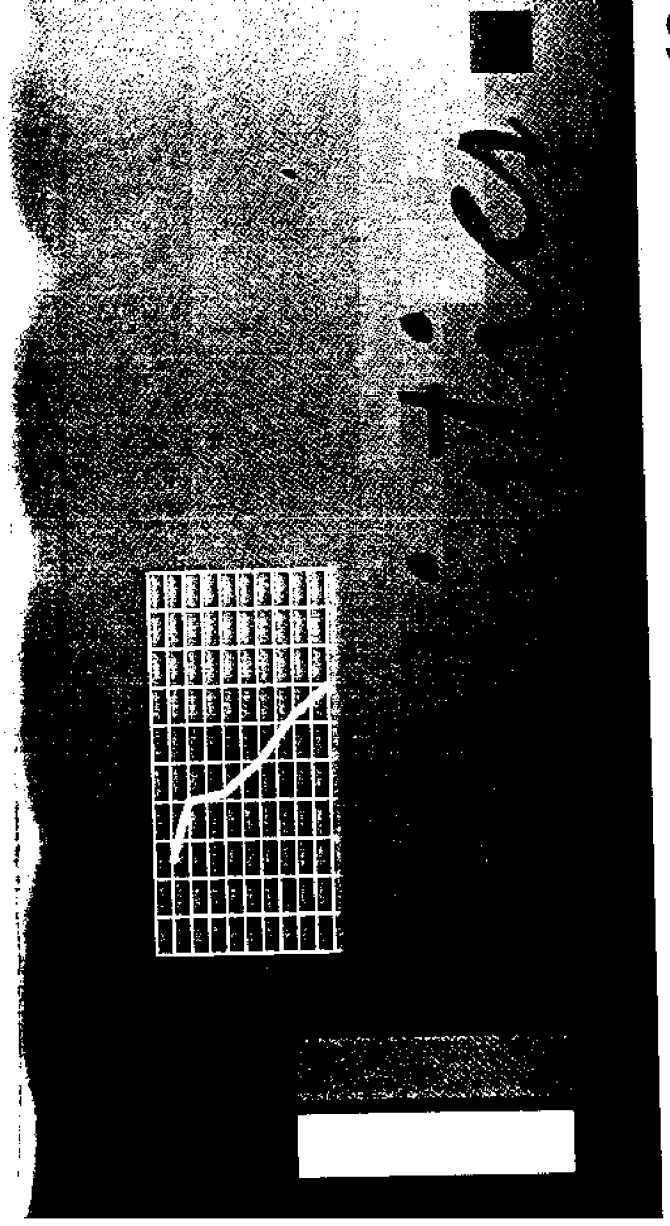
Australian Bureau of Statistics

1991-92

Cost of Environment Protection Australia

Selected Industries



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COST OF ENVIRONMENT PROTECTION, AUSTRALIA
SELECTED INDUSTRIES
1991-92

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Australian Bureau of Statistics

Catalogue No. 4603.0

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Inquiries

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- *For information about other ABS statistics and services*, please refer to the back page of this publication.

PREFACE

This publication presents estimates of costs incurred for environment protection for a number of sectors of the economy. The sectors included have been broadened from the data included in the 1990-91 edition and cover the public sector, agriculture, mining, manufacturing, gas and electricity utilities, retail and wholesale industries and the household sector.

Statistics on this topic are important for a number of reasons. Firstly, they are indicative of the response of various sectors to environment protection regulations and policies. Secondly, the data will in due course be incorporated into environmental accounts to be developed by the ABS over the next few years. Finally, the statistics provide some indication of the demand for goods and services provided by the environment management 'industry'.

Given the exploratory nature of this work, the ABS welcomes feedback from readers regarding the range and quality of the data and the explanations provided. Please send any comments to the Environment Statistics Unit, Australian Bureau of Statistics, PO Box 10, Belconnen, ACT 2616.

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June 1995

CHAPTER 1 COLLECTION FRAMEWORK AND SUMMARY RESULTS

1.1 Introduction

This is the second ABS publication reporting on a project to estimate costs incurred for environmental protection in Australia. The first issue of this publication, released in January 1994, provided estimates for pollution abatement and control activities in the manufacturing, mining and public sectors.

In addition to manufacturing, mining and public sector data, this edition includes statistics from the agriculture, retail, wholesale and household sectors. It also extends the earlier work by developing estimates for some elements of environmental protection expenditures other than pollution abatement and control.

Statistics on this topic are important for a number of reasons:

- they are indicative of the response of various sectors to environment protection regulations and policies;
- the data can be used in environmental 'satellite' accounts designed to augment the core system of national accounts;
- the statistics provide some indication of the demand for goods and services provided by the environment management 'industry'.

Work on estimating environmental expenditures has been guided by the OECD Pollution Abatement and Control framework, and the recently released second edition of the European System for the Collection of Economic Information on the Environment (SERIEE). The Technical Appendix contains detail on both these approaches. Data availability constraints prevent the compilation of complete estimates in accord with either of these frameworks at this stage. Consequently, the less data intensive OECD Pollution Abatement and Control framework has been adapted to suit Australian circumstances. Estimates have also incorporated the approach inherent in SERIEE of valuing a broader range of expenditures beyond the narrower costs of abating and controlling pollution. The approach to data collection in all sectors has been to focus collection efforts on those expenditures considered to be most significant, with the remaining gaps being left unfilled for the time being. Although the resultant estimates may therefore be partial, they are conceptually in accord with emerging international practice for estimating environmental expenditures, and are considered to capture the most significant expenditures in each sector.

1.2 Methodology for estimating environmental expenditures

Two separate streams of activity were undertaken to estimate environmental expenditures for 1991-92. The first and major activity related to the collection and compilation of pollution abatement expenditures using data collected from existing ABS collections in a number of industry sectors, as well as extraction of data from ABS public finance records.

The second stream of activity involved researching a range of other sources for information on environmental expenditures (primarily by government on this first occasion) not related to pollution abatement and control. Sources for this research included Commonwealth and State budget papers, annual reports of departments and public authorities, and contacts in local councils and manufacturers of environmental goods. SERIEE indicates that the breadth of such environment expenditures not related to pollution abatement and control would include:

- protection of species;
- protection of landscapes and habitats (including protection of forests);
- rehabilitation of species populations and landscapes;
- measurement control laboratories;
- protection against radiation;
- research and development for environmental protection;
- education training and information activities specifically oriented towards environment protection;
- public information, and general environment administration.

The first stream of activity was largely influenced by the OECD work on estimating pollution abatement and control expenditures. The OECD defined Pollution Abatement and Control (PAC) as *'...purposeful activities aimed at the prevention, reduction and elimination of pollution or nuisances that could have a harmful effect on the environment'* (OECD, 1993). More recently, in 1994, an extended definition appeared to further clarify the earlier definition, as follows: *'... pollution control and abatement are all purposeful activities directly aimed at the prevention, reduction and elimination of pollution or nuisances arising as a residual from production processes or from the consumption of goods and services'* (OECD, 1994). This publication has adopted the extended definition.

This OECD framework includes the collection of both capital and current expenditures incurred for pollution abatement activities by both the private and public sectors. The OECD set down a basis of expenditure representing the 'abater principle'. Initially estimates at this level were described by the OECD as representing the sector *executing* the environmental activity. Later documentation (OECD, 1994) changed this description, referring to the 'abater estimate' as representing *'from which economic sector . . . the demand for PAC services come[s]..'*

The OECD also suggests collection of data which identifies flows between the private and public sectors, including fees and charges paid by the private sector to the public sector, and grants and subsidies paid to the private sector by the public sector. These adjustments in theory make it possible to identify which sector is carrying the 'financial burden' of the pollution abatement activities, and ensures that expenditures are not 'double-counted' in both the public and private sectors. The estimates achieved by taking account of such flows are described as the 'financer principle' by the OECD model.

