Interface

Scientifically-defined regulatory standards increase the need for 'operational rigour'. By this it is meant that a case can be thrown out of court if it can be proved that a monitoring procedure has not been followed exactly. In order to maintain the accuracy and precision of measurements, instrumentation must be calibrated regularly and, to ensure national standards of uniformity, it is advantageous if a provision to this effect is included in the legal mandate. The point was made in Chapter 5 that at present some neighbourhood noise provisions are rather vague on the subject of instrument calibration: for example, the Control of Noise (Measurement and Registers) Regulations 1976 require only that the calibration of the measuring equipment "must be maintained". At present there is no statutory scheme to ensure a 'traceability chain' for acoustic instrumentation used by LAs, in other words to ensure that instrument calibration can be traced back ultimately to an absolute reference standard for acoustical measurements. Chapter 5 also mentioned that the National Physical Laboratory was considering instituting such a scheme (Berry, 1986).

Acoustic instrumentation used for enforcement purposes needs to be portable, and therefore reasonably light, small and robust. Noise measurements often need to be made at locations where there is no fixed source of electric power, so equipment must be suitable for battery operation. The development of microprocessors has meant that increasingly complex, intregrating circuitry can be fitted into smaller and smaller housings. These instruments can be left unattended 'in the field' for extensive periods of time. Equipment which is left to record automatically must also be weather-proof and 'vandal-proof'.

Although the use of microprocessors has resulted in a decrease in the price of electronic equipment such as pocket calculators and home computers, the market for acoustic instrumentation is not so large as

to have caused a similarly drastic drop in the price of this equipment. Prices range from about £700 for a precision sound level meter, to upwards of £1200 for an integrating meter. Noise level analysers cost approximately £8000, while the price of a real-time frequency analyser is around £23,000. Economies of scale mean that it generally does not make sense for small LAs to purchase very expensive instrumentation. The development of equipment sharing initiatives, whereby large, urban authorities loan out equipment to satellite, rural authorities, or a group of authorities establishes an equipment sharing co-operative, provide solutions to this problem. Although several such ventures have been established (for example, Authorities 7 and 8 were members of the same cooperative), they are all informal and depend on local initiatives. The House of Lords Select Committee on Science and Technology (1985) recommended that central government should encourage the formation of inter-authority groupings, and that a provision to this effect be included in legislation.

Technology needs to be cheap for the routine enforcement of widely used legislation, but can be more expensive and complex if its use is confined to certain focal points, such as aircraft noise monitoring around major airports.

7.5 TECHNICAL, LEGAL AND OPERATIONAL MODELS

7.5.1 Introduction

This Section considers the problem of domestic noise. The underlying premise is that, where the control of pollution is concerned, there are limits both to what may be achieved by a scientific approach, and also to what may be achieved by a regulatory approach (by which it is meant a control policy based on legislative sanctions). It is argued that, unlike other sources of environmental noise, for which the use of scientific limit values imposed by legislative means constitute in the main an appropriate strategy of control, the control of domestic noise does not fit happily into this regulatory scheme.

In Chapter 6 the point was made that "domestic noise is not for the acoustic scientist" (Robinson, pers. comm.). Although some sources of domestic noise are amenable to monitoring, it is proposed that too much emphasis on attempting to develop ratings suitable for domestic sources - or on a 'technical fix'- will only serve to complicate a problem which, in many instances, is the result of a social situation where one or more parties refuse to modify their behaviour. Although psychoacousticians can presently determine a community's response to a particular source of noise, they are still a long way from quantifying an individual's response to noise. Whilst it is impossible to say what advances the future may bring in accomplishing this task, the present problem of the growing number of domestic complaints to EHDs remains to be confronted.

Complaints in themselves are not reliable indicators of community annoyance due to noise (see Chapter 5). Complainants may not be representative of the population as a whole, and complaints may be made for a variety of reasons, some of which may have little to do with the nature of the noise itself. For instance, complaint levels are influenced by public awareness of effective channels for complaint. Basing control policies solely on the level of complaint about various sources of noise may not, therefore, tackle the fundamental problem. It is for this reason that the Department of the Environment has recently commissioned the Building Research Station to undertake a national noise survey to determine public response to noise, and in particular domestic noise (Utley, pers. comm.).

Nevertheless, EHDs are organised, in the main, to respond to public complaints about noise rather than to discover noise problems in a proactive manner. This is the most cost-effective strategy for the policing of offences which hinge on the criterion of 'nuisance'. The exception to this reactive approach is the decision to set up a NAZ, which is a policy initiated by the council itself. However, a zone may often be established to encompass premises which have been the subject of complaint in the past, and the policing of registered noise levels within a zone often depends on the public making complaints to

the EHD in the first instance. Therefore, in terms of resource allocation within EHDs, and of EHOs' workloads, the level of complaint to LAs is a crucial factor in the determination of any noise control policy.

Several EHOs argued that where domestic noise was concerned, the COPA provisions do not work satisfactorily. Indeed, many officers considered that the dilemma as to what to do about the increasing number of domestic complaints was the major contemporary problem in the regulation of neighbourhood noise. The particular characteristics of many domestic noise problems mean that a control strategy based only on ultimate recourse to criminal sanctions will not provide a satisfactory outcome in all instances of domestic noise nuisance. It is suggested that alternative remedies based on neighbour mediation and arbitration may well make a positive, additional contribution to the control of domestic noise. The argument is outlined in more detail below.

7.5.2 The Problem of Domestic Noise

71% of complaints recorded in the noise complaint questionnaire concerned domestic noise. The IEHO national statistics for 1985/86 found that domestic noise accounted for 60% of complaints, commercial and industrial sources for 28%, construction noise for 5%, noise in streets (s.62 of COPA) for 2% and noise from sources exempt from control under COPA for 5%. Domestic noise not only now comprises the largest source of noise complaints to LAs, but also the annual rate of increase in domestic complaints exceeds the annual rate of increase of complaints for all other sources of noise combined.

This increase in the burden of noise complaints has occurred at a time when Central Government controls over local authority spending are stricter than ever before (Macrory, 1986a). Many EHOs complained that their authorities had insufficient resources to make an adequate response to all complaints about noise. As a consquence several EHDs in the survey had adopted administrative procedures which effectively

by-passed any investigation of domestic noise complaints, or which provided a "sifting" technique to defer investigation until the complainant contacted the EHD for a second time:

1. One authority did not investigate one-to-one neighbour complaints and instead sent the complainant a standard letter giving details of how to take a private action under s.59 of COPA (a 'do-it-yourself kit').

2. Four authorities required the complainant either to contact the EHD for a second time or to return a completed noise record sheet (or in the case of one authority, a byelaw form), before a complaint about domestic noise was investigated.

3. The remaining three authorities investigated cases of domestic noise nuisance on the basis of the initial complaint - in the same manner as industrial/commercial complaints.

The legality of procedures 1. and 2. is uncertain, however, since they probably do not fulfil an authority's statutory duty to investigate noise nuisances under s.57 of COPA. Although there is no reported case law on the subject, Chapter 4 mentioned that the Ombudsman found one authority using the DIY-kit procedure for one-to-one neighbour complaints guilty of maladministration (C. Lees, Bromsgrove District Council, pers. comm.).

However, even the authorities which had a policy of investigating all domestic noise cases on the basis of the initial complaint, differed in the extent to which officers were prepared to pursue an investigation of a case before they would recommend that the complainant take private action under s.59. The Chief EHO in one LA considered that recourse to s.59 was indicative of a failure on the part of the authority to fulfil its statutory duty to investigate noise nuisances under s.57. Consequently EHOs in this authority tried to remedy all noise nuisances under s.58. In contrast, the other two authorities were really only prepared to pursue a lengthy

investigation of a domestic noise case if more than one household was affected by the nuisance, otherwise s.59 was recommended.

The present situation is inequitable, as the treatment which domestic noise complaints receive varies markedly from authority to authority. In contrast, complaints about industrial and commercial noise received very similar treatment: all authorities in the survey investigated industrial or commercial noise problems on the basis of the initial complaint.

Whilst all noises have the common characteristic of being a potential source of annoyance, domestic noise has some particular characteristics which set it apart from industrial and commercial noise:

1. It is the result of activities which, unlike industry or commerce, are not generally conducted for financial gain, and hence do not contribute to the economic well-being of the community.

2. Where civil liberties and personal freedom are concerned, the regulation of private behaviour conducted in peoples' homes is a much more sensitive issue than the regulation of industry or commerce.

3. As mentioned previously (Section 7.2.1), many domestic noise problems tend to be of a behavioural nature, while many industrial/commercial noise problems are of a technical nature. Remedying a nuisance resulting from a technical problem often requires expenditure on abatement methods, whereas the abatement of a "behavioural" nuisance usually merely requires those responsible for it to refrain from doing something.

4. There should, in theory at least, be more scope for residents to remedy domestic noise problems amicably, without recourse to third parties, than to remedy industrial or commercial noise problems in this way. This is because the abatement of a domestic "behavioural" noise will not usually threaten anyone's livelihood, nor will it

require any expenditure on sound insulation or abatement methods. By contrast, if an industrial or commercial operation is inherently noisy, and the abatement of the noise requires a substantial financial outlay, it is unlikely that informal approaches from local residents will have much effect. There are always exceptions to this broad categorisation, however. For instance, it is not inconceivable that some businesses may well respond to a petition from local residents. Some domestic noise nuisances may be the result of neighbours starting up small businesses in their homes. Other domestic noise nuisances may stem from inadequate sound insulation between premises, such that even 'normal behaviour' can cause a problem for neighbours.

5. The preponderance of domestic complaints to LAs means that in reality neighbours, for whatever reasons, are failing to remedy their grievances about noise without recourse to an intermediary. In many cases neighbourly relations must have broken down. A survey undertaken by Aston University (Tebay et al., 1986) found that the majority of neighbour disputes concerned noise. In some extreme instances noise-induced neighbour disputes have led to violence and even to murder (for example, The Independent, 1988b, Evening Standard, 1988a and 1988b).

6. Acoustic science, at least at present, has little role to play in regulating domestic noise, although it has a valuable contribution to make in the regulation of industrial and commercial noise (see Chapter 6).

7. EHOs are generally unwilling to adopt formal enforcement measures unless they have witnessed a noise for themselves. This is a precaution both against becoming unwittingly involved in a neighbour dispute, and also against embarking on a course of action which could end up in court, without a solid foundation of evidence. As mentioned in Chapter 6, officers found it particularly difficult to witness domestic noise problems. The occurrence of noise from industrial and commercial sources is usually reasonably predictable, and consequently

can be witnessed without too much trouble. The occurrence of domestic noise nuisances is often erratic, however. One domestic case in the noise complaint questionnaire, for example, required 17 visits before officers witnessed a nuisance.

Despite these differences, s.s 58 and 59 of COPA make no distinction between the source of the noise (with the exception of the additional defence of BPM for noise resulting from trade or industry): any noise nuisance from "premises" counts (see Chapter 4). Although the vast majority of enforcement action, in relation to both domestic and industrial or commercial noise nuisances, is informal (according to the IEHO statistics, approximately 90% are remedied - or written off - without resorting to service of statutory notices or to prosecution), is it appropriate to employ procedures stemming from the criminal law to deal with neighbour problems? When COPA was framed, industrial noise was the largest source of complaint (see Chapter 6, Figure 6.4). Although legal remedies may be valuable for certain sorts of noise problem, and for use as a last resort, it is proposed that the regulatory approach in COPA is not an appropriate or effective method for resolving neighbour disputes.

7.5.3 Alternative Options for Domestic Noise

One method of relieving the burden of domestic complaints on LAs would be for Government to recommend that all LAs adopt the procedure used by the authority in the survey, where one-to-one neighbour complaints were not investigated, but the complainant was sent a 'DIY kit' containing instructions for taking a private action under s.59. Public intervention by LAs under s.58 would then be reserved for industrial or commercial noises and for domestic noise problems where more than one complainant was involved. This distinction would mean that LAs would effectively be relieved of the burden of trying to deal with neighbour disputes (as presumably these are mostly one-to-one domestic complaints).

Total reliance on private legal remedies, however, raises the question of whether such an approach is fair for the elderly, the sick, the underprivileged, and those with a poor grasp of the English language and of the English legal system. EHOs in the survey reported that complainants were generally reluctant to make use of s.59, preferring the LA to act as an intermediary. Although sometimes this might have been due to mistaken notions of the cost involved, officers said that people seemed genuinely reluctant to live next door to someone whom they had taken to court.

Instead of promoting private remedies, the second alternative is to increase the scope of public intervention by providing LAs with stricter regulatory powers. The use of party patrols by some urban LAs in the survey is a good example of an interventionist and sanctioning approach to neighbourhood noise policing. Romaine (1983), himself a local government noise control officer, recommended that in extreme cases, LAs should have direct powers to authorise the confiscation of noisy equipment from noise-makers who failed to respond to a statutory notice. Approaches such as these may well leave LAs open to criticism for being 'heavy handed'.

The third and favoured alternative is the promotion of community self-help remedies involving neighbour arbitration and mediation schemes. British society is becoming increasingly multiracial and heterogeneous. This increase in the diversity of 'social norms' means that in any one community there may not be a consensus of opinion as to what is considered a 'reasonable' or socially cooperative way to behave. Rather than seeking redress through the courts, itself an adversarial process, it may be more appropriate for aggrieved parties to be encouraged, via recourse to an arbitrator or mediator, to try to reach an agreement between themselves. If all people complaining to LAs about a one-to-one neighbour problem could be referred to an arbitrator or mediator, it would then be equitable to remove these sorts of noise complaint from s.58 control. Ultimate recourse to s.59 would be retained, however, for cases where voluntary arbitration or mediation failed.

7.5.3.1 Neighbour Arbitration and Mediation Schemes

A number of neighbour dispute arbitration and mediation schemes have been set up in this country, dealing in the main with complaints of noise, racial abuse and petty vandalism. They are based on similar, well-established schemes operating in the United States and Australia. In this country the mediators/arbitrators are volunteers from the community. Volunteers are seen as more neutral than council employees in cases where the LA is the landlord of the parties involved. The aim of such schemes is:

> "to bring dispute resolution into the community - to be dealt with informally as opposed to a long, expensive, alienating and often unrewarding judicial process in the courts" (London Borough of Islington, Police Sub-Committee memorandum, 5 March 1987).

Arbitration involves a solution being imposed on the parties by the arbitrator, whereas mediation involves an attempt to reach a solution which is agreeable to all concerned. The solution could involve the alleged offender in making reparation by financial payments or by service either to the complainant or to the wider community, or by agreeing to modify future behaviour. It is not suggested that such schemes would provide the answer for all one-to-one domestic noise complaints, but they may well provide a useful alternative to private legal remedies or to laborious attempts by EHOs to solve the problem under s.58 of COPA.

7.5.3.2 Additional Points

Campaigns such as the Darlington Quiet Town Experiment (Chapter 3), to increase public awareness about the effects of noise and the promotion of quieter patterns of living, may help to reduce the incidence of noise problems where people were genuinely unaware that they were creating a nuisance. However, educational measures such as these are unlikely to have much impact on people who have no consideration for their neighbours.