Work undertaken for this edition of the publication has found that data inadequacies make accurate calculation and explanation of pollution abatement costs in accord with the OECD framework very complex. It also seems that different calculations are necessary depending on which of the two descriptions of the 'abater' estimate is to be generated (see Technical Appendix).

Consequently, the results in Section 1.3 below present a simplified version of the OECD model, representing expenditure by each sector on pollution abatement costs and other environmental expenditures. The estimate produced is close to the 'financer' basis described above, in that double counting is eliminated as far as possible, with the estimate indicating the financial burden carried by each sector.

Statistics are also included in Table 1.1 for other environmental expenditures. On this first occasion collection of these other environmental costs in Australia focused on expenditures in the public sector, as these expenditures were considered to be most significant and relatively easy to identify. Most of the items specified by SERIEE were covered in the data compilation, although the form in which the data were available did not make it possible to provide a detailed disaggregation.

1.3 1991-92 Australian results

Table 1.1 provides a *partial* estimate for Australian expenditure on environmental protection in 1991-92 of $5.1 billion. This represented 1.3% of GDP in that period.

This estimate is not directly comparable to the results released in the first edition of this publication, as the sector coverage is wider. The coverage has also been extended from pollution abatement expenditures (as in the first edition) to also include other environmental expenditures which are aimed at management, conservation and protection of the natural environment. Where the earlier statistics are available, and adjustments can be made for comparability (i.e. for the public sector, and mining and manufacturing industries) the estimates for both years are included in the relevant chapters.

A number of data quality and coverage issues affect the estimate in Table 1.1. As indicated above, although there are a number of points at which coverage has not been complete, the approach for all sectors has been to target those expenditures and activities considered most significant. The remaining areas of undercoverage and data quality concern are as follows:

- Difficulty in assessing the environmental protection costs associated with change-in-production (or integrated) technologies. These technologies have the dual aim of abating pollution and providing technical and commercial improvements in the way a business operates. The difficulty is establishing what proportion of the total cost should be allocated to pollution abatement and control, given that there could be other reasons for the acquisition of the new equipment including increasing capacity and efficiency. The approach taken by the ABS to this issue has been to ask respondents to include costs of equipment intended primarily for environment protection purposes (including complying with environment legislation). This approach will not include a proportion of expenditures for 'clean technology' equipment which has the *dual* aim of abating pollution and providing technical and commercial improvements in the way a business operates.
- The public sector data have partly been compiled using data classified according to the Government Purpose Classification. The categories of activities used for this publication included: household garbage, other sanitation, sewerage, urban stormwater drainage and other environment protection. Other environmental outlays also exist under a variety of government purpose classifications (eg agricultural land management, forests etc) but it is not possible to separate out the environmental component on the basis of the present classification. The estimates will therefore be an underestimate of total environmental expenditure undertaken by the public sector.
- Considerable work has been necessary to estimate public sector environment expenditures other than pollution abatement. On this first occasion, Commonwealth and State budget papers, as well as the annual reports of public sector departments and public trading enterprises were examined. However, the structure of these documents meant it was not always possible to separate out the environmental from the non-environmental expenditures in some programmes and activities. In such cases, a conservative approach was taken, by including only those expenditures which could be specifically identified as environmental in nature.
- The estimate of the costs for the public sector to abate its own pollution are also underestimates at this stage and for this edition relate only to the public sector gas and electricity authorities. A more complete coverage of these costs in this sector would include expenditures for the general government sector, as well as the remaining government business enterprises.
- Estimates of expenditures in the agriculture, retail, wholesale and household sectors have been attempted for the first time in this edition. A number of methodological and coverage issues associated

with estimates from these sectors are discussed in the relevant chapters, and are likely to result in underestimates.

- Industry coverage at this stage is incomplete, hence data are not available for sectors such as construction, transport, the service sector and so on.

TABLE 1.1 PARTIAL ESTIMATE OF AUSTRALIA'S ENVIRONMENTAL PROTECTION COSTS, 1991-92

Sector	*Pollution abatement costs* $ million	*Other environmental costs* $m	*Total cost of environment protection (a)* $m
PUBLIC SECTOR - total	**1 766.7**	**1 086.0**	**2 852.7**
Sanitation and protection of the environment (b)	*1 640.0*	..	*1 640.0*
capital	1 082.0	..	1 082.0
current	558.0	..	558.0
Other identified pollution abatement and control costs	*126.7*	..	*126.7*
Gas and electricity utilities	104.7	..	104.7
Water management costs (c)	22.0	..	22.0
Other environmental costs (d)	..	1 086.0	*1 086.0*
PRIVATE SECTOR - total (e)	n.a.	n.a.	**2 300.0**
Agriculture - total (f)	*n.a.*	*n.a.*	*285.4*
Mining - total	*151.7*	*n.a.*	*151.7*
capital	53.4	n.a.	53.4
current	98.3	n.a.	98.3
Manufacturing - total (g)	*1 005.2*	*n.a.*	*1 005.2*
capital	484.0	n.a.	484.0
current	522.4	n.a.	522.4
Retail / Wholesale - total (h)	*27.2*	*n.a.*	*27.2*
current	27.2	n.a.	27.2
Household sector - total (i)	*118.7*	*709.8*	*828.5*
Total	*n.a.*	*n.a.*	**5 152.7**

(a) In most cases, these estimates are partial, for reasons listed in the following footnotes.
(b) For Pollution Abatement, fees and charges received by the public sector are excluded, and the value of grants paid is included.
(c) Refer to Chapter 2, Section 2.4.2
(d) The 'Other environmental costs' category includes expenditures recorded in Commonwealth and State budget papers. Refer to Chapter 2, Section 2.5.
(e) Includes $2 million pollution abatement and control expenditures by electricity and gas utilities in the private sector. See Chapter 2, Section 2.4.1
(f) Excludes grants and subsidies of $35.7 million. Capital and current splits are not available. Nor was it possible to determine which of the agriculture expenditures were for pollution abatement and other environment expenditures. Expenditures of grants and subsidies are included in public sector expenditure. Refer to Chapter 3 for more detail.
(g) Excludes grants and subsidies of $1.2 million. Expenditures of grants and subsidies are included in public sector expenditure. Refer to Chapter 5.
(h) Represents current expenditures only. Refer to Chapter 6.
(i) Note - in line with National Accounts Standards, all household expenditures are treated as current expenditures.
n.a. - not available

The statistics in Table 1.1 represent costs incurred *by* each sector of the economy in relation to environment protection, whilst ensuring as far as possible that 'double counting' of expenditures is avoided, particularly as between the public sectors and other sectors. Double counting would occur, for example, where the public sector provides grants and subsidies to the private sector for environmental protection, if the private sector also records the expenditure of the grant or subsidy. Consequently, the table represents 'own' expenditure by each sector, excluding any income received from another sector. For reasons discussed in more detail in Chapter 2, the estimates have been compiled substantially in accordance with the 'financer' basis described in the OECD Pollution Abatement and Control model (see Technical Appendix). Thus:

- government grants and subsidies are included in the public sector rather than the recipient sector (where the corresponding expenditures are deducted);
- likewise, rates, charges and fees paid for environmental purposes from the private sector to the public sector are included in the private sector part of the account.