The EEC Directive on noise labelling of household equipment should help consumers to make informed choices about the relative noisiness of appliances. Ultimately, technology-forcing product standards for electrical equipment used in the home should help to reduce the noise impact of these devices. These measures would have to be introduced at the level of the European Community, however, in order to prevent barriers to trade. Quite how the hi-fi industry could ever agree to noise limits for their products is uncertain, since one of their best selling points is the acoustic power of amplifiers.

Finally, several EHOs mentioned noise problems caused by inadequate sound insulation between dwellings. Studies by the Building Research Establishment have shown that many modern dwellings fail to meet the sound insulation performance standards specified by the Building Regulations. Surveys of dwellings built during the 1970s found that 55% of party walls and 44% of party floors tested failed to meet the performance standard for insulation against airborne sound, whilst 63% of the sample of party floors failed to meet the performance standard for insulation against impact sound (Utley and Alphey, 1974; Sewell and Scholes, 1979).

At present new construction is checked for compliance with sound insulation standards only at the design stage, when the probable performance of the construction is assessed from plans submitted to the local authority for general Building Regulation approval. No post construction tests are required to determine whether or not the building actually meets the standards in practice. There is thus no means of checking the quality of the work or of determining whether the materials specified at the design stage are actually used, both of which can have a detrimental effect on the sound insulation performance (Noise Council, 1986).

An increase in the level of compliance with the sound insulation standards could be achieved if local authorities were empowered to test the performance of a random sample of new dwellings once

construction was complete, and to require builders to take remedial measures before occupation in cases of sub-standard performance. By adopting this approach in France, the rate of compliance with sound insulation standards has risen from less than 50% to over 90% (ibid).

A European survey in 1982 found that people living in flats have more reason to complain about noise than people living in houses (Commission of the European Communities, 1983, reported in Clegg and Whittaker, 1986). The sound insulation requirements, however, do not apply to flats which are formed by conversion. Some local authorities get round this problem by specifying adequate standards of sound insulation as conditions in the planning consent for such premises. Until recently, however, this use of planning powers had a dubious legal basis. The case of London Borough of Newham v Secretary of State for the Environment and East London Housing Association Ltd ((1986) 134 ENDS Report 23) helped to clarify the position: the High Court held that sound insulation conditions on flat conversions were a legitimate use of planning powers. Local authorities can now adopt this course of action with impunity. However, the achievement of an adequate standard of sound insulation in flat conversions through Building Regulation control, rather than through planning legislation, is preferable as it has the advantage of ensuring uniform national standards, rather than standards which may well vary from authority to authority.

Several recent cases in the magistrates' courts have extended liability in nuisance to the landlord of rented premises as the "person responsible" for noise nuisances resulting from inadequate interfloor sound insulation (for example, Rossell v London Borough of Southwark (1986) 132 ENDS Report 17). Whether liability could also be extended to architects and builders responsible for the construction of dwellings with defective standards of sound insulation has yet to be put to the test.

7.6 CRITIQUE OF THE INTERDISCIPLINARY APPROACH

The research in this thesis has demonstrated the use of a novel methodology for the study of a law enforcement system where technology plays, or has the potential to play, a significant role in regulation. The essence of this method - the so-called 'interdisciplinary approach' - is to consider the problem initially from individual disciplinary perspectives, and then to consider the interaction and interfaces between the disciplines.

The preceding Sections of this Chapter have illustrated the novel insights that can be gained by using this approach for the analytical study of an area of environmental policy - in this case, neighbourhood noise - in which decision-making processes are influenced by disparate disciplines. The work has confirmed that approaches to environmental policy which are limited to a single discipline, or multidisciplinary approaches which do not consider adequately the interfaces between the disciplines, are likely to give rise to simplistic or even misleading conclusions.

It is proposed that an interdisciplinary approach such as the one adopted in this thesis provides an appropriate methodology for the analytical study of other areas of pollution regulation. Although the detailed aspects and results of the interdisciplinary approach will vary according to the nature of the particular sector of pollution policy being addressed, it is considered that the three-model approach used in the thesis - consisting of the Legal, Technical and Operational Models - provides a robust framework for analysis. In the light of the significant changes presently taking place in other pollution control sectors such as air, water and waste (outlined in Chapter 2), this interdisciplinary approach would be very relevant in predicting the ramifications of the implementation of these new controls.

There are two basic premises behind the development of the three models. The first premise is that in addition to explaining the processes of policy formation, an understanding of the processes of policy implementation is vital to the successful study of policy systems. This premise led to the development of the Legal and Operational Models. The second premise is that the basis of pollution control policy is heavily influenced by science and technology - in particular, as described in Chapters 1 and 2, increasing technical specificity is discernible in many areas of pollution legislation. This premise led to the inclusion of the Technical Model.

Although the interdisciplinary approach is primarily of use for academic study, it is hoped that it may influence to some degree the thinking of participants in the policy process.

A drawback of the interdisciplinary approach is that tackling a field of study from the perspective of three different disciplines means that authenticity for each particular discipline may be difficult to achieve, given the inevitable limitations on time and resources. The larger the area of study, the harder it is to maintain authenticity and the more laborious and time-consuming the work becomes. Consequently, the interdisciplinary approach is unwieldy if applied to a very large sector of public policy.

Authenticity was a particular problem for the Technical Model, since the measurement and rating of environmental noise is such a broad-ranging and complex field. Concerning the Operational Model, the major shortcoming lay in the limited number of local authorities used in the noise survey, although considerable effort was made to choose a representative sample. The Legal Model was not so problematic, since neighbourhood noise is a very small policy sector. Even so, had there been time, it would have been illuminating to have researched the historical influences on policy more fully. Nevertheless, it is considered that the interdisciplinary approach adopted in this thesis has succeeded in capturing the essential nature of each of the models, and, as a result of integrating the models, in enabling novel insights

to be gained concerning neighbourhood noise policy and the question of science in legislation and its enforcement.

REFERENCES

Andenaes, J. (1966), The General Preventive Effects of Punishment. Univ. of Pennsylvania Law Review, 114: 949-983

Ando, Y. and Hattori, H. (1973), Statistical Studies on the Effects of Intense Noise on Human Foetal Life. J. of Sound and Vibration, 27: 101-110

Ankers, M.S. (1986), Neighbourhood Noise - Complaints and Control. Paper given at the 93rd Environmental Health Congress, Scarborough, 22-25 September 1986. Organised by the Institution of Environmental Health Officers

Anti-Noise League (1935), Noise Abatement Exhibition. Science Museum, South Kensington, 31 May-30 June 1935 (Anti-Noise League, London)

ASA Z24.3 (1944), American Standard Specification for Sound Level Meters for Measurements of Noise and Other Sounds. (Acoustical Society of America)

Ashby, E. (1977), Reconciling Man with the Environment. Oxford University Press, London

Ashby, E. and Anderson, M. (1981), The Politics of Clean Air. Clarendon Press, Oxford

Attenborough, K. (1977), A Model of Noise Levels in the United Kingdom. Institute of Acoustics Spring Conference 1977

Aubert, V. (1952), White-Collar Crime and Social Structure. American Journal of Sociology, 58: 263-271

Avon, Gloucestershire and Somerset Environmental Monitoring Committee (1985), Vibration: A Guide for Environmental Health Officers. (produced by Wansdyke District Council, Avon)

Avon, Gloucestershire and Somerset Environmental Monitoring Committee (1988), Noise - A Guide for Environmental Health Officers (produced by Wansdyke District Council, Avon)

Baldwin, G.R. and Veljanovski, C.G. (1984), Regulation by Cost-Benefit Analysis. Public Administration 62(1): 51-69

Ball, H.V. and Friedman, L.M. (1965), The Use of Criminal Sanctions in the Enforcement of Economic Legislation: A Sociological View. Stanford Law Review 17: 197-223

Banton, M. (1964), The Policeman and the Community. (Tavistock Publications, London)

Beranek, L.L., Reynolds, J.L., and Wilson, K.E. (1953), Apparatus and Procedures for Predicting Ventilation System Noise. J. Acoust. Soc. Amer. 25: 313-321

Barkhausen, H. (1926), Ein Neuer Schallmesser fur die Praxis. A.F. Techn. Physik 1926, 599: Z. VD1, 1927, 1471

Barraclough, J.F. (1982), Noise Abatement Zones - Can They be Made to Work? National Society for Clean Air 49th Annual Conference, 20 October 1982, Llandudno (NSCA, Brighton)

Bennion, F.A.R. (1980), Statute Law. (Oyez Publishing Limited, London)

Bernard, P. (1986), Environmental Noise Measurements. Bruel and Kjaer Technical Review 1986 No. 1 (Bruel and Kjaer, Denmark)

Berry, B.F. (1981), The Assessment of Environmental Noise. Symposium on the Problem of Assessing Environmental Noise, 25 March 1981 (Union Internationale des Laboratoires Independants, The Association of Consulting Scientists)

Berry, B.F. (1985), Evaluation of Impulsive Environmental Noise. I. Laboratory Studies of Annoyance Reactions. Inter-Noise 1985

Berry, B.F. (1986), A Survey of Local Authority Noise Measurements. Acoustics '86, 1986 Spring Conference of the Institute of Acoustics, University of Salford 7-10 April 1986

Berry, B.F., Fuller, H.C., John, A.J. and Robinson, D.W. (1979), The Rating of Helicopter Noise: Development of a Proposed Impulse Correction. NPL Acoustics Report Ac. 93 (National Physical Laboratory, Teddington)

Berry, B.F. and Moss, I.K. (1987), A Survey of the Work of Local Authorities on Noise. NPL Report Ac. 113 (National Physical Laboratory, Teddington)

Bickerdike, J. (1972), Noise Complaints - A Survey of Local Authority Methods of Investigation. Environmental Health 80: 11

Bickerdike, J. (1981), Noise in the Community. Public Works Congress 1981, Session under the auspices of the Environmental Health Officers' Association

Birch, C. (1977), Not So Softly, Softly. Municipal Engineering 154 (11): 363

Bird, D and Wright, D. (1983), The Use of Noise Abatement Zones as a Community Safeguard: Principles and Practice. Department of the Environment, Institution of Environmental Health Officers Joint Seminar: Noise Abatement Zones Seven Years On - An Assessment. 30 November 1983, Bloomsbury Crest Hotel, London

Bittner, E. (1967), The Police on Skid Row: A Study of Peace Keeping. American Sociological Review 32: 699-715

Black, D.J. (1971), The Social Organisation of Arrest. Stanford Law Review 23: 1087-1111

Black, D.J. (1973), The Mobilisation of Law. The Journal of Legal Studies 2: 125-149

Boehmer-Christiansen, S. (1988), Black Mist and Acid Rain - Science as Fig Leaf of Policy. Political Quarterly, April 1988

Botsford, J.H. (1969), Using Sound Levels to Gauge Human Response to Noise. Journal of Sound and Vibration 3(10): 16-28.

Bramer, T.P.C. and Eade, P.W. (1982), The Use and Abuse of BS 4142. In: Noise Nuisance Assessment: BS4142 Reviewed and Criticised. Proceedings of the Institute of Acoustics, Birkbeck College, London, 8 February 1982

Braund, S. and Strevens, D.N. (1983), A Nuisance in Fact But Not in Law. Environmental Health, October 1983: 277

Brenner, J.F. (1974), Nuisance Law and the Industrial Revolution. The Journal of Legal Studies 3: 403-433

British Standards Institution (1961), Comments from members of sub-committee ACM/3/3 on ISO draft secretariat proposal for noise rating numbers with respect to conservation of hearing, speech communication and annoyance. Document No. AB (ACM) 9128

Broch, J.T. (1962), Loudness Evaluation: a Review of Current Methods. Bruel and Kjaer Technical Review 2: 1962 (Bruel and Kjaer, Denmark)

Broch, J.T. (1984), Mechanical Vibration and Shock Measurements. (Second Edition) (Bruel and Kjaer, Denmark)

Brooker, P., Critchley, J.B., Monkman, D.J. and Richmond, C. (1985), United Kingdom Aircraft Noise Index Study: Main Report. D.R. Report 8402 (Prepared on behalf of the Department of Transport by the Civil Aviation Authority)

Brown, E.F., Dennis, E.B., Henry, J. and Pendray, G.E. (1930) City Noise. (Noise Abatement Commission, New York Department of Health)

Bruce-Lindsay, R. (1966), The Story of Acoustics. The Journal of the Acoustical Society of America 39 (4): 629-644

Bruce-Lindsay, R. (Ed.) (1973), Acoustics: Historical and Philosophical Development. Benchmark Papers in Acoustics (Dowden, Hutchinson and Ross, Stroudsberg, Pennsylvania)

Bruel and Kjaer (1982), Measuring Vibration. (booklet) (Bruel and Kjaer, Denmark)

Bruel and Kjaer (1984), Measuring Sound. (booklet) (Bruel and Kjaer, Denmark)

Bruel and Kjaer (1986), Sound Intensity. (booklet) (Bruel and Kjaer, Denmark)

B.S. 3383 (1961), Normal Equal Loudness Contours for Pure Tones and Normal Threshold of Hearing Under Free-field Listening Conditions (British Standards Institution, London)

B.S. 3489 (1962), Sound Level Meters (Industrial Grade) (British Standards Institution, London)

B.S. 2475 (1964), Octave and One-Third Octave Band Pass Filters (British Standards Institution, London)

B.S. 4142 (1967), Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas (British Standards Institution, London) (Amended 1975 and 1982)

B.S. 4197 (1967), A Precision Sound Level Meter (British Standards Institution, London)

B.S. 661 (1969), Glossary of Acoustical Terms (British Standards Institution, London)

B.S. 5228 (1975), Code of Practice for Noise Control on Construction and Demolition Sites (British Standards Institution, London)

B.S. 5969 (1981), Specification for Sound Level Meters. Specifies meters having four degrees of precision, designated Types 0, 1, 2 and 3 (British Standards Institution, London)

B.S. 6472 (1984), Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) (British Standards Institution, London)

B.S. 5228 (1984), Noise Control on Construction and Open Sites (British Standards Institution, London) published in 4 parts:

Part 1: 1984. Code of practice for basic information and procedures for noise control.

Part 2: 1984. Guide to noise control legislation for construction and demolition, including road construction and maintenance.

Part 3: 1984. Code of practice for noise control applicable to surface coal extraction by opencast methods.

Part 4: 1986. Code of practice for noise control applicable to piling operations.

Bugler, J. (1972), Polluting Britain: A Report. (Penguin Books, Harmondsworth)

Building Research Station (1968), Subjective Response to Road Traffic Noise. BRS Current Paper 37/68 (Building Research Station, Garston, Watford)

Burgess, E.W. (1950), Comment to paper by F.E. Hartung. Amer. Journal of Sociology 56: 32-33

Burns, W. (1968), Noise and Man. (John Murray, London)

Burns, W. and Robinson, D.W. (1970), Hearing and Noise in Industry. (HMSO, London)

Burrows, P. (1982), Government Intervention. Ch. 1 in Richardson, G., Ogus, A. and Burrows, P. (1982) Policing Pollution: A Study of Regulation and Enforcement (Clarendon Press, Oxford)

Byrne, T. (1983), Local Government in Britain: Everyone's Guide to How it All Works. (2nd Edition) (Penguin Books, London)

Carson, W.G. (1970a), White Collar Crime and the Enforcement of Factory Legislation. British Journal of Criminology 10: 383-398

Carson, W.G. (1970b), Some Sociological Aspects of Strict Liability and the Enforcement of Factory Legislation. Modern Law Review 33: 396-412

Central Office of Information (1976), The Appointment and Duties of Justices of the Peace in England and Wales. Booklet obtained from the Magistrates' Association (Central Office of Information on behalf of the Lord Chancellor and the Chancellor of the Duchy of Lancaster)

Central Statistical Office (1985), Social Trends. No. 15 (Deo Ramprakash, Ed.) (HMSO, London)

Charnley, G.R. (1983), The Noise Abatement Zone - A Sound Solution? Department of the Environment/Institution of Environmental Health Officers Joint Seminar: Noise Abatement Zones Seven Years On - An Assessment. 30 November 1983, Bloomsbury Crest Hotel, London

Christie, D. (1982), Limitations of BS. 4142. In: Noise Nuisance Assessment: BS4142 Reviewed and Criticised, Proceedings of the Institute of Acoustics, Birkbeck College, London, 8 February 1982

Churcher, B.A.G. and King, A.J. (1930), The Analysis and Measurement of the Noise Emitted by Machinery. Journal of the Institute of Electrical Engineers 68: 97-113

Churcher, B.A.G. and King, A.J. (1937), The Performance of Noise Meters in Terms of the Primary Standard. Journal of the Institute of Electrical Engineers 81(487): 57

Circular 58/60 (1960), Ministry of Housing and Local Government. Noise Abatement Act, 1960. (HMSO, London)

Circular 22/67 (1967), Ministry of Housing and Local Government. Noise: Industrial Noise. (HMSO, London)

Circular 59/68 (1968), Ministry of Housing and Local Government Noise from Concrete Breakers. (HMSO, London)

Circular 36/69 (1969), Ministry of Housing and Local Government. Noise: Industrial Noise. (HMSO, London)

Circular 10/73 (1973), Department of the Environment. Planning and Noise. (HMSO, London)

Circular 2/76 (1976), Department of the Environment. The Control of Pollution Act 1974. Implementation of Part III - Noise. (HMSO, London)

Circular 22/80 (1980), Department of the Environment. Development Control - Policy and Practice. (HMSO, London)

Circular 8/81 (1981), Department of the Environment. The Local Government, Planning and Land Act 1980 - Various Provisions. (HMSO, London)

Circular 2/82 (1982), Department of the Environment. Control of Pollution Act 1974: Codes of Practice on Noise from Audible Intruder Alarms, Model Aircraft and Ice-Cream Van Chimes, Etc.. (HMSO, London)

Circular 1/85 (1985), Department of the Environment. The Use of Conditions in Planning Permissions. (HMSO, London)

Clay's Public Health Inspectors' Handbook, 12th Edition (1968), Revised by F.G. Davies, Ch. V - Noise, pp. 62-63 (H.K. Lewis and Co., London)

Clean Air (1981), Vol.11(1):2

Clegg, J.D. and Whittaker, B. (1986), Public Opinion on Environmental Noise. National Society for Clean Air, 53rd Annual Conference, Blackpool 27-30 October 1986

Commission of the European Communities (1980), Communication from the Commission to the Council. Progress Made in Connection with the Environment Action Programme and Assessment of the Work Done to Implement it. COM(80) 222 Final. 7 May 1980

Commission of the European Communities (1983), The Europeans and the Environment. (XI/446/83-EN) Eurobarometer No.18

Commission of the European Communities (1986), EEC Fourth Environmental Action Programme (1987-1992). Draft for a Resolution of the Council of the European Communities on the Continuation and

Implementation of a European Community Policy and Action Programme on the Environment (1987-1992). COM(86) 485 Final

Committee on the Problem of Noise (1963), Noise: Final Report. (Chairman: Sir Alan Wilson) Cmnd 2056 (HMSO, London)

Council for Science and Society (1977), The Acceptability of Risks. (Chairman: Sir Michael Swann) (Barry Rose Ltd in association with the Council for Science and Society)

Craik, R.J.M. and Stirling, J.R. (1986), Amplified Music as Noise Nuisance. Applied Acoustics 19: 335-356

Cranston, R. (1979), Regulating Business: Law and Consumer Agencies. (Macmillan, London)

Cranston, R. (1984), Consumers and the Law. 2nd Edition (Weidenfeld and Nicholson, London)

Cresswell, C. (1979), Neighbourhood Noise Levels - Newcastle's Experience and Some Future Problems. Muncipal Engineering 156(15): 569-570

Crocker, M.J. and Price, A.J. (1975), Noise and Noise Control, Volume I. (CRC Press, Cleveland, Ohio)

Davis, K.C. (1969), Discretionary Justice. (Louisiana State Press, Baton Rouge)

Davis, K.C. (1975), Police Discretion. (West Publishing Company, St. Paul, Minnesota)

Dawson, H. (1984), Noise and Society. (National Society for Clean Air, Brighton)

Delaney, M.E. (1986), Acoustics at the National Physical Laboratory. Acoustics Bulletin April 1986: 5-8

Delaney, M.E., Whittle, L.S., Collins, K.M. and Fancey, K.S. (1976), Calibration Procedures for Sound Level Meters to be used for Measurements of Industrial Noise. NPL Acoustics Report Ac.75 (National Physical Laboratory, Teddington)

Department of Employment (1972), Code of Practice for Reducing the Exposure of Employed Persons to Noise. (HMSO, London)

Department of Employment (1986), Enterprise and Deregulation Unit, Consultation Document. Review of Licensing of Businesses. (10 February 1986) (Department of Employment, London)

Department of the Environment (1977), Environmental Standards: a Description of United Kingdom Practice. Pollution Paper No. 11 (HMSO, London)

Department of the Environment (1978), Central Unit on Environmental Pollution. Pollution Control in Great Britain: How it Works - A Review of Legislative and Administrative Procedures. (Second Edition) Pollution Paper No. 9 (HMSO, London)

Department of the Environment (1979), Central Government Controls Over Local Authorities. White Paper, Cmnd 7634 (HMSO, London)

Department of the Environment (1981), Policy on Environmental Noise Pollution Control - Note by the Department of the Environment. December 1981. Circulated as RCP(82)4

Department of the Environment (1982a), Code of Practice on Noise from Ice-Cream Van Chimes etc. (HMSO, London)

Department of the Environment (1982b), Code of Practice on Noise from Audible Intruder Alarms. (HMSO, London)

Department of the Environment (1982c), Code of Practice on Noise from Model Aircraft. (HMSO, London)

Department of the Environment (1982d), Bothered by Noise - A Guide to Noise Complaints Procedure. (HMSO, London)

Department of the Environment (1984), Central Directorate of Environmental Pollution, Controlling Pollution: Principles and Prospects. The Government's Response to the Tenth Report of the Royal Commission on Environmental Pollution. Pollution Paper No. 22 (HMSO, London)

Department of the Environment (1986a), Department of the Environment / Scottish Development Department / Welsh Office. Consultation Document. Air Pollution Control in Great Britain: Review and Proposals. December 1986 (Department of the Environment, London)

Department of the Environment (1986b), Central Directorate of Environmental Protection. Public Access to Environmental Information. Report of an Interdepartmental Working Party on Public Access to Information held by Pollution Control Authorities. Pollution Paper No. 23 (HMSO, London)

Department of the Environment (1987), Department of the Environment / MAFF / Welsh Office. Consultation document. The National Rivers Authority: the Government's Proposals for a Public Regulatory Body in a Privatised Water Industry. July 1987 (Department of the Environment, London)

Department of the Environment (1988a), Protecting Your Environment - A Guide. (Central Office of Information, HMSO, London)

Department of the Environment (1988b), Department of the Environment / Welsh Office. Consultation document. Inputs of Dangerous Substances to Water: Proposals for a Unified System of Control. The Government's Consultative Proposals for Tighter Controls over the Most Dangerous

Substances Entering the Aquatic Environment ("The Red List"). July 1988 (Department of the Environment, London)

Department of the Environment (1988c), Department of the Environment / Welsh Office. Consultation document. Integrated Pollution Control. July 1988 (Department of the Environment, London)

Dickens, B.M. (1970), Discretion in Local Authority Prosecutions. The Criminal Law Review: 618-633

Duerden, C. (1970), Noise Abatement. (Butterworths, London)

Ehrlich, I. and Posner, R.A. (1974), An Economic Analysis of Legal Rulemaking, pp. 324-335, in Ogus, A.I. and Veljanovski, C.G. (Eds.) Readings in the Economics of Law and Regulation (1984), (Clarendon Press, Oxford)

ENDS Report (1981), 'Quango Axe Falls on Noise Advisory Council', 68: 14

ENDS Report (1982), 'Noise Pollution: What Role for EEC Initiatives?' 87: 15-16 (April 1982)

ENDS Report (1986), 'A Five Year Plan for Europe's Environment', 141: 9-11 (October 1986)

Environmental Health (1986), '£50,000 Fine for Disobeying Pollution Notice'. 94(1): 22

Environmental Protection Agency, (1974), Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Report No. 550/9-74-004, US Environmental Protection Agency, Washington, D.C. 20460, March 1974

Evening Standard (1987), 'When Racism Spoils the Party.' Final Edition, 8 January 1987, p.13

Evening Standard (1988a), 'Torment of Man Who Shot his Noisy Neighbour.' Final Edition, 9 September 1988, p.5

Evening Standard (1988b), Comment - 'Shotgun Justice.' Final Edition, 9 September 1988, p.7

Eysenck, H.J. (1967), The Biological Basis of Personality. (Charles C. Thomas, Springfield, Illinois)

Fidell, S. (1984), Community Response to Noise. In Jones, D.M. and Chapman, A.J. (Eds.) Noise and Society. (1984), (John Wiley and Sons, England)

Fidell, S. and Teffeteller, S. (1981), Scaling the Annoyance of Intrusive Sounds. J. Sound and Vibration 78(2): 291-298

Finnegan, R. (1972), Are Models Useful? In: Patterns of Decision Making? O.U. Decision Making in Britain Course Team. Decision Making in Britain: Social Sciences, a Second Level Course. Block VIII (parts 1-4) (The Open University Press)

Fisher, P.S. (1982), The Assessment of Industrial Noise Involving Tonal Character. In: Noise Nuisance Assessment: BS4142 Reviewed and Criticised. Proceedings of the Institute of Acoustics, Birkbeck College, London, 8 February 1982.

Fletcher, H. and Munson, W.A. (1933), Loudness, its Definition, Measurement and Calculation. J. Acoust. Soc. Amer. 5:82

Flindell, I.H. (1982), Noise Rating by Measures of Intrusion or Annoyance. In: Noise Nuisance Assessment: BS4142 Reviewed and Criticised. Proceedings of the Institute of Acoustics, Birkbeck College, London, 8 February 1982.

Flindell, I.H., (1988), Perception of and Reaction to Noise. Clean Air 18(1):21-31 (Spring 1988)

Forster, R.S. (1959), Noise Nuisances and their Abatement. pp. 219-221. The Noise in Industry Conference, Earls Court, April 10 1959. Insulation. July 1959: 195-231

Frankel, M. (1974), The Alkali Inspectorate: The Control of Industrial Air Pollution. (Social Audit Limited)

Frazer, W.M. (1950), A History of Public Health 1834-1939. 1st Edition 1950 (Bailliere and Cox, London)

Friedman, L.M. (1967), Legal Rules and the Process of Social Change. Stanford Law Review 19: 786-840

Fuller, H.C. and Robinson, D.W. (1973), Subjective Reactions to Steady and Varying Noise Environments. NPL Acoustics Report AC.62 (National Physical Laboratory, Teddington)

Gearty, C.A. (1986), The Role of the Courts in the Control of Environmental Pollution: A Legal and Historical Analysis. Unpublished Ph.D. thesis, Emmanuel College, University of Cambridge

Gilbert, D.G.R. (1987), Pesticide Safety Policy and Control Arrangements in Britain. Unpublished PhD thesis, Imperial College Centre for Environmental Technology, University of London

Gill, H.S. and Large, J.B. (1979), Factors Affecting Environmental Sound Propagation. National Society for Clean Air 46th Annual Conference, 15-18 October 1979, Scarborough (NSCA, Brighton)

Gittins, M. (1986), Pollution Topics. Environmental Health 94(2): 47

Greater London Council (undated) Disco Rules OK? Code of Practice for Discotheques. (Greater London Council)

Greater London Council (undated) Code of Practice for Pop Concerts: A guide to safety, health and welfare at one day events. (Greater London Council)

Greenwood, J. and Wilson, D. (1984), Public Administration in Britain. (George Allen and Unwin, London)

Guardian (1983), 'Drink-drive Loophole is Rejected'. 9 December 1983, Home News

Guardian (1987), 'Radiation Workers 'Face Increased Risk of Cancer''. 19 November 1987, p.7

Guardian (1988a), 'The Government Glimpse of a Green Light Ahead'. 29 September 1988

Guardian (1988b), 'Council Brings River Pollution Case Against Water Authority'. 14 June 1988, p.2

Gunningham, N. (1974), Pollution, Social Interest and the Law. (Martin Robertson, London)

Guruswamy, L.D. and Tromans, S.R. (1986), Towards an Integrated Approach to Pollution Control: the Best Practicable Environmental Option and its Antecedents. Journal of Planning and Environment Law September 1986: 643-655

Haigh, N. (1984), EEC Environmental Policy and Britain: An Essay and a Handbook. (Environmental Data Services, London)

Haigh, N. (1987a), The EIA Directive - Its Purpose and Scope. Environmental Health 95(11): 7-10

Haigh, N. (1987b), Collaborative Arrangements for Environmental Protection in Western Europe, pp. 366-387, In: Environmental Policies in East and West. (Ed. by Enyedi, G.; Gijswijt, A.J. and Rhode, B.) (Taylor Graham, London)

Haigh, N. (1987c), EEC Environmental Policy and Britain. (Second Edition) (Longman, Harlow, Essex)

Halsbury's Laws (1980), Halsbury's Laws of England. 4th Edition, Vol. 34, p. 100 (Butterworths, London)

Hart, H.L.A. (1961), The Concept of Law. (Oxford University Press)

Hartung, F.E. (1950), White-Collar Offenses in the Wholesale Meat Industry in Detroit. Amer. J. of Sociology 56: 25-32

Hassall, J.R. and Zaveri, K. (1979), Acoustic Noise Measurements. 4th Edition, (Bruer and Kjaer, Denmark)

Hawkes N., Lean G., Leigh D., McKie R., Pringle P., and Wilson A. (1986), The Worst Accident in the World, Chernobyl: the End of the Nuclear Dream. (Pan Books Ltd and William Heinemann, Ltd) The Observer 1986