1.4 Future directions

The ABS is continuing work in the area of environmental expenditures. Questions have been included in industry collections subsequent to the 1991-92 collections used for this publication. Estimates for the 1992-93 financial year are to include waste handling expenses for a range of additional sectors including construction, community services, and transport and storage industries. The ABS envisages further work will occur in the area of estimating environmental expenditures other than pollution abatement, and will monitor international developments in this area.

The next issue of this publication will contain data for both 1992-93 and 1993-94 financial years.

1.5 Structure of this report

The second chapter of this publication presents data for the public sector (which accounted for over half of the estimate for environmental costs in Australia) and discusses in more detail some of the methodological issues which arose from the treatment of data from this sector. Subsequent chapters are presented in the order in which they appear in the Australian and New Zealand Standard Industrial Classification.

CHAPTER 2 PUBLIC SECTOR ENVIRONMENT PROTECTION EXPENDITURE

2.1 Introduction

The public sector in Australia is defined as all entities majority-owned and/or controlled by the Commonwealth, State or local governments. Included are government departments and associated bodies that deliver traditional public services (referred to as the general government sector) as well as government trading and financial enterprises.

This chapter examines environmental costs incurred by the public sector for 1991-92; an overview of the results is given in Section 2.2. These costs are identified through a number of sources, with the remainder of the chapter structured as follows:

- Section 2.3 presents the consolidated outlays of general government and public trading enterprises on sanitation and protection of the environment, as defined in ABS government finance statistics. This category of expenditures equates with pollution abatement and control as defined in the OECD model (see Chapter 1 and Technical Appendix);

- Section 2.4 presents other identified public sector pollution abatement and control costs, as identified from an ABS survey of electricity and gas utilities, and some additional costs related to water management;

- Section 2.5 presents other environmental costs incurred by the general government sector which are not related to pollution abatement and control, for example expenditure related to national parks, reserves and wildlife, and soil conservation and land management. These costs have been identified through Commonwealth and State budget papers, as separate identification of these costs in ABS government finance statistics was not possible.

2.2 Overview of results

This section provides a brief overview of expenditures of the public sector on environmental protection. Table 2.1 indicates that the costs borne by the sector in 1991-92 were estimated at $2.9 billion. Sixty per cent of this represented expenditure on pollution abatement activities.

TABLE 2.1 PUBLIC SECTOR ENVIRONMENTAL EXPENDITURES (a), AUSTRALIA, 1991-92
($million)

Category	
Sanitation and protection of the environment (GPC 0730) (b)	
- capital	1 082.0
- current	558.0
Other identified pollution abatement and control expenditures	
- gas and electricity utilities	104.7
- water management costs *(c)*	22.0
Total - public sector pollution abatement costs	*1 766.7*
Other environmental costs (d)	*1 086.0*
Total environmental costs *(a)*	**2 852.7**

(a) These figures are a partial estimate only, as a result of known under-counting in a number of the components of the estimate. See footnotes (b), (c) & (d).
(b) Outlays on pollution abatement occur in a number of other GPC codes, which include non-environmental expenditures. Hence data from these codes are not included. See section 2.3.1.
(c) This is a partial estimate only, as data were not available in comparable forms from all State budget papers. It was also not possible to provide a capital/current split of these data. See section 2.4.2.
(d) It was not possible to provide a capital/current split of these data. Estimates of other environmental expenditures were developed from Commonwealth and State budget papers, and as such only those items which could be specifically identified as environmental expenditures not related to pollution abatement were included in the estimate. A number of items appeared to include an element of environmental expenditures, but the proportion could not be separately identified, and hence was not included in the estimate. This estimate does not include other environmental expenditures for local government.

2.3 Public sector outlays on sanitation and protection of the environment

Statistics in this section focus on the consolidated outlays of general government and public trading enterprises on sanitation and protection of the environment, as defined in government finance statistics (see Section 2.3.1) . In practice, this represents the consolidated outlays of the general government sector, and the capital outlays of water and sewerage public trading enterprises which accounted for most of the outlays of the public trading enterprise sector in relation to sanitation and protection of the environment.

As indicated at the end of Chapter 1, these outlays data are presented at a level which avoids double counting as far as possible between sectors. Broadly speaking the 'financer' basis of compilation has been applied (see discussion on the OECD framework in Chapter 1 and the Technical Appendix). Thus government grants and subsidies for environmental

activities are recorded in the general government sector and the corresponding expenditures, where they have been identified, are omitted from business and household expenditures.

In regard to the operations of public trading enterprises (PTEs) providing services such as sewerage, stormwater drainage and waste handling, capital outlays and income transfer payments are included in ABS government finance statistics. Current expenditure is not included as the sales of their goods and services are expected to fund the provision of those services. The fees and charges paid to these enterprises by the private sector are included in the current expenditures of industry and households.

Work which attempted to value the cost of services provided by public trading enterprises, to arrive at abater estimates as specified in the OECD model, proved problematic for two reasons, as follows:

- difficulties identifying all public trading enterprises providing environmental services, and isolating the relevant expenditures in their accounts
- difficulties identifying the extent to which the provision of environmental services by public trading enterprises is funded by the public sector itself (i.e. through purchases of services by government from public trading enterprises), compared with funding by industry and households.

In any case, adequate data relating to rates and charges have been obtained from industry and households via existing surveys and other sources in line with the financer approach.

Estimates for this section have been developed by extracting data from ABS government finance statistics on the basis of the Government Purpose Classification.

2.3.1 The Government Purpose Classification system

The ABS government finance statistics system classifies government transactions by purpose according to the Government Purpose Classification (GPC). To facilitate international comparisons, the GPC closely follows the principles of the United Nations Classification of the Functions of Government (COFOG).

The transactions classified by the Government Purpose Classification represent the current and capital outlays of general government and the capital outlays and income transfers of Public Trading Enterprises. The codes qualifying for inclusion as pollution abatement activities are listed in Table 2.2. It was not possible to separately identify expenditures on environmental protection not related to pollution abatement and control within the GPC. Identification of these expenditures is presented in Section 2.5.

TABLE 2.2. GOVERNMENT PURPOSE CLASSIFICATION - SANITATION AND PROTECTION OF THE ENVIRONMENT (GPC CODES 0730)

GPC code no	Description	Contents
0731	Household garbage	Administration, regulation and support of household garbage, collection and disposal services.
0732	Other sanitation	Administration, regulation and support of sanitary services other than household garbage such as the disposal of industrial waste and radioactive waste and cleaning of streets and gutters.
0733	Sewerage	Administration, regulation and support of sewerage collection, treatment and disposal operations. Includes assistance for development, expansion and operation of effluent drainage systems and deep main town systems.
0734	Urban stormwater drainage	Regulation, support and operation of urban stormwater drainage services such as the linking or lining of creeks and provision of open or deep draining systems.
0739	Protection of the environment not elsewhere classified	Administration, regulation, support and operation of specific activities which the other detailed level project codes do not cover. These activities include the development and operation of monitoring equipment for measuring air and noise quality. The category is also often used to code outlays on activities for which there is not sufficient information to allow coding to one of the four digit codes from 0731 to 0734. For this reason, the category should be treated as a non-specific category.

2.3.2 Outlays by the public sector on sanitation and protection of the environment - results

The statistics in this section have been structured to ensure that the flow of funds in the form of grants and transfers are taken into account. Therefore the tables reflect the financial burden borne by Commonwealth, State and local governments, not necessarily the level of government at which the funds are spent. Specifically, this means data shown for any level of government represent expenditure of their own funds, plus any funds they passed on in the form of grants or transfers to other levels of government. The exception to this is the case of untied grants received by State or local governments. Where untied Commonwealth grants have been passed on to State or local governments and spent by them for environment protection purposes, the outlays have remained assigned to the level of government at which they were spent.

Table 2.3 presents outlays on sanitation and protection of the environment activities, as identified in Table 2.2 and indicates the level of government financing the activity. This takes into account grants and subsidies made from one level of government to another, with the exception of untied grants, discussed above. The majority of outlays for these activities were financed by State governments ($1 050 million), with most of the remainder accounted for by local government. At $905 million, the collection,

treatment and disposal of sewerage accounted for the largest proportion of pollution abatement outlays.

Sewerage outlays of $771 million contributed the most to State government outlays. In contrast, local government outlays appear to be more evenly spent across the range of pollution abatement activities.

TABLE 2.3 PUBLIC SECTOR OUTLAYS ON SANITATION AND PROTECTION OF THE ENVIRONMENT 1991-92 ($ million)

	Government Purpose Classification					
Level of government and expenditure category	*731 Household garbage*	*732 Other sanitation*	*733 Sewerage*	*734 Urban stormwater drainage*	*739 Other PAC*	*Total*
Commonwealth						
Current outlays	-	-	-	-	22	22
Capital outlays	-	-	(2)	-	7	6
Total outlays	-	-	*(2)*	-	*30*	*28*
State						
Current outlays	-	2	47	-	181	230
Capital outlays	-	30	724	26	39	821
Total outlays	-	*32*	*771*	*27*	*220*	*1 050*
Local (a)						
Current outlays	95	145	(24)	78	14	308
Capital outlays	41	15	156	36	-	250
Total outlays	*136*	*160*	*132*	*114*	*14*	*558*
All levels						
Current outlays	95	147	22	79	215	558
Capital outlays	41	45	883 (b)	64	49	1 082 (b)
Total outlays	**136**	**192**	**905** (b)	**143**	**264**	**1 640** (b)

(a) There are some concerns regarding the accuracy of coding for local government outlays at this level - these figures should be treated with caution.
(b) Includes some transfers unable to be separately identified, hence component items do not add to total
Note: bracketed numbers represent negative outlays i.e. a net income was recorded for this item. Where figures have been rounded, discrepancies may occur between totals and the sums of the component items.

Sewerage operations were by far the most capital intensive activity, and accounted for 82 per cent of all capital expenditures. The remainder of expenditures were fairly evenly distributed across the other pollution abatement and control activities.

Some major capital works funding included:

- works-in-progress for the Hunter Sewerage project to provide sewerage to properties in the lower Hunter Valley, as well as inland and ocean sewage treatment plants amplification and upgrading (NSW);
- the Western and North Western Trunk Sewer projects, and the continuing work on modifications to the Multipurpose Outfall sewer project, Latrobe Valley (Vic.) and;
- the Beenyup Sewerage Ocean Outlet (WA).

TABLE 2.4 PUBLIC SECTOR OUTLAYS ON SANITATION AND PROTECTION OF THE ENVIRONMENT, 1991-92
($ million)

	Government purpose classification					
	731	*732*	*733*	*734*	*739*	
State	*Household garbage*	*Other sanitation*	*Sewerage*	*Urban stormwater drainage*	*Other PAC*	*Total*
New South Wales						
Current outlays	8	61	13	56	99	236
Capital outlays	-	30	424	1	23	478
Total outlays	*8*	*91*	*437*	*57*	*121*	*714*
Victoria						
Current outlays	58	54	14	5	23	155
Capital outlays	1	11	208	22	7	250
Total outlays	*59*	*65*	*222*	*28*	*30*	*405*
Queensland						
Current outlays	(2)	9	(6)	11	19	31
Capital outlays	25	1	89	19	13	147
Total outlays	*21*	*10*	*83*	*30*	*32*	*177*
South Australia						
Current outlays	26	13	(2)	4	31	73
Capital outlays	3	1	44	16	1	65
Total outlays	*29*	*14*	*42*	*20*	*32*	*137*
Western Australia						
Current outlays	(3)	6	(2)	1	14	15
Capital outlays	13	2	88	4	1	107
Total outlays	*9*	*7*	*86*	*5*	*15*	*123*
Tasmania						
Current outlays	9	3	(1)	1	6	17
Capital outlays	1	-	16	-	-	18
Total outlays	*9*	*3*	*15*	*1*	*6*	*36*
Northern Territory						
Current outlays	-	1	-	-	13	15
Capital outlays	-	-	7	-	4	11
Total outlays	-	*1*	*7*	-	*17*	*26*
Australian Capital Territory						
Current outlays	-	-	7	-	-	7
Capital outlays	-	-	4	-	-	4
Total outlays	-	-	*11*	-	-	*11*
Australia						
Current outlays (a)	95	147	22	79	215 (a)	558
Capital outlays	41	45	883 (b)	64	49	1 082
Total outlays	**136**	**192**	**905** (b)	**143**	**264** (a)	**1 640**

(a) The data for current outlays includes Commonwealth current outlays of $10.3 m spent at the *national* level in GPC 0739. This figure is not shown separately in this table, and is therefore added into the current outlays total for GPC 0739.
(b) Includes some transfers unable to be separately identified, hence component items do not add to total.
Note: bracketed numbers represent negative outlays i.e. a net income was recorded for this item. Where figures have been rounded, discrepancies may occur between totals and the sums of the component items.

2.3.3 Comparison of public sector outlays on sanitation and protection of the environment for 1990-91 and 1991-92

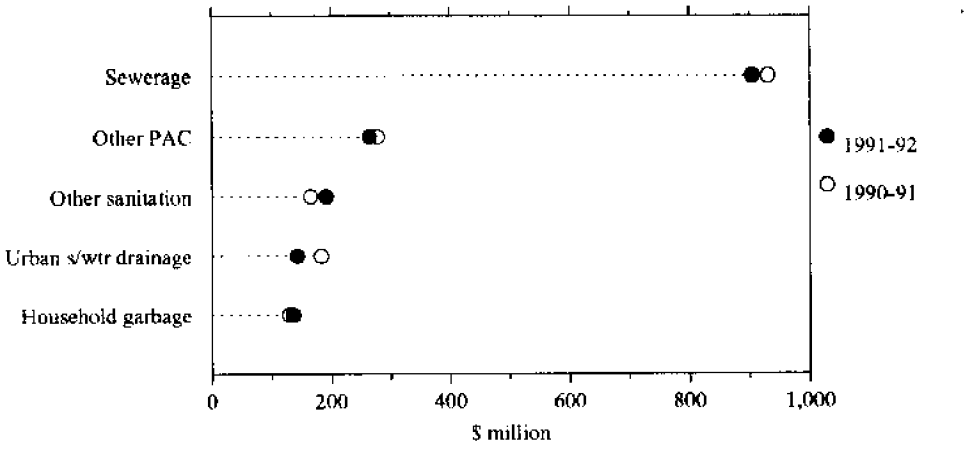
Public sector financing of sanitation and protection of the environment recorded in the Government Purpose Classification system in 1991-92 amounted to $1 640 million, compared with $1 662 million in 1990-91. Most of the difference was accounted for by a lower level of capital expenditure on sewerage activities in 1991-92 compared with the previous year.

TABLE 2.5 PUBLIC SECTOR OUTLAYS ON SANITATION AND PROTECTION OF THE ENVIRONMENT 1990-91 (a) AND 1991-92 ($ million)

	Year	
	1990-91 (b)	1991-92
Total	1 662	1 640

(a) Outlays (capital and current) for general government and PTE capital outlays on GPC codes 0731 - 0739. These codes represent household garbage, other sanitation, sewerage, urban stormwater drainage and protection of the environment not elsewhere classified. These estimates do not include gross operating expenditures of public trading enterprises, water management costs or pollution abatement and control costs for electricity and gas authorities.
(b) The figure for 1990-91 has been adjusted from that published in the previous edition of this publication, to exclude all water treatment costs, for comparative purposes. Also excludes gross operating expenditures of public trading enterprises, pollution abatement and control costs of utilities, and water management costs.