Hawkins, K. (1983), Bargain and Bluff: Compliance Strategy and Deterrence in the Enforcement of Regulation. Law and Policy Quarterly 5: 35-73

Hawkins, K. (1984a), Environment and Enforcement: Regulation and the Social Definition of Pollution. (Clarendon Press, Oxford)

Hawkins, K. (1984b), Creating Cases in a Regulatory Agency. Urban Life 12: 371-395

Hawkins, K. and Thomas, J.M., (1984), The Enforcement Process in Regulatory Bureaucracies. Ch.1, pp.3-22 In: Hawkins, K. and Thomas, J.M. (Eds.) Enforcing Regulation. (1984) (Kluwer Nijhoff Publishing, Boston)

HC Debates (1930), Vol.251, Session 1930-31

HC Debates (1959), First Reading of the Noise Abatement Bill, presented by Rupert Speir. Vol. 613. Col: 406. Session 1959-60 (11 November 1959)

HC Debates (1960a), Second Reading of the Noise Abatement Bill. Vol. 618. Cols: 1571-1632. Session 1959-60 (4 March 1960)

HC Debates (1960b), Rupert Speir, Second Reading of the Noise Abatement Bill. Vol. 618. Col: 1576. Session 1959-60 (4 March 1960)

HC Debates (1960c), Rupert Speir, Second Reading of the Noise Abatement Bill. Vol. 618. Col: 1574. Session 1959-60 (4 March 1960)

HC Debates (1960d), Report in the House of Committee Stage and Third Reading of the Noise Abatement Bill. Vol. 624. Cols: 856- 933. Session 1959-60 (27 May 1960)

HC Debates (1960e), John Hynd, Second Reading of the Noise Abatement Bill. Vol. 618. Col: 1590. Session 1959-60 (4 March 1960)

HC Debates (1960f), Third Reading of the Noise Abatement Bill. Vol. 624. Cols: 856-933. Session 1959-60 (27 May 1960)

HC Debates (1960g), Rupert Speir, Lords Amendments Considered. Vol. 627. Col: 2237. Session 1960-61 (25 October 1960)

HC Debates (1960h), Sir Keith Joseph, Parliamentary Secretary to the Minister of Housing and Local Government. Second Reading of the Noise Abatement Bill. Vol. 618. Col: 1629. Session 1959-60 (4 March 1960)

HC Debates (1969), The Prime Minister, Harold Wilson. Oral Answers - Environmental Pollution (Royal Commission). Vol. 793. Cols: 638-639. Session 1969-70 (11 December 1969)

HC Debates (1970), Mr McNair Wilson, First Reading of a Bill to Control Noise. Vol. 801. Cols: 414-417. Session 1969-70 (6 May 1970)

Health and Safety Executive (1981), Industrial Air Pollution: Health and Safety 1981. (HMSO, London)

Higginson, R.F. and Rennie, A.J. (1980), A Case Study of Environmental Noise Evaluation. NPL Acoustics Report Ac. 96 (National Physical Laboratory, Teddington)

Hill, M.J. (1975), Varieties of Discretion: Their Characteristics and the Scope for their Control. Public Administration Bulletin December 1975: 72-84

HL Debates (1930), Vol.76. Session 1930-31

HL Debates (1960a), Lord Taylor, Second Reading of the Noise Abatement Bill. Vol. 224. Col: 902. Session 1959-60 (30 June 1960)

HL Debates (1960b), Noise Abatement Bill Receives Royal Assent. Vol. 225. Col: 1150. Session 1960-61 (27 October 1960)

HL Debates (1960c), Lord Waldegrave, Second Reading of the Noise Abatement Bill. Vol. 224. Col: 902. Session 1959-60 (30 June 1960)

HL Debates (1960d), Lord Conesford, Second Reading of the Noise Abatement Bill. Vol. 224. Col: 900. Session 1959-60 (30 June 1960)

HL Debates (1960e), Second Reading of the Noise Abatement Bill. Vol. 224. Cols: 897-912. Session 1959-60 (30 June 1960)

HL Debates (1960f), Committee Stage of the Noise Abatement Bill. Vol. 225. Cols: 30-46. Session 1959-60 (11 July 1960)

HL Debates (1960g), Noise Abatement Bill: Report. Vol. 225. Cols: 417-439. Session 1959-60 (18 July 1960)

HL Debates (1973), Vol. 340. Cols: 342-368. Session 1972-73 (14 March 1973)

HL Debates (1974a), Committee Stage: Protection of the Environment Bill. Vol. 349. Col: 330. Session 1973-74 (29 January 1974)

HL Debates (1974b), Committee Stage: Protection of the Environment Bill. Vol. 349. Col: 338. Session 1973-74 (29 January 1974)

HL Debates (1974c), Committee Stage: Protection of the Environment Bill. Vol. 349. Cols: 323-325. Session 1973-74 (29 January 1974)

HL Debates (1974d) Protection of the Environment Bill, Committee

before the House. Vol. 349. Cols: 303-304. Session 1973-74 (29 January 1974)

HMSO (1972), Pollution: Nuisance or Nemesis? A Report on the Control of Pollution, A study of public opinion undertaken at the request of Peter Walker, Secretary of State for the Environment, in connection with U.N. Conference on the Human Environment, Stockholm, June 1972. (HMSO, London)

HMSO (1970), The Protection of the Environment: the Fight Against Pollution. White Paper, Cmnd 4373 (London, HMSO)

HMSO (1985), Lifting the Burden. White Paper, Cmnd. 9571 (HMSO, London)

HMSO (1986a), Efficiency Scrutiny Report. Inspecting Industry: Pollution and Safety Report and Annexes. Cabinet Officer Review, commissioned jointly by the Secretaries of State for the Environment and for Employment (HMSO, London)

HMSO (1986b), Building Businesses ... Not Barriers. White Paper, Cmnd 9784 (HMSO, London)

Holdgate, M.W. (1979), A Perspective of Environmental Pollution. (Cambridge University Press)

Holdgate, M.W. (1983), Environmental Policies in Britain and Mainland Europe. pp. 6-18 In: Britain, Europe and the Environment. Contributions to a Conference held at Imperial College of Science and Technology, Ed. by Macrory, R. (1983) (Centre for Environmental Technology, London)

Hood, R. (1972), Sentencing the Motoring Offender. (Heinemann, London)

Hopper, G. (1961), Noise and Vibration - A Problem of the Twentieth Century. pp. 108-114 In: The Sanitarian 70(2) (November 1961). Paper 5 at the 1961 Annual Conference of the Association of Public Health Inspectors

Horder, Lord (1935), The Elimination of Needless Noise. In: The Anti-Noise League: Noise Abatement Exibition. Science Museum, South Kensington, 31 May - 30 June 1935 (Anti-Noise League, London)

Horsman, E.R. (1985), Presentation of Cases in Magistrates' Courts. The Magistrate 41(3): 36

House of Lords Select Committee on the European Communities (1982), Noise in the Environment (Thirteenth Report). Session 1981-82, (HMSO, London)

House of Lords Select Committee on the European Communities (1985), Motorcycle Noise (Ninth Report). Session 1984-85 (HMSO, London)

House of Lords Select Committee on Science and Technology (1985), Science and Technology in Local Government (First Report). Session 1985-86, Volume 1 - Report (HMSO, London)

Howell, D. (1974), Foreword; in Noise Advisory Council, Noise in the Next Ten Years. (HMSO, London)

Hutter, B.R. (1984), The Law Enforcement Procedures of Environmental Health Officers. (D.Phil Thesis, Wolfson College, University of Oxford)

IEEP (1987), Institute for European Environmental Policy Annual Report 1987 (IEEP, London)

International Electrotechnical Commission (1961), IEC. 123. Recommendations for Sound Level Meters (IEC, Geneva)

Institute of Acoustics (1982), Noise Nuisance Assessment: BS 4142 Reviewed and Criticised. Proceedings of the Institute of Acoustics, Birkbeck College, London, 8 February 1982

Institution of Environmental Health Officers (1982), The Environmental Health Officer (pamphlet)

Institution of Environmental Health Officers (1983), Annual Report 1982. (IEHO, London)

Institution of Environmental Health Officers (1984), Annual Report 1983/84. (IEHO, London)

Institution of Environmental Health Officers (1985), Annual Report 1984/85. (IEHO, London)

Institution of Environmental Health Officers (1986), Annual Report 1985/86. (IEHO, London)

Insulation (1959) The Noise in Industry Conference. Earls Court, April 10 1959. Insulation, July 1959: 195-231

ISO Recommendation R226 (1961), Normal Equal Loudness Contours for Pure Tones and Normal Threshold of Hearing under Free Field Listening Conditions. (ISO, Geneva)

ISO Recommendation R1996 (1971), Assessment of Noise with Respect to Community Response. (ISO, Geneva)

ISO 2204 (1973), Acoustics - Guide to the Measurement of Airborne Acoustical Noise and Evaluation of its Effects on Man. (ISO, Geneva)

ISO 1996/1 (1982) Acoustics - Description and Measurement of Environmental Noise. Part 1: Basic Quantities and Procedures (ISO, Geneva)

ISO 1996/2 (1987) Acoustics - Description and Measurement of Environmental Noise. Part 2: Acquisition of Data Pertinent to Land Use (ISO, Geneva)

ISO 1996/3 (1987) Acoustics - Description and Measurement of Environmental Niose. Part 3: Application to Noise Limits (ISO, Geneva)

Jackson, P. (1985), Policy Implementation and Monetarism: Two Primers Ch. 1 pp. 11-32 In: Implementing Government Policy Initiatives: The Thatcher Administration 1979-83. Ed. by P. Jackson (1985) (RIPA, London)

Jasanoff, S. (1982), Science and Administrative Rule-Making: Lessons from the OSHA Cancer Policy. Osgoode Hall Law Journal 20(3): 536-561

Jasanoff, S. and Nelkin, D., (1982), Science, Technology and the Limits of Judicial Competence. American Bar Association Journal 68: 1094-1099

Jenkins, M.P., Salvidge, A.C., and Utley, W.A. (1976), Noise Levels at the Boundaries of Factories and Commercial Premises. Building Research Establishment Current Paper No 43/76 (BRE, Garston, Watford)

Jones D.M. and Chapman, A.J. (1984a), Audition and Man, Noise and Society. Chapter 1. In: Jones, D.M. and Chapman, A.J. (Eds.) Noise and Society. (1984), (John Wiley and Sons, England)

Jones, D.M. and Chapman, A.J. (Eds.) (1984b), Noise and Society. (John Wiley and Sons, England)

Jowell, J. (1973), The Legal Control of Administrative Discretion. Public Law Autumn: 178-220

Jowell, J. (1975), Law and Bureaucracy. (Dunallen Publishing Company, New York)

Jowell, J. and Millichap, D. (1983), The Enforcement of Planning Control in London. Journal of Planning and Environment Law October 1983: 644-654

Jowell, J. and Millichap, D. (1986), The Enforcement of Planning Law: A Report and Some Proposals. Journal of Planning and Environment Law July 1986, 482-498

Jowell, R. and Witherspoon, S. (Eds.) (1985), British Social Attitudes, 1985. (Gower Publishing, London)

Kadish, S.H. (1963), Some Observations on the Use of Criminal Sanctions in Enforcing Economic Regulations. University of Chicago Law Review 30: 423-449

Kagan, R.A. (1978), Regulatory Justice: Implementing a Wage-Price Freeze. (Russell Sage, New York

Kagan, R.A. (1984), On Regulatory Inspectorates and the Police. Ch.3, pp.37-64. In: Hawkins, K. and Thomas, J.M. (Eds.) Enforcing Regulation (1984) (Kluwer Nijhoff Publishing, Boston)

Kaye, G.W.C. (1935), Some Scientific Aspects of Noise. pp. 11-18. In: Anti-Noise League, Noise Abatement Exhibition. Science Museum, South Kensington, 31 May-30 June 1935 (Anti-Noise League, London)

Keast, D.N. (1960), The Basic Sound Measuring System. In: Noise Reduction (L.L. Beranek, Ed.), Ch. 5, pp. 87-102 (McGraw-Hill Book Company, New York)

Kelman, S., (1984), Enforcement of Occupational Safety and Health Regulations: a Comparison of Swedish and American Practices. Ch.5. pp.97-119. In: Hawkins, K. and Thomas, J.M. (Eds.) Enforcing Regulation (1984) (Kluwer Nijhoff Publishing, Boston)

Kerse, C.S. (1975), The Law Relating to Noise. (Oyez Publishing, London)

King, A.J. (1965), The Measurement and Suppression of Noise. (Chapman and Hall, London)

Kingsbury, B.A. (1927), A Direct Comparison of the Loudness of Pure Tones. Physical Review 29: 588-600

Kittelsen, K.E. and Poulsen, C. (1964), Statistical Analysis of Sound Levels. Bruer and Kjaer Technical Review 1964 No. 1 (Bruel and Kjaer, Denmark)

Kohler, H.K. (1984), The Description and Measurement of Sound. In: Jones, D.M. and Chapman, A.J. (Eds) Noise and Society (1984) (John Wiley and Sons, England)

Kosten, C.W. and Van Os, G.J. (1962), Community Reaction Criteria for External Noises. In: The Control of Noise, National Physical Laboratory Symposium No. 12. 373-382. (HMSO, London)

Kryter, K.D. (1960), The Meaning and Measurement of Perceived Noise Levels. Noise Control 6(5): 12-27

Kryter, K.D. (1970), The Effects of Noise on Man. (Academic Press, London)

Kuehn, J. (1963), Instruments and Measurements. In: Noise Measurement and Control. (P. Lord and F.L. Thomas, Eds.) Ch.6 pp.84-106 (Heywood and Company, London)

Langdon, F.J. (1978), Reliability of Estimates of Annoyance with Road Traffic Noise. Proceedings of the Third International Congress on Noise as a Public Health Problem, pp. 567-70, (Freiburg, West Germany, 25-29 September 1978)

Langdon, F.J. (1985), Noise and Health: A Brief Review of Recent Research. National Society for Clean Air 52nd Annual Conference, 14-17 October 1985 Scarborough (NSCA, Brighton)

Langdon, F.J. and Scholes, W. (1968), The Traffic Noise Index. Building Research Station Current Paper CP38 (BRS, Garston, Watford)

Large J.B., Flindell, I.H. and Walker, J.G. (1980), Environmental Noise Criteria. National Society for Clean Air 47th Annual Conference, 22-25 September 1980, Bournemouth (NSCA, Brighton)

Laurie, P. (1970), Scotland Yard: A Personal Inquiry. (The Bodley Head, London)

Law Times (1959), The Nuisance of Noise. 228: 66-67 (4 September 1959)

Levitt, R. (1980), Implementing Public Policy. (Croom Helm, London)

Lidstone, K.W., Hogg, R. and Sutcliffe, F. (1980), Prosecutions by Private Individuals and Non-Police Agencies. Research Study No. 10, Royal Commission on Criminal Procedure (HMSO, London)

London Borough of Islington (1987) Police Sub-Committee Memorandum, 5 March 1987, Appendix A: Southwark Mediation Scheme

Macrory, R.B. (1982), Nuisance. (Oyez Longman Publishing, London)

Macrory, R.B. (1984), Street Noise - The Problems of Control. Journal of Planning and Environment Law June 1984: 388-394

Macrory, R.B. (1985), In court: Noise Abatement Zones. ENDS Report 120: 23

Macrory, R.B. (1986a), Environmental Policy in Britain - Reaffirmation or Reform? IIUG dp 86-4 (International Institute for Environment and Society, Berlin)

Macrory, R.B. (1986b), Science, Legislation and the Courts. pp. 64-72 In: The Assessment of Environmental Problems. Contributions to a conference held at Imperial College of Science and Technology. Ed. by Conway, G. (1986) (Centre for Environmental Technology, London)

Macrory, R.B. (1986c), In Court: Liability for Noise Nusiance. ENDS Report 132: 17

Macrory, R.B. and Withers, S. (1985), The Application of Administrative and Criminal Punishments with Regard to Hazardous Wastes in England. (Imperial College Centre for Environmental Technology, University of London)

Mannheim, (1964) Criminal Justice and Social Reconstruction. p.146

Martin, A.R. (1978), Environmental Health Officers and Occupational Health (Exploratory Research into the Function and Role). MSc thesis, Imperial College, University of London

Mayntz, R., Holm, K., and Hoebner, P. (1969), Introduction to Empirical Sociology. First published by Penguin Education in 1976, translated by Hammond, A., Davis, H., Shapiro, D. (Penguin Books, Harmondsworth, Middlesex)

McKennell, A.C. (1963), Aircraft Noise Annoyance around London (Heathrow) Airport. Central Office of Information, Report SS 337

McKnight, A.D (1974), Law and Administration. Ch.2, p.39 In: Environmental Pollution Control: Technical, Economic and Legal Aspects. McKnight, A.D., Marstrand, P.K. and Sinclair, T.C. (Eds.) (1974) (George Allen and Unwin, London)

Meij, G.V. (1971), A Critical, Historic Survey of Methods of Measurement and Assessment of Annoyance Caused by Noise. Transactions of the South African Institute of Electrical Engineers 62 Part 9: 149-201

Middlesex Officer Liaison Group on Noise Control (1982), Noise Nuisance - Guidance Notes for Environmental Health Staff. M.C. Gregory (Hon Secretary), c/o L.B. Ealing

Miers, D.R. and Page, A.C. (1982), Legislation. (Sweet and Maxwell, London)

Miller, D.C. (1935), Anecdotal History of the Science of Sound (to the Beginning of the Twentieth Century). (Macmillan, New York)

Mills, C.H.G. and Robinson, D.W. (1963), The Subjective Rating of Motor Vehicle Noise. Appendix IX, pp. 173-185. In: Noise - Final Report (1963), Committee on the Problem of Noise (HMSO, London)

Ministry of Health (1953), Report of the Working Party on the Recruitment, Training and Qualifications of Sanitary Inspectors. (HMSO, London)

Ministry of Public Building and Works (1968), Noise Control on Building Sites. Advisory Leaflet No. 72 (HMSO, London)

Montgomery, D.B.H. (1986), Environmental Health Education in the United Kingdom. Environmental Health 94(9): 231-240

Mulholland, K.A. (1979), Local Environmental Health Officers and Noise. Environmental Health 87(4): 74-79

Moodie, P. (1981), Criminal Law and Pollution. Environmental Policy and Law 7: 17-20

NAMAS Executive (1985), Introducing NAMAS. (brochure) (National Physical Laboratory Teddington)

New Scientist (1986a), 'New Noise Measures Aid Plan for More Flights'. 24 July 1986 No. 1518, p.23

New Scientist (1986b), 'Is Your Card Marked for Cancer?' 5 June 1986

New Scientist (1987), 'Radiation Watchdog Seeks Lower Dose Limits'. 19 November 1987, p.26

Noise Abatement Society (1969), The Law on Noise. (Noise Abatement Society, London)

Noise Abatement Society (1984), The War Against Noise in Great Britain. Report by Chairman to the International Noise Abatement Congress, Sarajevo, Yugoslavia

Noise Advisory Council (1971) Neighbourhood Noise. A Report by the Working Group on the Noise Abatement Act (Chairman: Sir Hilary Scott) (HMSO, London)

Noise Advisory Council (1972), Traffic Noise: the Vehicle Regulations and their Enforcement. Report by a Working Group of the Council (HMSO, London)

Noise Advisory Council (1974a), Noise in the Next Ten Years. Report by the Panel on Noise in the Seventies (HMSO, London)

Noise Advisory Council (1974b), Noise in Public Places. Report by a Working Group of the Council (HMSO, London)

Noise Advisory Council (1975a) Bothered by Noise? How the Law can Help You. (HMSO, London)

Noise Advisory Council (1975b), Noise Units. A report by a Working Party for the Research Sub-Committee of the NAC (HMSO, London)

Noise Advisory Council (1978), A Guide to the Measurement and Prediction of the Equivalent Continuous Sound Level Leq. Report by a Working Party for the Technical Sub-Committee of the Council (HMSO, London)

Noise Advsory Council (1980), A Study of Government Noise Insulation Policies. Report by a Working Group of the Council, (HMSO, London)

Noise Advisory Council (1981), The Darlington Quiet Town Experiment. Report by a Working Group of the Council (HMSO, London)

Noise Council (1986), Noise Legislation - Its Effectiveness for Noise Control. (The Noise Council, London)

Noll, R.G. (1971), Reforming Regulation: An Evaluation of the Ash Council Proposals. (The Brookings Institution, a staff paper, Studies in the Regulation of Economic Activity, USA)

Nonet, P., (1969), Administrative Justice: Advocacy and Change in a Government Agency. (Russell Sage Foundation, New York)

OECD (1980), Conference on Noise Abatement Policies. 7-9 May 1980 (Organisation for Economic Cooperation and Development, Paris)

OECD (1985), The State of the Environment 1985. Ch.8 - Noise (Organisation for Economic Cooperation and Development, Paris)

OECD (1986), Fighting Noise: Strengthening Noise Abatement Policies. (Organisation for Economic Cooperation and Development, Paris)

Ogus, A. (1982) The Regulation of Pollution. Ch. 3, pp. 30-68. In: Policing Pollution: A Study of Regulation and Enforcement. (Richardson, G. with Ogus, A. and Burrows, P.) (Clarendon Press, Oxford)

Ogus, A.I. and Veljanovski, C.G. (1984), Introduction to: Readings in the Economics of Law and Regulation. (Clarendon Press, Oxford)

Open University (1972), Technology Foundation Course, Noise Abatement. Prepared by Keith Attenborough (The Open University Press, Milton Keynes), p.5.

Open University (1975), The Control of the Acoustic Environment. Units 11 and 12 of the Environmental Control and Public Health Course. Prepared by the Course Team (The Open University Press, Milton Keynes)

Osborn, W.C. (1974), The Law Relating to the Regulation of Noise. Ch. 11 pp. 271-303, In: Environmental Pollution Control: Technical, Economic and Legal Aspects. A.D McKnight, P.K. Marstrand and T.C. Sinclair (Eds.) (1974) (George Allen and Unwin, London)

Pain, H.J. (1976), The Physics of Vibrations and Waves. Second Edition, p. 150 (John Wiley and Sons, London)

Pallett, D.S. (1975), Noise and the National Measurement System. Proceedings of Noise-Con 75, 157-182

Parkin, P.H., Purkis, H.J., Stephenson, R.J. and Schlaffenberg, B. (1968), London Noise Survey. Building Research Station Report S.O. Code No. 67-266, HMSO, London

Paulus, I. (1974), The Search for Pure Food. (Martin Robertson, London)

Peachey, J.E. and Macrory, R.B. (1983), Underlying Themes in the Policy Process. pp.86-95. In: Britain, Europe and the Environment. Contributions to a Conference held at Imperial College of Science and Technology, Ed. by Macrory, R.B. (1983) (Centre for Environmental Technology, London)

Penn, C.N. (1977), Noise Abatement Zones. NSCA 6th Technical Seminar,

Manchester, 9-10 March 1977

Penn, C.N. (1979), Noise Control. (Shaw and Sons, London)

Pepinsky, H.E. (1976), Crime and Conflict: A Study of Law and Society. (Martin Robertson, London)

Piliavin, I. and Briar, S. (1964), Police Encounters with Juveniles. American Journal of Sociology 70: 206-214

Pound, R. (1959), Jurisprudence. Volume II p. 124

Rayleigh, Lord (1882), On an Instrument Capable of Measuring the Intensity of Aerial Vibrations. Philos. Mag. 14: 186-187

Reiss, A.J. Jr. (1971), The Police and the Public. (Yale University Press, New Haven)

Reiss, A.J. (1984), Selecting Strategies of Control over Organisational Life. Ch.2, pp. 23-35. In: Hawkins, K. and Thomas, J.M. (Eds.) Enforcing Regulation. (1984) (Kluwer Nijhoff Publishing, Boston)

Report of the Committee on Safety and Health at Work (Robens Committee) (1972), Cmnd. 5034 (HMSO, London)

Report on Staffing in Environmental Health (1978), p.32 (ADC, AMA, LACSAB, LGTB)

Reynolds, F. (1977), Noise Control - the Present and Future Position. NSCA 6th Technical Seminar, Manchester, 9-10 March 1977

Rhodes, G. (1981), Inspectorates in British Government: Law Enforcement and Standards of Efficiency. (George Allen and Unwin, London)

Rhodes, G. (1986a), Relations between Central and Local Government: the Experience of the Environmental Health and Trading Standards Services. Research Paper 4: Environmental Health (RIPA, London)

Rhodes, G. (1986b), Central - Local Relations: The Experience of the Environmental Health and Trading Standards Services (RIPA, London)

Richardson, G.M. and Ogus, A.I. (1979), The Regulatory Approach to Environmental Control. Urban Law and Policy 2: 337-357

Richardson, G.M. with Ogus, A.I. and Burrows, P. (1982), Policing Pollution: A Study of Regulation and Enforcement. (Clarendon Press, Oxford)

Robinson, D.W. (1962), General Problems of the Control of Noise. Paper A-1, pp. 5-17. In: National Physical Laboratory Symposium No. 12, The Control of Noise - Proceedings of a Conference held at the National Physical Laboratory, 26-28 June 1961 (HMSO, London)

Robinson, D.W. (1969), An Outline Guide to Criteria for the Limitation of Urban Noise. NPL Aero Report Ac. 39 (National Physical Laboratory, Teddington)

Robinson, D.W. (1971), Towards a Unified System of Noise Assessment. J. Sound and Vibration 14(3): 279-298

Robinson, D.W. (1972), An Essay in the Comparison of Environmental Noise Measures and Prospects for a Unified System. NPL Acoustics Report Ac. 59 (National Physical Laboratory, Teddington)

Robinson, D.W. (1976), The Assessment of Noise, with Particular Reference to Aircraft. Aeronautical Journal 80: 147-161

Robinson, D.W. (1977), Practice and Principle in Environmental Noise Rating. NPL Acoustics Report Ac. 81 (National Physical Laboratory, Teddington)

Robinson, D.W. (1980), National and International Standardisation. Proceedings of the Institute of Acoustics, Conference on Standardisation in Acoustics, National Physical Laboratory, Teddington, 1980

Robinson, D.W. and Dadson, R.S. (1956), A Redetermination of the Equal Loudness Relations for Pure Tones. British Journal of Applied Physics 7: 166-181

Romaine, D.R., (1983), The Control of Neighbourhood Noise. Noise and Vibration Worldwide. May 1983: 99-103

Romaine, D.R. (1986), Alternative Noise Abatement Zones. National Society for Clean Air 53rd Annual Conference, 27-30, October 1986, Blackpool

Rossi, P.H., Waite, E., Bose, C.E. and Berk, R.E. (1974), The Seriousness of Crimes - Normative Structure and Individual Differences. Amer. Sociol. Review 39: 224-237

Rowland, A.J. and Cooper, P. (1983), Environment and Health. Ch. 1. (Edward Arnold, London)

Royal Commission on Environmental Pollution (1971), First Report. Cmnd. 4585, (Para. 72) (HMSO, London)

Royal Commission on Environmental Pollution (1976), Fifth Report. Air Pollution Control: An Integrated Approach. Cmnd. 6371 (HMSO, London)

Royal Commission on Environmental Pollution (1984), Tenth Report: Tackling Pollution - Experience and Prospects. Cmnd. 9149 (HMSO, London)

Royal Commission on Environmental Pollution (1988), Twelfth Report. Best Practicable Environmental Option. Cmnd 310 (HMSO, London)

Salem, S.R. (1983), Discretion in Criminal Justice: A theoretical analysis of the concept and a proposed framework for examining its exercise in the criminal justice process. Unpublished Ph.D thesis, Clare Hall, University of Cambridge

Sanders, A. (1985a), The Prosecution Process, Ch. 7 pp.65-85. In: Managing Criminal Justice: A Collection of Papers. Edited by D Moxon. Home Office Research and Planning Unit (HMSO, London)

Sanders, A. (1985b), Class Bias in Prosecutions. Howard Journal 24: 176-199

Sanitary Journal (1930), New Clauses in Private Acts. 36(4): 78 (November 1930) ('the Organ of the Sanitary Inspectors' Association')

Sayre, F.B. (1933), Public Welfare Offences. Columbia Law Review 33: 55-88

Scharf, B. and Hellman, R. (1979), Comparison of Various Methods for Predicting the Loudness and Acceptability of Noise: Part II: Effects of Spectral Pattern and Tonal Components (EPA Report 550/9-79-102 (1979))

Schultz, T.J. (1982), Community Noise Rating. (Second Edition) (Applied Science Publishers, London)

Selznick, P. (1966), TVA and the Grass Roots: A Study in the Sociology of Formal Organisation. (revised edition) (Harper and Row, New York)

Sewell, E.C. and Scholes, W.E. (1979), Sound Insulation Performance Between Dwellings Built in the Early 1970s. Current paper CP20/78 (Building Research Establishment, Garston, Watford)

Sewell, E.C., Alphey R.S., Savage J.E. and Flynn, S.J. (1980), Field Measurement of the Sound Insulation of Plastered Cavity Masonry Walls. Building Research Establishment paper

Shore, P. (1977), Foreword. In: Department of the Environment (1977) Environmental Standards: A Description of United Kingdom Practice. Pollution Paper No. 11 (HMSO, London)

Shover, N., Lynxwiler, J., Groce, S. and Clelland, D. (1984), Regional Variation in Regulatory Law Enforcement: The Surface Mining Control and Reclamation Act of 1977. pp. 121-146. In: Hawkins, K. and Thomas, J.M. (Eds.) Enforcing Regulation. (1984) (Kluwer Nijhoff Publishing, Boston)

Skolnick, J.H. (1966), Justice Without Trial: Law Enforcement in Democratic Society. (John Wiley, New York)

Smith, M. and Pearson, A. (1969), The Value of Strict Liability. Criminal Law Review 6: 5-16

Solesbury, W. (1976), The Environmental Agenda. Public Administration, Winter 1976: 379-397