FIGURE 2.1 PUBLIC SECTOR OUTLAYS ON SANITATION AND PROTECTION OF THE ENVIRONMENT, 1990-91 AND 1991-92, AUSTRALIA



2.4 Other identified public sector pollution abatement and control costs

This section presents other identified pollution abatement and control costs, as identified from an ABS survey of electricity and gas utilities, and some additional costs related to water management.

2.4.1 Pollution abatement and control expenditures of electricity and gas utilities

Statistics on pollution abatement and control expenditures by gas and electricity utilities have been obtained through the 1991-92 ABS Census of Utilities. As for units in the manufacturing and mining industries (see chapters 4 and 5) utilities were asked to indicate capital and current expenditures they undertook to abate and control pollution being emitted at their own locations.

The data presented in this section represents the pollution abatement and control costs of electricity and gas utilities in the public sector. An additional $2 million of pollution abatement and control expenditures were recorded by private sector gas and electricity utilities. This expenditure is excluded from the following tables, and is separately accounted for in the private sector estimates in Chapter 1.

In the case of public sector utilities, these expenditures differ from the public sector expenditures recorded in Section 2.3, as they are not recorded as part of the Government Purpose Classification GPC codes 0730. Hence these data represents additional public sector pollution abatement and control activity.

Pollution abatement and control expenditure for these public sector utilities was $104.7 million, of which 59% ($61.7 million) was capital expenditure. Electricity utilities accounted for virtually all (99.6%) expenditures. The largest component of current expenditure was 'other' expenditure, which included estimates for labour, materials, electricity and fuels expended in environmental protection. The main category was capital expenditure on equipment which reduced air pollutants ($22.1 million) and hazardous and non-hazardous solid waste pollutants (19.2 million).

TABLE 2.6 PUBLIC SECTOR ELECTRICITY AND GAS UTILITIES POLLUTION ABATEMENT AND CONTROL EXPENDITURE, AUSTRALIA, 1991-92
($ million)

	Current	*Capital*	*Total*
Electricity utilities	42.9	61.4	104.3
Gas utilities	-	0.3	0.3
Total	42.9	61.7	104.7

TABLE 2.7 ELECTRICITY AND GAS UTILITIES POLLUTION ABATEMENT AND CONTROL CURRENT EXPENDITURE COMPONENTS, AUSTRALIA, 1991-92
($million)

Sector	Govt fees, charges and taxes	Purchased services	R&D expenses	Environmental impact assessments	Environmental / energy audits	Other current expenditures	Total
Total electricity and gas	0.2	6.3	4.9	1.4	2.0	28.2	42.9

TABLE 2.8 ELECTRICITY AND GAS UTILITIES POLLUTION ABATEMENT AND CONTROL CAPITAL EXPENDITURE COMPONENTS, AUSTRALIA, 1991-92
($million)

Sector	Water pollutants	Solid waste pollutants - (hazardous & non-hazardous)	Air pollutants	Noise pollutants	Other pollutants, land rehabilitation	Total
Total electricity and gas	2.5	19.2	22.1	0.2	17.7	61.7

2.4.2 Water treatment costs as pollution abatement and control expenditures - review

The structure of the Government Purpose Classification system in Australia allows for separate identification of the costs of sewerage treatment and water supply (in addition to the GPC codes listed in Table 2.2, the GPC code for Water Supply is 0720). The first edition of this publication attempted to identify separately the cost of water treatment within this classification, as the only component of water supply considered at the time to be valid pollution abatement expenditure. Within the water supply process, treatment refers to purification processes to bring raw water to drinkable standards. Consequently, to identify the water treatment component of water supply expenditure, Australia followed the lead of the OECD (OECD 1993, p 14) in taking 50 per cent of the cost of water supply as water treatment costs, in the absence of any better estimates. At that time, the ABS committed to determining a more appropriate percentage for the 1991-92 release. This section discusses international developments since that time, and work undertaken by the ABS.

The trend in international classifications of environmental expenditures is to exclude treatment of drinking water from such estimates. The Single European Standard Statistical Classification of Environmental Protection Activities and Facilities (ECE/Eurostat 1994), includes categories for water management and protection, including such items as sewerage networks, waste water treatment and monitoring installations. No items are included in the classification for water purification which equate with drinking water treatment. The rationale for this is as follows. The end product of the drinking water treatment process is delivered to consumers through the tap as drinkable water. This process does not fit the definition of pollution abatement and control expenditure 'to reduce harmful effects *on* the environment'. The definition also specifically excludes activities to exploit

natural resources and drinking water treatment falls into this category. The inclusion of such expenditures in broader environmental expenditures is considered inappropriate for similar reasons as drinking water treatment is not an item on which expenditure results in any longer term improvement in the quality or management of the natural environment.

Water treatment, as it occurs within the water supply process is designed to remove contaminants - both pollutants and naturally occurring micro-organisms such as typhus - and deliver to consumers tap water of a quality complying with Drinking Water Standards, as specified by the National Health and Medical Research Council. The treatment process servicing *urban* populations may involve a number of steps, including:

- mixing the water with a flocculant, which assists in settling out of debris;
- several filtration phases;
- pH correction;
- fluoridation; and
- disinfection, to eliminate algae, bacteria and moulds.

A number of sources indicate that this process may well account for less than 50 per cent of the cost of water supply. A Parliament of NSW Joint Select Committee report on the Sydney Water Board (JSC, 1994) reported that 20 per cent of costs were for treatment, with the remaining 80 per cent being in transport of water. Actual costs at various treatment plants in Sydney vary from 12 per cent - 50 per cent of the cost of water supply, depending on a number of variables, such as the extent of water treatment necessary (whether full treatment - including all filtration stages - or just disinfection), the quality and proximity of the raw water source, and the density and size of population which the treatment plant services (i.e. economies of scale for the treatment plant and the pipe system).

Other facts about water supply and use in Australia also suggest that the cost of water treatment as a proportion of water supply is generally much lower than 50 per cent. Rural water use accounts for 82 per cent of total water use in Australia. With consumers in rural areas receiving partially treated or untreated water, and these consumers accounting for over three-quarters of water use in Australia, a more realistic ceiling to water treatment costs as a proportion of water supply seems to be a factor of 20-25 per cent.

Although any such estimates for drinking water treatment costs are therefore excluded from pollution abatement and control estimates in this publication, there are other water quality management costs which are not separately identifiable in the GPC system, but which are valid pollution abatement expenditures. Such expenditures are aimed at improving the quality of water in the natural environment through reduction of pollution, as opposed to resource use and exploitation. Such expenditures may include:

- programmes to control blue-green algae and eutrophication
- salinity control
- erosion control.

These items are not separately identifiable through the Government Purpose Classification system. The only other readily available sources for identifying these data were Commonwealth and State Budget papers. However, these data sources proved problematic, as not all water management costs could be identified separately from other water costs. The format of State Budget papers made it difficult to determine any reasonable estimate for Queensland, South Australia, Western Australia and the ACT. However, some data estimates were possible from budget papers for the Commonwealth ($3 million), New South Wales ($1.7 million), Victoria ($2.4 million), Tasmania ($7.3 million) and the Northern Territory ($7.7 million).