Southwood, R. (1986), Lead in the Environment. pp.12-21. In: The Assessment of Environmental Problems. Contributions to a conference held at Imperial College of Science and Technology. Ed. by Conway, G. (1986) (Centre for Environmental Technology, University of London)

Steer, D. (1980), Uncovering Crime: The Police Role. Royal Commission on Criminal Procedure, Research Study No. 7 (HMSO, London)

Stevens, K.N., Rosenblith, W.A. and Bolt, R.H. (1955), A Community's Reaction to Noise: Can it be Forecast? Noise Control 1: 63-71

Stevens, S.S. (1961), Procedure for Calculating Loudness: Mark VI J. Acoust. Soc. Am. 33: 1577-85

Stevens, S.S. (1972), Perceived Level of Noise by Mark VII and Decibels (E). J. Acoust. Soc. Am. 51: 575-93

Strauss, H.G. (1935), The Law and Noise. In: The Anti-Noise League: Noise Abatement Exhibition, Science Museum, South Kensington, 31 May - 30 June 1935 (Anti-Noise League, London)

Sullivan, D.C. and Siegel, L.J. (1972), How Police Use Information to Make Decisions: An Application of Decision Games. Crime and Delinquency 18: 253-262

Sutherland, E.H. (1940), White-Collar Criminality. American Sociological Review 5(1): 1-12

Sutherland, E.H. (1945), Is White Collar Crime Crime? American Sociological Review 10: 132-139

Sutton, P. (1979), The Effects of Weather on Noise Measurement and Assessment. National Society for Clean Air Annual Conference, 15-18 October 1979, Scarborough (NSCA, Brighton)

Tappan, P.W. (1947), Who is the Criminal? Americal Sociological Review 12: 96-102

Taylor, R. (1975), Noise. (Second Edition) (Penguin Books, Harmondsworth, Middlesex)

Taylor, R. (1981), Noise in Court. Justice of the Peace 145:100

Taylor, R., (1987), United Kingdom: Noise Pollution. pp.457-459 In: European Environmental Yearbook 1987, Institute for Environmental Studies, Milan (DOCTER International UK, London)

Tebay, S., Cumberbatch, G. and Graham, N., (1986), Disputes Between Neighbours. Final Report, January 1986. (Applied Psychology, Aston University, Birmingham)

Tempest, W. and Bryan, M.E. (1972), Low Frequency Sound Measurement in Vehicles. Applied Acoustics 5:139

Tempest, W. and Bryan, M.E. (1976), Noise Measurement and Evaluation. Proc. Institute Electrical Engineers 123 (10R) IEE Reviews: 1113-1137

Tench, D., (1981), Towards a Middle System of Law. (The Consumers' Association, London)

The Independent (1988a), 'Thatcher Backs 'Green' Policies'. 28 September 1988

The Independent (1988b), 'Man Killed Loud Reggae Neighbour'. Tuesday 12 July 1988, p. 3

The Times (1959a), 'Paris Week of Silence'. Tuesday 26 May 1959, p. 9

The Times (1959b), 'Effects of Noise on Efficiency'. Wednesday 9 December 1959, p. 12

The Times (1959c), 'Anti-Noise Bill to be Modified'. Tuesday 15 December 1959, p. 10

Topler and Boltzmann (1870), Ueber ein Neue Optische Methods, die Schwingungen Tonender Luftsaulen zu Analysinen. Ann. Phys and Chem, 141: 321-352

TRACOR (1970), Community Reaction to Airport Noise - Final Report. Document Number T-70-AU-7454-U (TRACOR, Austin, Texas)

Trevor-Jones, D. (1986), Sound Insulation and the Law. London Environmental Bulletin 3(4)/4(1): 8-9

Turner, R.M. (1940), Noise and Public Health. The Sanitarian 8(11): 232-236 (June 1940)

Utley, W.A. (1977), Neighbourhood Noise in the United Kingdom - A Review. In: Noise Nuisance Assessment - BS 4142: Reviewed and Criticised. Proceedings of the Institute of Acoustics, Birkbeck College, London, 8 February 1982

Utley, W.A. and Alphey, R.S. (1974), A Survey of the Sound Insulation Between Dwellings in Modern Building Constructions. Building Research Establishment Current Paper, CP52/74, (BRE, Garston, Watford)

Utley, W.A. and Buller, I.B. (1987), A Study of Complaints about Noise from Domestic Premises. BRS 196/87 (Building Research Establishment, Garston, Watford)

Utley, W.A. and Salvidge, A.C. (1980), Noise Abatement Zones 1976-79. Environmental Health 88(5): 104-108

Veljanovski, C. (1983), Regulatory Enforcement: An Economic Study of the Factory Inspectorate. Law and Policy Quarterly 5: 75- 96

Veljanovski, C. (1984), The Economics of Regulatory Enforcement. Ch.8, pp.171-188. In: Hawkins, K. and Thomas, J.M. (Eds.) (1984) Enforcing Regulation. (Kluwer Nijhoff Publishing, Boston)

Vogel, D. (1986), National Styles of Regulation: Environmental Policy in Great Britain and the United States. (Cornell University Press, Ithaca)

Von Moltke, K. (1988), The Vorsorgeprinzip in West German Environmental Policy. Appendix 3, pp. 57-70. In: Royal Commission on Environmental Pollution (1988) Twelfth Report. Best Practicable Environmental Option. Cmnd 310 (HMSO, London)

Wakstein, C. (1974), Pollution by Noise: Social and Technial Aspects. In: Environmental Pollution Control: Technical, Economic and Legal Aspects. A.D. McKnight, P.K. Marstrand and T.C. Sinclair (Eds.) (1974) (George Allen and Unwin, London)

Walker, D.M. (1980), The Oxford Companion to Law. (Clarendon Press, Oxford)

Weber, M. (1947), The Theory of Social and Economic Organisation. Trans. A. Henderson and T. Parsons, p. 340 (The Free Press Edition 1964, New York)

Whittle, L.S. and Robinson, D.W. (1974), Discotheques and Pop Music as a Source of Noise-Induced Hearing Loss: A Review and Bibliography. NPL Acoustics Report AC 66, March 1974 (National Physical Laboratory, Teddington)

Williams, (1961) Criminal Law. Second Edition, p. 259

Williams, P.R. and Robinson, D.W. (1985), The Rating of Environmental Noises Containing Tonal Components: A Literature Review. Institute of Sound and Vibration Research Memorandum No. 665 (ISVR, University of Southampton)

Wilson, D. (1984), The Secrets File: the Case for Freedom of Information in Britain Today. (Heinemann Educational, London)

Winfield and Jolowicz (1979), Winfield and Jolowicz on Tort. (11th Edition), Ed. by Rogers, W.V.H. (Sweet and Maxwell, London)

Working Party on Environmental Health Education (1986), Professional Profile of an Environmental Health Officer. Consultative Document (Institution of Environmental Health Officers, London)

World Health Organisation (1972), Health Hazards of the Human Environment. Chapter 15: Non-Ionising Radiation and Ultrasonic Waves, pp. 253-256 (WHO, Geneva)

World Health Organisation (1980), Environmental Health Criteria. 12: Noise. Published under the joint sponsorship of the United Nations Environment Programme and the WHO (WHO, Geneva)

World Health Organisation Chronicle (1947), Constitution of the World Health Organisation, Annex 1. Vol. 1, p.29

Wright. D. (1982), Noise Abatement Zones as a Method of Neighbourhood Noise Control. MSc thesis, Imperial College Centre for Environmental Technology, University of London

Wynne, B.E. (1982), Science and Law as Conflict-Resolving Institutions - the Implications of Recent Sociology of Science. Paper presented at the annual meeting of the British Society for the Philosophy of Science, University of Durham, September 1982

APPENDIX 1

Key Events in the History of Neighbourhood Noise Legislation

720 BC	Authorities in Greek city of Sybaris able to prevent industrial noise in residential areas and provide for zoning of the city.
BC	Magistrates in Pompeii authorised to prevent street noise.
13th century	Noisy or unpleasant trades, eg. tanners, butchers, smiths, restricted to specific areas of London.
1725 onwards	Common law of nuisance applied to noise problems.
Mid 19th century	Several national Acts passed dealing with, inter alia, specific noise problems, eg. Locomotives Act 1865; Steam Whistles Act 1872; Explosives Act 1875.
" "	Several local Acts introduced dealing with public order and minor street offences, including some relating to specific noise problems, eg. Metropolitan Police Act 1839.
1875	Public Health Act 1875, consolidating and expanding Public Health Act 1848. Noise omitted from list of statutory nuisances.
1882	Municipal Corporations Act 1882 enabled the London County Council, county councils and borough councils outside London to make byelaws controlling, amongst other things, specific noise problems.
1899	London Government Act 1899 enabled London boroughs to make byelaws controlling, inter alia, specific noise problems.
1930	First local Acts passed making noise amenable to statutory nuisance procedure, but only if the noise was: (1) excessive or unreasonable or unnecessary, and (2) injurious or dangerous to health, and (3) capable of being prevented or mitigated having due regard to all the circumstances of the case.
1932	First anti-noise pressure group founded: the Anti-Noise League.
1933	For authorities outside London, s.249 Local Government Act 1933 amended byelaw-making provisions.
1935	Anti-Noise League staged a "Noise Abatement Exhibition" at the Science Museum, London.
1936	Public Health Act 1936 consolidated and expanded 1875 enactment. Noise omitted from list of statutory nuisances.
1939	For London authorities, s.146 London Government Act 1939 amended byelaw-making provisions.

" " Demise of Anti-Noise League (as a result of onset of war?)

1959 The Noise Abatement Society founded.

1960 Noise Abatement Act 1960 made noise "which is a nuisance" amenable to statutory nuisance procedure; the first national enactment of general application to neighbourhood noise.

" " Committee on the Problem of Noise (the "Wilson Committee") established "to examine the nature, sources and effects of the problem of noise and to advise what further measures can be taken to mitigate it".

1963 Final Report of the Wilson Committee.

1967 BS 4142 ("Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas") published.

1970 Noise Advisory Council (NAC) established.

" " In November 1970, a working group of the NAC (the "Scott Committee") was set up "to study further the working of the Noise Abatement Act; to formulate proposals for strengthening it; and to report".

1971 Scott Committee report, "Neighbourhood Noise", published.

1972 S.235 Local Government Act 1972 updated byelaw-making provisions in Local Government Act 1933.

" " S.101 Local Government Act 1972 permitted the delegation of the decision to serve a noise abatement notice to individual officers.

1973 Circular 10/73 "Planning and Noise" published.

" " Protection of the Environment Bill introduced in the House of Lords, incorporating many of the recommendations of the Scott Committee.

1974 Generalelection in February 1974 interrupted passage of the Protection of the Environment Bill. Reintroduced as "Control of Pollution Bill" which received Royal Assent on 31 July 1974.

" " Report from working party of NAC, "Noise in Public Places", published.

" " Report from working party of NAC, "Noise in the Next Ten Years", published.

1975 The Control of Noise (Code of Practice for Construction and Open Sites) Order 1975, SI No.2115, designated BS 5228 as the code of practice for use on construction sites in accordance with s.71

COPA.

" " Control of Noise (Appeals) Regulations 1975, SI No.2116, published.

1976 Neighbourhood noise provisions of Control of Pollution Act 1974 (Part III) implemented on 1 January.

" " Circular 2/76 published giving information on the implementation of Part III COPA.

" " Enabling regulations for noise abatement zones in Part III COPA made (Control of Noise (Measurement and Registers) Regulations 1976, SI No.37).

" " Start of the Darlington Quiet Town Experiment in September 1976.

1981 NAC disbanded in February 1981.

" " Orders made giving legal effect to codes of practice under COPA s.71 (Control of Noise (Code of Practice on Noise from Ice Cream Van Chimes etc.) Order SI No.1828; Control of Noise (Code of Practice on Noise from Audible Intruder Alarms) Order SI No.1829; Control of Noise (Code of Practice on Noise from Model Aircraft) Order SI No.1830).

1984 BS 5228 updated in four parts. The Control of Noise (Codes of Practice for Construction and Open Sites) Order 1984, SI No. 1992, approved the first three parts.

1985 EEC Directives, setting permissible sound power levels for specified types of construction plant and equipment offered for sale in the Community, implemented in Britain (by the Construction Plant and Equipment (Harmonisation of Noise Emission Standards) Regulations 1985 SI No.1968).

" " "Lifting the Burden" white paper. DOE review of statutory nuisance and noise in relation to government's deregulation policy.

1986 EEC Directive setting product standards for the sound power level of lawnmowers implemented in Britain (by the Lawnmowers (Harmonisation of Noise Emission Standards) Regulations 1986 SI No. 1795).

1987 The Control of Noise (Codes of Practice for Construction and Open Sites) Order 1987, SI No.1730 approved Part 4 BS. 5228 - Code of Practice for Noise Control Applicable to Piling Operations.

" " Lawnmowers (Harmonisation of Noise Emission Standards) (Amendments) Regulations 1987, SI No.876, amended SI 1986 No.1795.

1988 Construction Plant and Equipment (Harmonisation of Noise Emission Standards) Regulations 1988, SI No.361, implemented EEC Directives 84/532/EEC and 86/662/EEC.

APPENDIX 2

Physical Description of Sound

1. Sound

Sound is defined as "any pressure variation (in air, water or other medium) that the human ear can detect" (Bruel and Kjaer, 1984). Sound consists of rapid, small-scale fluctuations of the instantaneous air pressure above and below the local barometric pressure, often following a repetitive or periodic pattern, which can be detected by the human ear (Schultz, 1982). According to the British Standards Institution, "sound is the sensation of hearing excited by mechanical disturbance" (BS 661).

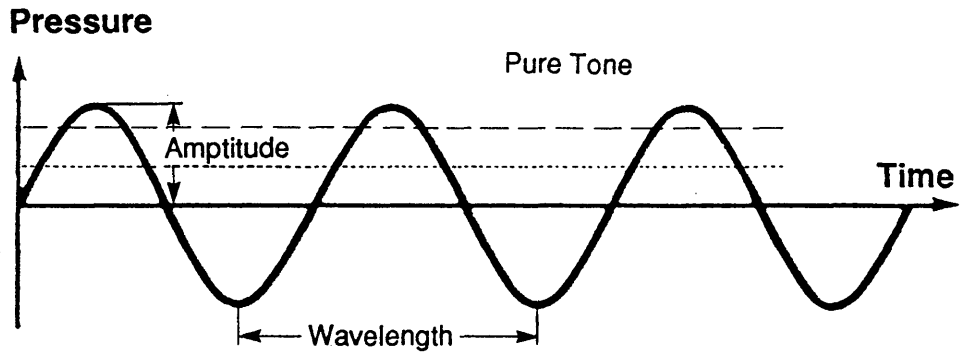
Sound waves may be initiated by a vibrating solid object (such as a loudspeaker diaphragm) or by a turbulent airflow (such as that from a whistle or the wake of a jet engine). Sound waves radiate away from the source at a constant speed of approximately 320 metres per second. The simplest type of sound wave has a sinusoidal form. A sound wave may be completely characterised by three variables: amplitude, intensity and frequency (Figure A).