Data availability problems also meant expenditures undertaken by local councils were not available. Consequently, these estimates should be considered as partial, and an indication of the expenditures which should be included in future work, pending improved data sources.

2.5 Other environment protection expenditures

Table 2.10 provides estimates for environment protection expenditure by general government not specifically attributable to 'pollution abatement and control' activities. The statistics have been compiled from Commonwealth and State Budget Papers and, as such, provide a partial, preliminary estimate only of other environment protection expenditures undertaken by general government.

It should be noted first that the data categories in Table 2.9 and 2.10 reflect generic descriptions developed by the ABS to draw together data identified through Budget papers. These categories emerged out of the data collection process, rather than being imposed on the data as a result of any specific framework or classification system. At the outset of this process a conceptual approach was developed based on Commonwealth expenditures, however this approach proved unworkable for the State government expenditures. Therefore the categories used for presenting other environment expenditures represent an amalgamation of expenditures into a workable set of items, and reflect the current state of data availability, rather than any conceptual framework. There is a considerable gap between other environmental data available in the public sector in Australia, and SERIEE - the European System for the collection Economic Data on the Environment - which provides a classification system for such data. Additionally, it is emphasised that Table 2.10 provides only partial information on Commonwealth, State and Territory expenditures. Complete coverage would require inclusion of local government and public sector non-budget agencies such as water boards. However resources did not permit compilation of data from the approximately 900 local councils in Australia.

Budget presentations were found to be not comparable across States. It is likely that the varying administrative structures and functions may cause groups of transactions that serve similar functions to be classified differently

across the States. In some cases, environmental expenditures have not been able to be separately identified from broader programme costs. Where possible, a figure has been derived based on average staffing resources; however, where an expenditure has not been explicitly identified as primarily an environment protection expenditure, the item has not been included.

Table 2.9 provides a summary of the items which were generally included in each of the 'Other' environmental expenditure categories, and provides brief notes on problems encountered in developing estimates for each category.

TABLE 2.9 DESCRIPTION OF OTHER ENVIRONMENTAL EXPENDITURE CATEGORIES

Category	Description of expenditures and methodological problems
National Parks and Wildlife Protection	Includes National, Flora and Fauna Park management and development, and related administrative expenses where identified. Note that these estimates differ from those included in the previous edition of this publication because items relating primarily to expenditures on recreational parks and reserves, as well as cultural heritage, have been excluded where possible. This category also includes items relating to protection/conservation of wildlife and ecosystems not necessarily included in parks and reserves, such as protection and conservation of coastal regions and native vegetation.
Soil Conservation and Land Management	Includes agricultural resource management and support services, where such management has been identified as having a conservation/ sustainable land use focus. These include Total Catchment Management, Landcare, Natural Resource Management, National Soil Conservation programs and related advisory services. Note that this category may include some PAC expenditures, but which could not be split out from broader departmental budget estimates which appeared primarily other environmental in nature.
Water Resources Protection and Conservation	Includes environmental management of water resources including operations, maintenance and administration costs of the Murray Darling Basin Commission, and wetlands and river systems management. This category differs from the PAC category of water quality management, as Water Resources Protection and Conservation costs are targeted at water conservation and quality maintenance, rather than remedial actions to address the impact of pollution. Note that this category may include some PAC expenditures, but which could not be split out from broader departmental budget estimates which appeared primarily other environmental in nature
Conservation of Fisheries Resources	Includes biological and environmental research, expenditure on compliance activities, conservation strategies and protection of aquatic habitats.
Energy Conservation / Management	Includes environmental planning, renewable energy projects, and energy conservation policies where these items have been specifically identified in the Budget Papers. Some expenditure under this category may be included under the Administration and Other Environment Protection category below.
Administration and Other Environment Protection.	Includes coordination and management activities whose goal is general environment protection such as environmental education programs, environmental impact assessments, and general administrative and support services for environment and conservation agencies; as well as other environment protection expenditures not able to be allocated to one of the other categories.

Of the total $1 086 million identified in Table 2.10 over half (51.9%) was spent on National Parks, Reserves, and Wildlife Protection activities ($563 million). This figure is not directly comparable to the figure published in the 1990-91 release for National Parks and Wildlife (GPC 0813), for definitional and methodological reasons (refer to Table 2.9).

The next largest expenditure ($223 million) relates to Administration and other unspecified environment protection expenditures. In line with SERIEE, administration costs relating to a particular program would be reported under that programme where possible (eg administrative costs of National Parks and Wildlife should be included under National Parks, Reserves, and Wildlife Protection). Soil Conservation and Land Management ($198 million), and Water Resources Protection and Conservation ($63 million) contributed the next most to public sector spending on other environmental activities. However, the distinction between, and identification of activities relating explicitly to these two categories was not always clear, so that expenditures apparently related to both land and water protection have been allocated to one or the other category in some cases. Expenditure by Queensland on Soil Conservation and Land Management is a case in point, where this figure includes water protection and quality programs not separately identified.

Per capita expenditures on the above activities were between $45 and $48 per head in most States. The two Territories were at the extremities because of their particular population and area characteristics. New South Wales and Queensland spent slightly above the average at $59 and $65 per capita respectively.

TABLE 2.10 PARTIAL ESTIMATES (a) GENERAL GOVERNMENT OTHER ENVIRONMENT PROTECTION EXPENDITURES, BY STATE, 1991-92
($ million)

Government	*National Parks, Reserves, and Wildlife Protection*	*Soil Conservation and Land Management*	*Water Resources Protection and Conservation*	*Conservation of Fisheries Resources*	*Energy Conservation & or Management*	*Administration and other environment protection*	*Total*	*Per capita ($)*
New South Wales	146	57	22	19	1	104	349	59
Victoria	133	6	23	4	3	44	212	48
Queensland	111	79	-	1	-	-	192	65
South Australia	38	11	11	2	-	2	65	45
Western Australia	32	34	4	3	1	1	75	46
Tasmania	20	1	-	-	-	5	26	55
Northern Territory	21	4	-	1	-	8	35	205
ACT	2	2	-	-	-	-	5	17
Commonwealth	61	2	3	3	-	59	128	
Total	563	198	63	33	5	223	1 086	63

(a) The statistics have been compiled from Commonwealth and State Budget Papers and, as such, provide a partial, preliminary estimate only of other environment protection expenditures undertaken by the Australian public sector.

Note - where figures have been rounded, discrepancies may occur between totals and the sums of component items.

CHAPTER 3 AGRICULTURE ENVIRONMENT PROTECTION EXPENDITURE

3.1 Introduction

Environment protection expenditure by the agricultural sector was collected for the first time in 1991-92. The statistics were collected from a sample of farm businesses, hence, the estimates are subject to sampling variability, expressed as the percentage standard error in the tables below. In many cases the data have high relative standard errors and should be viewed with this in mind (footnotes to each table explain the standard error).

Because it has not been possible to clearly distinguish between pollution abatement and other environmental expenditures in the agricultural sector, the approach has been to provide a single aggregate for all environmental expenditures.

The inclusion of certain costs as environment protection expenditures is consistent with their inclusion as part of the Commonwealth Government's package to provide taxation concessions to assist landholders to undertake landcare activities. Some of the data therefore specifically relates to expenditure on measures to control and/or prevent land degradation. Under section 75B of the *Income Tax Assessment Act 1936*, landholders may claim a deduction for expenditures incurred "primarily and principally to conserve or carry water", as an incentive to carry out land care activities. Expenditures on water storage and reticulation systems therefore are also estimated, as an indication of efforts to conserve water resources. . Such expenditures include costs associated with the installation, extension or maintenance of bores and pipelines, drainage channels, irrigation channels, pumps, underground tanks, water towers, wells, windmills and dams for stock/water purposes. Management of watering points is particularly crucial in rangeland areas for managing stock according to land capability, as well as minimising the impacts on biodiversity in naturally dry areas.