(i) Amplitude

This is the magnitude of the pressure fluctuation and broadly speaking corresponds to the subjective impression of the loudness of the sound (but see Section 3 of this Appendix for a more detailed explanation). Amplitude is measured in Newtons per metre squared, or Pascals (Pa). Since the pressure fluctuations are so small, it is more convenient to talk in terms of micropascals (uPa, equivalent to 0.000001 Pa). To measure the amplitude of a sine wave it is usual to take the RMS value (root mean square) - a particular type of average value - or the peak value of the wave. The RMS value is useful in sound measurements since it takes into account the time history of the wave and gives an amplitude value which is directly related to the

FIGURE A

PARAMETERS OF A SOUND WAVE



– – – – RMS Level (Root mean square)

..... Average Level

$$\text{Frequency} = \frac{\text{Speed of Sound}}{\text{Wavelength}}$$

energy content of the signal. The RMS value is equivalent to 0.707(peak value).

(ii) Intensity

At a point in a travelling sound wave, the intensity of the sound is the average rate of flow of sound energy per unit area (the area is perpendicular to the direction of propagation of the sound). Intensity is measured in Watts per metre squared.

$$I = \frac{p^2}{pc}$$

I = intensity
P = RMS sound pressure in Pascals
pc = characteristic impedance of air (= density of air x speed of sound in air) = 440 kg/metre^2 seconds.

For environmental measurements in the 'free field' (generally speaking, this means measurements made out-of-doors), sound intensity is equal to sound pressure. This relationship does not hold for measurements made in the 'near field' (generally speaking, measurements made indoors) (Bruel and Kjaer, 1986).

(iii) Sound Power

Both pressure and intensity measurements are dependent on the distance from the sound source and on the sound field in which the sound waves are present. Sound power, however, is a quantity which is more or less independent of the environment. It is a measure of the rate at which energy is radiated in all directions from a sound source (in Watts). Intensity is equivalent to sound power per unit area.

(iv) Frequency

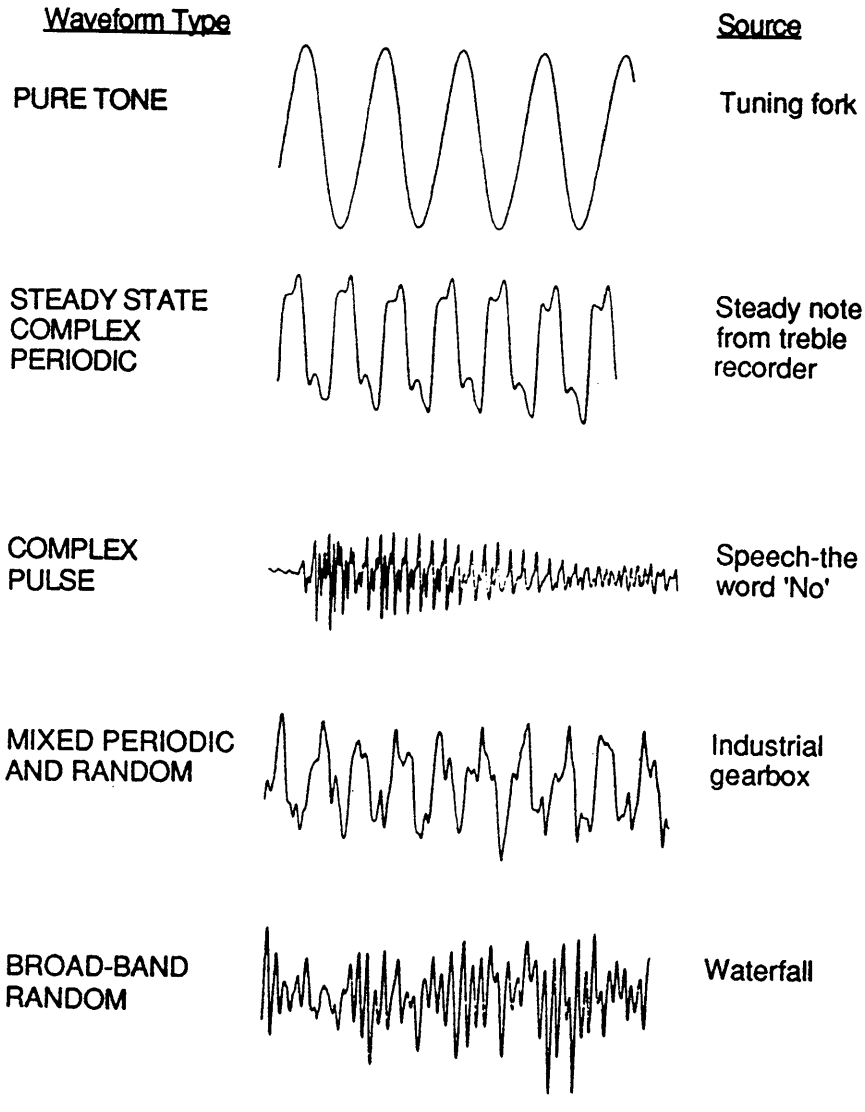
This is the number of pressure variations per second, measured in cycles per second, or Hertz (Hz): 1 Hz = 1 cycle per second. Frequency corresponds to the subjective impression of pitch: the rumble of thunder has a low frequency, whilst a whistle has a high frequency. Frequency equals the speed of sound divided by the wavelength (the distance from one wavetop or pressure peak to the next). Thus frequency is inversely proportional to wavelength, so high frequencies have short wavelengths while low frequencies have long wavelengths.

A sound which has only one frequency is known as a 'pure tone'. In practice pure tones are seldom encountered, since most sounds consist of a mixture of different frequencies: even a single note of a piano is composed of several frequencies and consequently has a complex waveform. Most sounds which are considered to be noise consist of a wide range of frequencies (Figure B).

2. Sound Pressure and Sound Pressure Level

The range of audible sound pressures is enormous: from 20 uPa (the threshold of hearing) to approximately 63 million uPa (the threshold of pain) (Schultz, 1982). Expressing this million to one range of audible sound pressures on a linear scale is impractical, so the range is "compressed" by using a logarithmic scale. This logarithmic scale divides up the range of audible sound pressures into 130 units, called DECIBELS (dB). This is a relative, rather than an absolute scale, since 0 dB is usually taken to be 20 uPa (the threshold of hearing) rather than absolute zero pressure. Consequently sound pressures expressed in decibels are referred to as SOUND PRESSURE LEVELS.

FIGURE B
SOME TYPICAL SOUND PRESSURE WAVEFORMS
(Kohler, 1984)



N.B. Time axis scales are not uniform

In mathematical terms, the sound pressure level, L, expressed in decibels is:

$$L = 10 \log \left(\frac{p^2}{p_o^2} \right) = 20 \log \left(\frac{p}{p_o} \right)$$

where P is the sound pressure and P_o is the reference pressure, usually 20 uPa (the threshold of hearing).

In other words, the sound pressure level is ten times the logarithm of the ratio of the square of the sound pressure in question to the square of the reference sound pressure (20 uPa). Figure C provides the sound pressure levels of some commonly encountered noises.

The term "decibel" was first used in 1927 in reports of the International Advisory Committee on Long Distance Telephony in Europe (Schultz, 1982). In addition to expressing sound pressures in a more convenient range of units, the decibel scale also gives a better approximation to the human perception of loudness than does the Pascal scale. This is because the ear itself reacts to sound in a logarithmic fashion, such that 1 dB is the same relative change in loudness everywhere on the decibel scale: each increase of 10 dB sounds subjectively about twice as loud to the ear. However, in terms of physical sound pressures, an increase of 6 dB corresponds to a doubling of sound pressure. The smallest change in sound pressure level that can be perceived by the ear is approximately 3 dB.

3. Frequency and Loudness

The normal range of audible frequencies extends from approximately 20 Hz up to 20,000 Hz. However, the ear is not equally sensitive at all audible frequencies. It is most sensitive to frequencies between 2000 Hz and 5000 Hz, and sensitivity drops off below 100 Hz and above 8000 Hz (Figure D).

FIGURE C
SOUND PRESSURE LEVELS OF SOME COMMONLY ENCOUNTERED NOISES
(OECD, 1985)

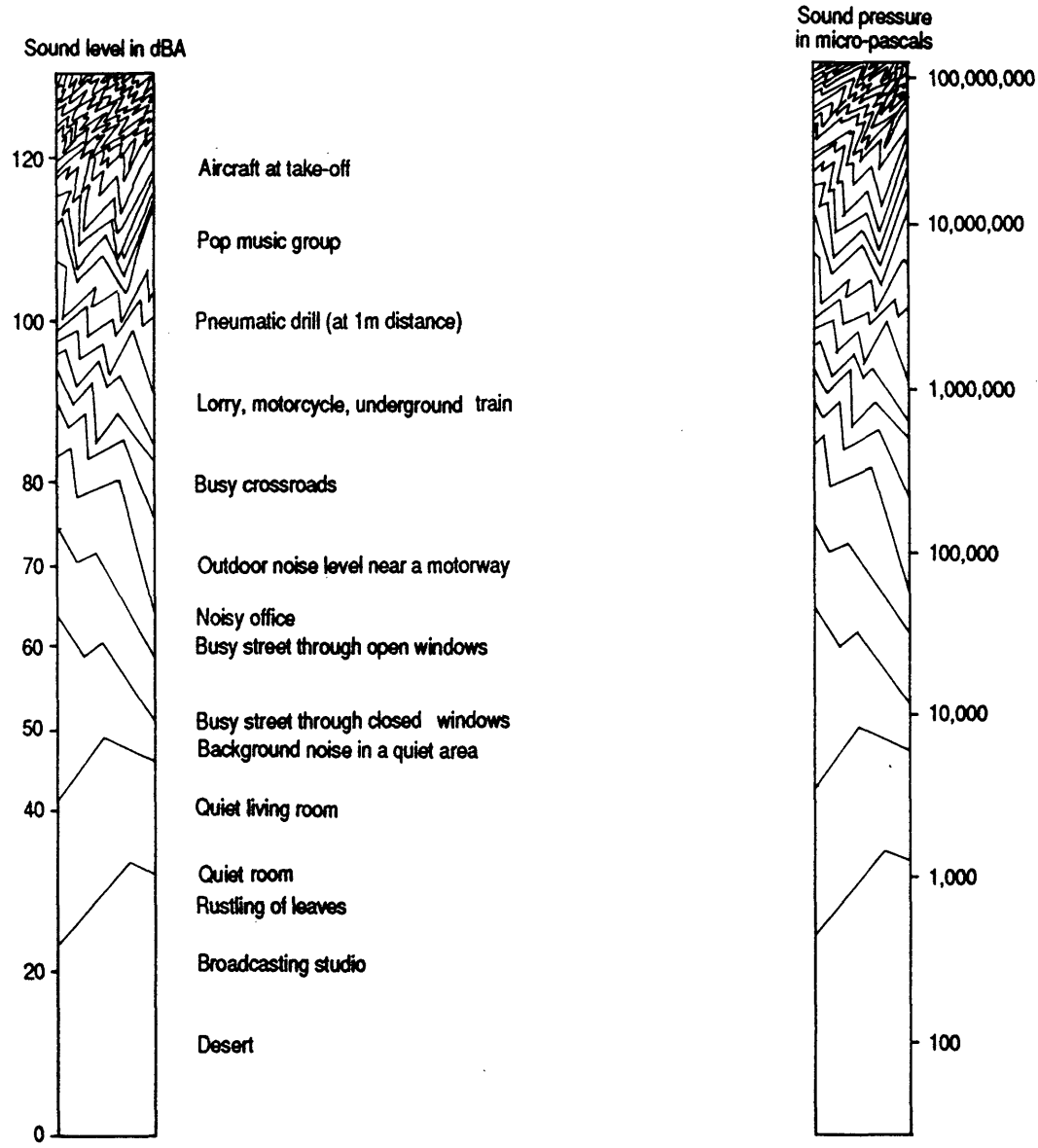
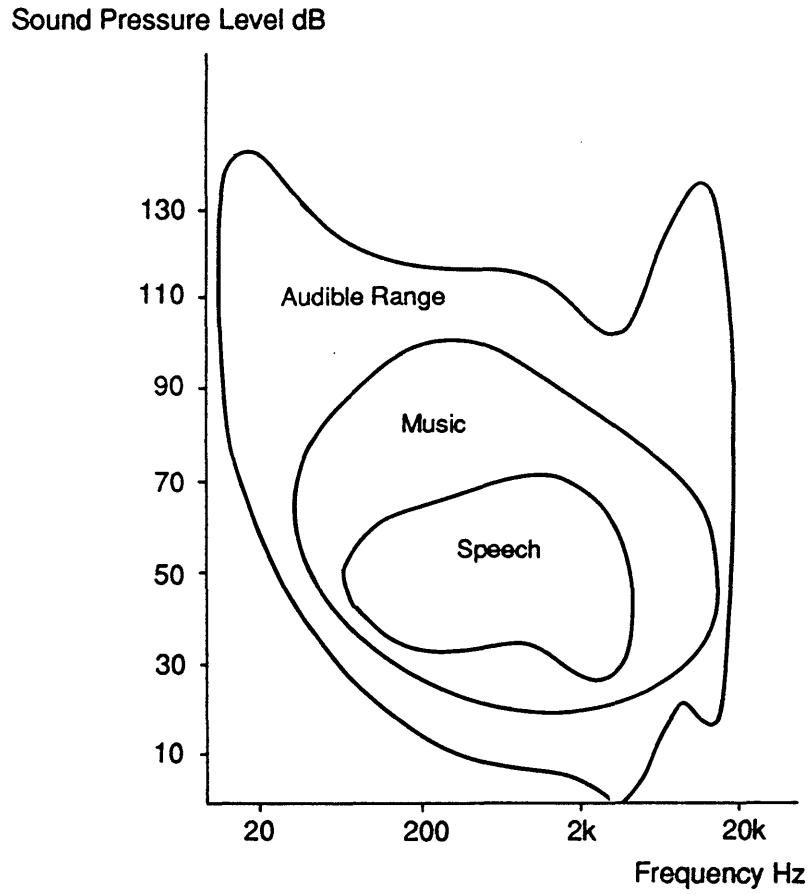


FIGURE D
RANGE OF AUDIBLE FREQUENCIES
(Bruel and Kjaer, 1984)



Sounds of different frequency do not sound as loud even when they have the same sound pressure level. A whole series of experiments was undertaken between 1925 and 1956 to investigate this phenomenon (Meij, 1971), mainly concerned with the development of equal loudness contours.