Expenditure on irrigation and drainage channels includes installation costs at the time of establishment of a whole irrigation system and, therefore, principally for the purposes of conveying water for use on the land. Conversely, drainage channels may be constructed primarily as a corrective measure to halt and treat land degradation.

Costs incurred to prepare and implement a whole farm plan (with the aim of better environmental management), and expenses for self-education on issues mainly concerning land care were also collected. These other expenditures by no means capture all costs incurred by the agricultural sector on environment protection. Further expenses could include water conservation measures such as drip irrigation, irrigation and waste water reuse; expenditures on land management practices such as minimum or no tillage techniques, stubble retention, strip cropping, improved pastures and

fertilisers, and conversion to organic production. The statistics presented in this chapter are therefore presented in two categories: expenditure to prevent / control land degradation; and other expenditures covering water storage and reticulation systems, farm plan costs and expenses for self education.

3.2 Overview of results

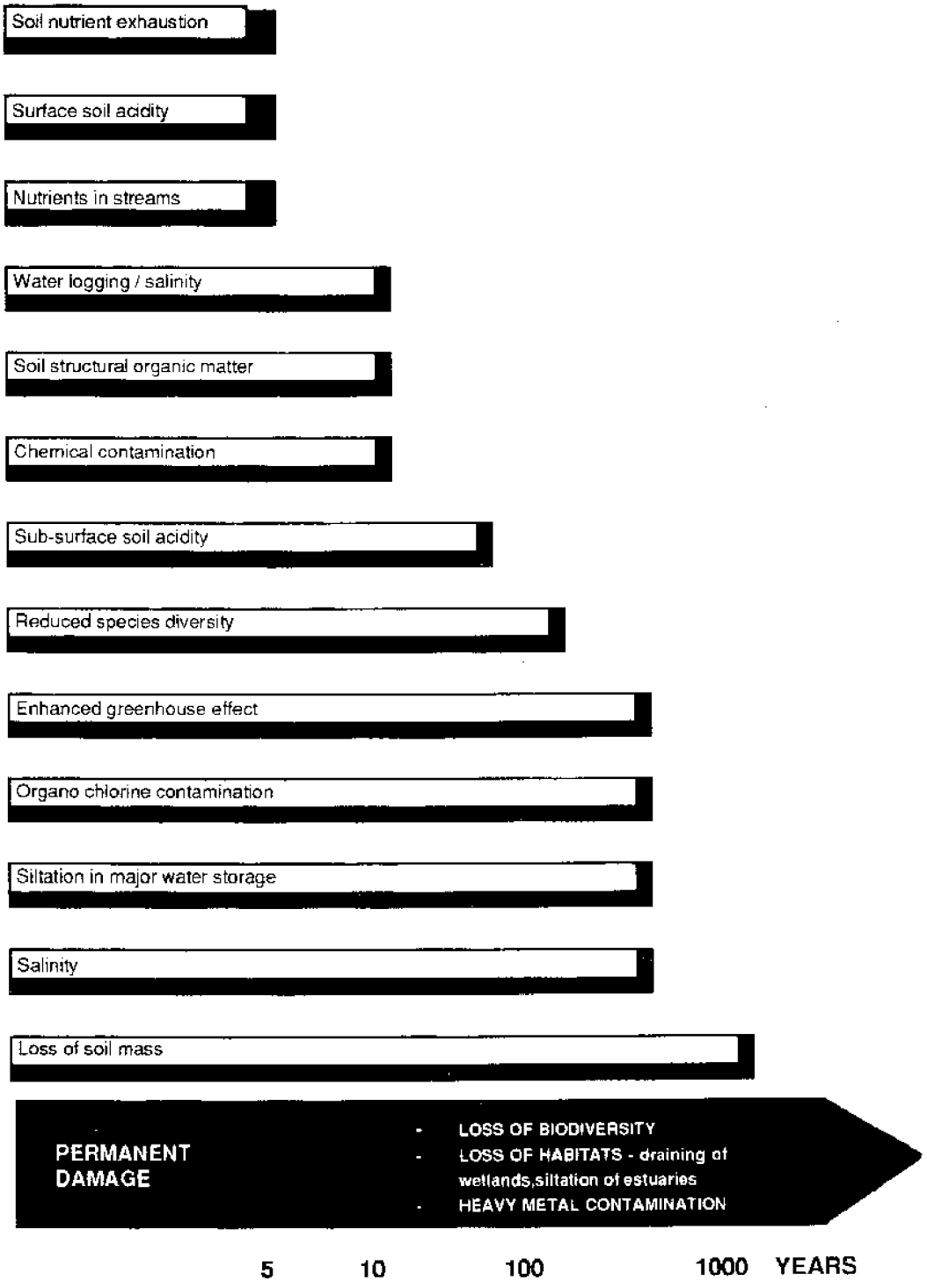
Table 3.1 provides a brief overview of the environmental expenditures of the agricultural sector on environmental protection. As outlined in section 3.1 above, it was not possible to clearly determine whether these expenditures were for pollution abatement or for other protection of the environment. Taking into account some grants and subsidies to the agriculture sector which were identified, the known environment protection expenditures by the agricultural sector for 1991-92 were $285.4 million. The data were provided by respondents in aggregate form only, so it is not possible to present the total in terms of capital and current expenditure components.

TABLE 3.1 AGRICULTURE ENVIRONMENTAL EXPENDITURES, AUSTRALIA, 1991-92
($ million)

Expenditure	
Environmental expenditures	321.1
Minus environmental grants and subsidies received (a)	35.7
Environmental expenditures by the agricultural sector	285.4

(a) This figure is deducted, to ensure there is no double counting in the final estimates for expenditures for all Australian industry and government. The figure is included on the public sector side of the equation.

FIGURE 3.1 IMPACTS OF AGRICULTURAL ACTIVITIES ON THE ENVIRONMENT AND POSSIBLE REPAIR PERIODS



Source: Ecologically Sustainable Development working Groups - Final Report Agriculture, November, 1991, Australian Government Publishing Service, 1991

3.3 Expenditures to prevent/control land degradation

Table 3.2 shows the amounts reported by farm businesses on specific measures to prevent/control land degradation in Australia in 1991-92. The total expenditure for these activities was $180 million in 1991-92, representing one per cent of Australia's agricultural turnover for the period.

Of this $180 million, nearly half (48%) was reported as being spent on eradication or extermination of animals or insects and destruction of weed or plant growth detrimental to the land ($85.5 million). Expenditure on eradication of animals and weeds was consistently high amongst all the States (with the exception of Western Australia where expenditures were fairly evenly distributed). However, difficulties were reported in separating expenditures for the purposes of normal crop management and costs incurred *specifically for the prevention of land degradation*. In particular, Queensland expenditure data for this item was estimated as the data reported expenditure on normal crop and pasture chemicals and did not relate specifically to the prevention of land degradation.

The next highest expenditure was on earthworks to control, treat or prevent erosion, salinity or waterlogging ($61.1 million or 34% of expenditures to prevent / control land degradation). These expenditures included gully stabilisations, grassed waterways, contour banking, dams for the explicit purpose of treating/preventing land degradation, as well as land levelling and grading. These last two practices may not be solely for 'landcare' purposes in certain industries such as vegetable, sugarcane and cotton, where land levelling and grading constitute normal farming practices. As such, expenditure on this item may be overestimated.