(i) Equal Loudness Contours

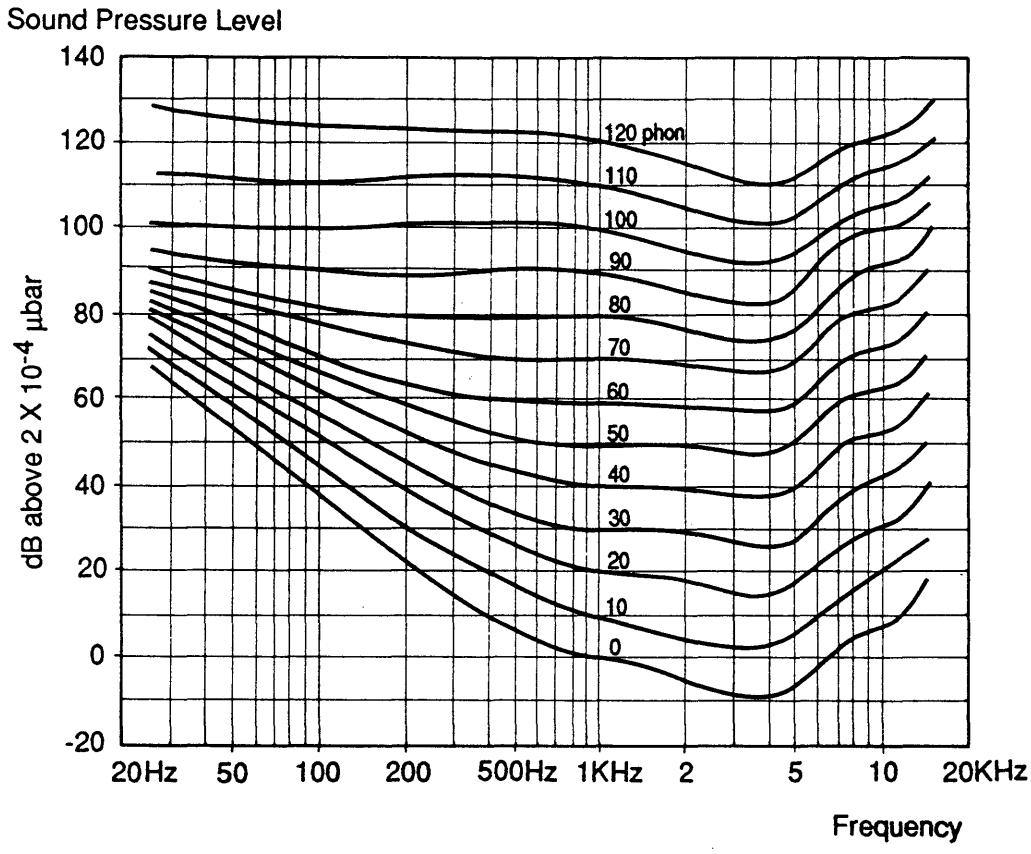
Fletcher and Munson (1933) carried out some comprehensive experiments using the so-called 'loudness balance' technique. A panel of observers was asked to compare the relative loudness of a 1000 Hz reference tone with a succession of sounds of varying frequency and sound pressure level. An observer first heard the reference tone through earphones, followed by the sound in question. The observer could vary the magnitude of the reference tone by using a control until it sounded as loud as the other tone. The reference tone was presented alternately with the other sound, until the observer considered the loudness of both to be the same. In this way the average perceived loudness of sounds of various frequencies and sound pressure levels, in relation to a 1000 Hz reference tone, was established for the panel. From these data, Fletcher and Munson produced a set of equal loudness contours (Figure E). For a given sound pressure level, sounds at the low and high ends of the audible frequency spectrum are perceived as being quieter than those in the middle of the spectrum, as the ear is more sensitive to frequencies in the middle of the audible range (2 kHz to 5 kHz).

From these equal loudness contours, it was possible to define the loudness level in PHONS of any given sound as:

> The sound pressure level in decibels of a 1000 Hz tone adjusted to sound exactly equal in loudness.

So, whatever the physical parameters of two sounds, if they have the same value in terms of phons this means that the "average" human ear will perceive them to be equally loud. The steps on the phon scale, however, are such that a doubling of phons does not correspond with a

FIGURE E
THE FLETCHER-MUNSON
EQUAL LOUDNESS LEVEL CONTOURS
(Broch, 1962)



doubling of perceived loudness: there is no simple relationship between the number on the scale and the magnitude of the sensation experienced. In order to overcome this disadvantage, another scale - the SONE scale - was devised, in which a doubling of the scale corresponds with a doubling of the perceived loudness of the sound (1 sone = 40 phons).

Various other determinations of equal loudness contours were made, for example, by Churcher and King (1937) and by Robinson and Dadson (1956). Robinson and Dadson's work formed the basis for an international standard set of equal loudness contours for pure tones (ISO R.226), which was incorporated into a British Standard in 1961 (BS 3383).

(ii) Calculation of Loudness

A great deal of work was undertaken, notably by Stevens and Zwicker, to devise methods of calculating the perceived loudness of noises from basic physical parameters, without recourse to the subjective appraisal of a jury of listeners. Their methods are applicable to complex noises, not just to pure tones, and take account of masking, that is, the ability of the loudest frequency bands to drown out the contributions of the other bands in the spectrum to the total impression of loudness.

Stevens' 'Mark VI Method' (Stevens, 1961) requires an octave or third-octave frequency analysis of the noise in question. For each frequency band, a loudness index is calculated graphically, which represents the potential contribution of that band to the total loudness. Weighting factors are then applied to each band (since the loudest band masks the contributions of the other bands to the total impression of loudness), and the weighted loudness indices are then summed to derive the total loudness of the noise, which is converted into phons via a quick calculation. A greatly modified version of this method was later published, called the 'Mark VII Method' (Stevens, 1972).

Zwicker's method of loudness calculation requires a third-octave frequency analysis of the noise. A more complex method than those of Stevens, it takes into account the asymmetry of masking (a loud band of noise inhibits the contribution to the total loudness of bands of higher frequency than itself more than those of lower frequency). It is a graphical method, really requiring the use of a computer (Broch, 1962).

APPENDIX 3

Key Events in the History of Noise Measuring Technology and Neighbourhood Noise Rating

1882	'Rayleigh disc' developed: a direct mechanical method of measuring sound pressure by means of a small, thin disc.
1906	Triode amplifier invented by L de Forest.
1915	E C Wente designed the first condenser microphone.
1925/26	First portable sound level meters in use, consisting of microphone, amplifier and indicating instrument.
1927	The "decibel" introduced as the unit of sound pressure level.
1930	Results of New York City noise survey published; the earliest systematic noise measurements to be carried out in the USA.
1930s	"Subjective" noise meters in vogue.
" "	Electrical networks developed which could filter frequency bands for determining the frequency spectrum of a noise.
1933	Fletcher and Munsen published experiments on the equal-loudness relations for pure tones.
" "	First sound level meters with A, B and C frequency weighting networks on the market.
1937	Further determinations of equal loudness contours made by Churcher and King.
" "	Unit of loudness level (phon) proposed.
" "	Experiments on loudness scaling led to proposal for "sone" unit of loudness (Stevens).
1944	Standardisation of A, B and C weightings for sound level meters (ASA Z24.3.1944).
1950s	Development of transistors and their incorporation into noise measuring equipment.
1956	Further determinations of equal loudness contours by Robinson and Dadson.
1956	Development of loudness calculation method for broad band noise (Stevens' "Mark II Method").
1958	Zwicker published details of loudness calculation method.

" "	Standardisation of phon and sone scales (BS 3045: 1958, and ISO R131: 1951)
1961	Standardisation of equal loudness contours for pure tones (ISO R226: 1961, and BS 3383: 1961).
" "	Revised standards for sound level meters (IEC 123: 1961).
" "	Improved version of Stevens' loudness calculation method published ("Mark VI Method").
" "	Public participation experiments and social surveys disclose relevance of duration, number of events and psychological factors.
1962	Britain adopts revised standards for sound level meters (BS 3489: 1962).
1963	Final Report of the Wilson Committee: research undertaken for the committee produced the Noise and Number Index for rating aircraft noise, and led to the development of BS 4142.
1964	Statistical distribution analysers on the market: enabled automatic computation of L-values.
1965	Standardisation of precision sound level meter (IEC 179: 1965).
" "	The A-weighted equivalent continuous sound level (Leq) first used in Germany to rate aircraft noise.
1966	Standardisation of loudness level calculation methods (Zwicker and Stevens' Mark VI) (ISO R532: 1966 and BS 4198: 1967).
1967	Britain adopts standard for precision sound level meter (BS 4197: 1967).
" "	Standardisation of rating method for industrial noise affecting residential premises (BS 4142).
1971	Standardisation of rating method for all types of environmental noise (excluding aircraft noise), in terms of Leq (ISO R1996: 1971).
1972	Improved version of Stevens' loudness calculation method published ("Mark VII Method").
" "	First integrating sound level meter on the market: enabled direct automatic calculation of Leq.
1974/75	Comprehensive noise analysing systems - "environmental noise analysers" - on the market.
1975	Noise Advisory Council recommended Leq as a suitable unifying

	noise rating scale.
" "	Use of Leq for rating construction site noise recommended in British standard (BS 5228: 1975).
1976	Leq recommended for rating noise from classified premises in Noise Abatement Zones (Control of Noise (Measurement and Registers) Regulations 1976, SI No.37).
Late 1970s	Development of digital tape recorders.
1980s	Development of microprocessor controlled acoustic equipment.
" "	Development of real-time frequency analysers.
1981	Revised standards for sound level meters (BS 5969: 1981 from IEC 651: 1979).
1984/85	Programmable and "modular" sound level meters appeared on the market.
1987	Portable sound intensity analysers appeared on the market.

SUMMARY

The thesis has confirmed the tendency towards the increasing incorporation of scientific and technical terms and criteria within the text of British pollution control legislation. The origins of this trend towards 'technical specificity' have been examined, and the implications for enforcement and for the future of pollution regulation have been considered. The focus of the thesis has been a study of neighbourhood noise policy, with the unifying theme being enforcement discretion - the room for decisional manoeuvre possessed by enforcement agents.

A better appreciation of the complexities and relationships of the issues involved has been achieved by the adoption of a novel interdisciplinary approach. This approach has involved the use of three conceptual models as analytical tools. These models have considered in turn the legal, operational and technical aspects of the policy system. The areas of overlap - or 'interfaces' - of the three models have then been examined, thereby enabling their interaction in the policy process to be investigated.

The Legal Model embodies the traditional legal viewpoint, in which the process of law enforcement is considered to be determined solely by the legal mandate originating from the legislature, together with judicial interpretations and additional advice from central government and other sources. The examination of the history of neighbourhood noise legislation undertaken has shown how the processes underlying the enactment of legislation shape its substance and form. In particular, the increase in the technical content of the legal mandate in recent years has been considered. An analysis of the substantive provisions of the legal mandate has revealed the extent to which they constrain enforcement discretion.

The Operational Model examines the behaviour of enforcement agents from a socio-legal perspective. This model evolved out of the realisation that an extensive gap exists between the legal mandate and its practical expression. Operational constraints on the enforcement process have been identified by means of interviews with Environmental Health Officers, and from the results of a real-time survey of the procedures used by a sample of eight Environmental Health Departments to enforce their legal mandate with respect to neighbourhood noise.

The Technical Model examines the scientific process of quantifying the relationship between a pollutant and its impact on 'targets' in the environment. The development of technology to measure sound, and of methods for the determination of dose-effect relationships for environmental noise, have been examined from a historical perspective in order to evaluate the scientific basis of the legal mandate. Likely future developments in acoustic technology have been considered in the context of their impact on enforcement and on the design of legislation.

It has been the examination of the interfaces - or 'integration' - of the three models that has provided the essential value of the interdisciplinary approach adopted in the thesis. The integration of the models has enabled novel themes, recommendations and conclusions for the use of technical criteria in the law enforcement process to be made. A summary of the more important conclusions is given below:

- The Legal Model predicts that a more technically explicit style of legislation should lead to the adoption of a stricter style of enforcement, because the incorporation of scientific and technical criteria tends to make legislation more rule-bound. However, viewing the problem from the perspective of the Operational Model, the influence of operational constraints - in particular the predominantly conciliatory approach to enforcement observed in the local authority survey - may tend to counteract any such trend (Section 7.2.1).

- A pertinent example of the influence of operational constraints on enforcement revealed by the survey is the different approach adopted by Environmental Health Officers towards domestic noise nuisance as opposed to industrial/commercial noise nuisance. Officers said they adopted a stricter approach to domestic noise. The reason for this is that most domestic noise problems tend to be of a 'behavioural' nature, while most industrial/commercial problems are of a 'technical' nature. A 'behavioural' nuisance is one whose abatement does not require expenditure on remedial work, but merely requires the person responsible to modify his or her behaviour in some way. In contrast, a 'technical' nuisance is one whose abatement involves expenditure on acoustic insulation or on the installation of quieter equipment. Officers more rapidly came to characterise as unreasonable a failure to remedy a behavioural nuisance than a technical nuisance (Section 7.2.1).

- The thesis questions the appropriateness of criminal sanctions for neighbourhood noise offences, and recommends that civil penalties may in some cases provide a cheaper and more suitable remedy (Section 7.2.2).

- The practicalities of day to day enforcement and the lack of comprehension by the courts of technical evidence are important constraints on the use of technology for enforcement purposes. These constraints mean that there is a need for consideration of appropriate levels of technical specification in the legal mandate, dependent on factors such as complexity and sophistication of the technology, resources available to the agency, level of expertise of the enforcement agents and of those subject to the legislation, and the attitudes of the judiciary (Sections 7.3.2 and 7.4.1).

- The use of technology in law enforcement can ultimately lead to 'automated justice': a situation where enforcement agents effectively hand over their discretion to a machine. Automated

justice is suited to a control system where enforcement agents can apply fixed penalty sanctions, without fear of biased law enforcement and without the need to go to court (unless the offender has grounds for appeal as to liability or level of fine). Automated justice also increases the scope for self-regulation (Section 7.3.3).

- The thesis argues that the control of domestic noise is unlike the control of other sources of environmental noise, in that it does not fit happily into a regulatory scheme in which the use of scientific limit values imposed by legislation constitutes, in the main, an appropriate strategy of control. The thesis considers that the control of domestic noise provides a good example of the limitations to what may be achieved both by a scientific limit-value approach, and also by a regulatory approach - by which is meant a control policy based on legislative sanctions (Section 7.5.1).

- The survey found that the treatment of domestic noise complaints varied considerably from authority to authority: a situation which is inequitable. The particular characteristics of many domestic noise problems mean that a control strategy based only on ultimate recourse to criminal sanctions does not provide a satisfactory outcome in all instances of domestic noise nuisance (Section 7.5.2). The thesis suggests that alternative remedies, including neighbour mediation and arbitration schemes, increasing public awareness about noise and improving the sound insulation performance of dwellings, may make positive contributions to the control of domestic noise (Section 7.5.3).

The conclusions arising from this study have illustrated the novel insights that can be gained by using the interdisciplinary approach developed for the thesis in the analysis of an area of environmental policy - in this case, neighbourhood noise - in which decision-making processes are influenced by disparate disciplines. The work has confirmed that approaches to environmental policy which are limited to a single discipline, or multidisciplinary approaches which do not consider adequately the interfaces between the disciplines, are likely to give rise to simplistic or even misleading results.

The interdisciplinary approach is considered to be very relevant to the study of other sectors of pollution policy, particularly in view of the current developments in environmental legislation.