The agricultural sector spent $19.2 million on the erection of fences to control/prevent land degradation. This included expenditures on alterations, extensions and additions to existing fences, for the purpose of excluding livestock or vermin to assist in repairing or controlling existing land degradation. This item may be understated as much of this expenditure would be reported separately as 'repairs and maintenance' for tax purposes.

TABLE 3.2 ENVIRONMENTAL EXPENDITURES BY STATE, 1991-92

	NSW		Vic.		Qld (a)		SA		WA		Tas.		Australia (b)	
Description	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*
Preventing / Controlling Land Degradation														
Eradication or extermination of animals or insects and destruction of weed or plant growth detrimental to the land	40.0	(13)	15.3	(12)	*(a)* 12.4	n.a.	6.0	(17)	3.8	(35)	2.7	(19)	85.5	n.a.
Earthworks to control, treat or prevent erosion, salinity or water logging	23.3	(20)	11.5	(47)	18.9	(12)	2.1	(27)	4.0	(23)	0.4	(31)	61.1	(13)
Tree or shrub establishment/ protection to control/prevent land degradation	5.2	(42)	3.4	(21)	1.9	(31)	0.9	(22)	2.0	(17)	0.4	(35)	**14.2**	**(17)**
Erection of fences to separate different land classes to prevent land degradation and/or to exclude livestock or vermin from areas affected by land degradation	4.9	(33)	3.3	(20)	4.2	(19)	1.7	(28)	3.7	(17)	0.5	(44)	19.2	(11)
sub-total	***73.4***	***(10)***	***33.5***	***(17)***	***37.5***	***n.a.***	***10.7***	***(12)***	***13.5***	***(13)***	***4.0***	***(15)***	***180.0***	***n.a.***
Water storage and reticulation systems	24.6	(20)	7.2	(15)	60.0	(10)	13.8	(16)	12.8	(14)	4.8	(48)	135.2	(6)
Costs incurred to prepare farm plan	1.9	(31)	0.6	(50)	0.6	(77)	0.1	(40)	1.1	(89)	0.1	(33)	4.5	(29)
Expenses for self-education	0.5	(52)	0.2	(29)	0.3	(26)	0.1	(46)	0.2	(24)	-	(30)	1.4	(19)
Total Environmental Expenditures	**100.4**	**(9)**	**41.5**	**(14)**	**98.4**	**n.a.**	**24.7**	**(10)**	**27.6**	**(10)**	**8.9**	**(27)**	**321.1**	**n.a.**

(a) The Queensland figure for eradication or extermination of animals or insects and destruction of weed or plant growth detrimental to the land is estimated. As such, standard errors (%) cannot be calculated.
(b) Australian total includes figures for the Northern Territory and Australian Capital Territory.

Note: The standard error indicates the extent to which an estimate might have varied by chance because only a sample of agricultural establishments was included. There are about two chances in three that a sample estimate will differ by less than one standard error from the number that would have been obtained if all agricultural establishments had been included and about nineteen chances in twenty that the difference will be less than two standard errors. The relative standard error is obtained by expressing the standard error as a percentage of the estimate.

Expenditure on tree or shrub establishment primarily to prevent or combat land degradation amounted to $14.2 million. This amount relates to costs associated with the planting/protection of plants to control salinity, stabilise erosion gullies and establishing windbreaks to prevent soil erosion.

These statistics represent preliminary estimates of environmental expenditures by the agricultural sector, with the common purpose of these activities being explicitly the prevention/control of land degradation. A more complete coverage of environmental expenditures would include the costs of activities such as waste/effluent disposal of intensive enterprises, and improved drainage and infrastructure for the prevention/control of irrigation salinity. NSW spent the most on controlling / preventing land degradation, both as a total ($73.4 million), and as a percentage of the State's total agricultural turnover (1.4%).

3.4 Expenditure classified by industry

As noted in Section 3.3 it was not possible to obtain a distribution by industry of Queensland expenditure on eradication or extermination of animals or insects and destruction of weed or plant growth detrimental to the land. These components are therefore not in the individual industry totals in Table 3.3 but are in the 'all industries' total. The analysis that follows is on the basis of industry figures that exclude Queensland, but this is not likely to greatly affect the industry rankings. With this proviso, the sheep/cereal grains and meat cattle industries reported the greatest expenditures on land degradation prevention/protection activities for 1991-92 ($25.7 million and $24.7 million respectively). These two industries are also the largest in terms of total turnover for the agricultural sector. Other major contributors to protection / prevention of land degradation expenditures were the sheep ($20.4 million), and sheep/meat cattle industries ($19.4 million).

TABLE 3.3 ENVIRONMENT PROTECTION EXPENDITURE BY INDUSTRY, AUSTRALIA, 1991-92

	Land degradation protection / prevention (a)			*Water storage, farm plan and self-education*			*Total environment protection expenditure*		
Industry	*$m*	*SE%*	*% of total industry turnover*	*$m*	*SE%*	*% of total industry turnover*	*$m*	*SE%*	*% of total industry turnover*
Poultry	0.5	(18)	0.1	0.4	(28)	0.1	0.9	(16)	0.2
Fruit	12.1	(21)	0.9	7.8	(26)	0.6	19.9	(16)	1.4
Vegetables	6.8	(17)	0.6	13.8	(18)	1.2	20.6	(13)	1.8
Cereal grains/oilseeds nec	15.0	(20)	0.9	5.1	(35)	0.3	20.1	(17)	0.9
Sheep/cereal grains	25.7	(17)	0.9	11.6	(16)	0.4	37.3	(13)	1.3
Meat cattle/cereal grains	4.2	(28)	1.1	4.0	(45)	1.0	8.2	(26)	2.1
Sheep/meat cattle	19.4	(20)	1.3	8.8	(33)	0.6	28.2	(17)	2.0
Sheep	20.4	(12)	1.2	14.5	(29)	0.8	34.9	(14)	2.0
Meat cattle	24.7	(23)	1.1	30.8	(10)	1.3	55.5	(12)	2.4
Milk cattle	14.0	(17)	0.7	14.0	(21)	0.7	28.0	(14)	1.3
Pigs	3.9	(36)	0.6	1.8	(22)	0.3	5.7	(25)	0.9
Sugar	3.9	(23)	0.6	12.1	(23)	1.7	16.0	(18)	2.3
Cotton	12.1	(16)	1.3	11.0	(17)	1.2	23.1	(12)	2.5
Other agriculture	4.9	(17)	0.6	5.5	(19)	0.7	10.4	(13)	1.3
All industries (a)	**180.0**	n.a.	**1.0**	**141.2**	(6)	**0.8**	**321.1**	n.a.	**1.7**

(a) An estimate for some Queensland expenditures is included in the 'all industries' total but is not separately estimated for individual industries. See section 3.3.

Note: The standard error indicates the extent to which an estimate might have varied by chance because only a sample of agricultural establishments was included. There are about two chances in three that a sample estimate will differ by less than one standard error from the number that would have been obtained if all agricultural establishments had been included and about nineteen chances in twenty that the difference will be less than two standard errors. The relative standard error is obtained by expressing the standard error as a percentage of the estimate.

The highest proportion of expenditure on prevention/protection of land degradation to industry turnover was in the sheep/meat cattle and cotton industries (each spending 1.3% of industry turnover). These industries contributed 10.8 per cent and 6.7 per cent respectively to such expenditures by the agricultural sector. The cotton industry, in particular, incurred substantial expenses for pest management (ABS, unpublished data). The next highest proportion was for the sheep (1.2%), meat, and meat cattle/cereal industries (1.1% each) (Figure 3.2).

Total expenditure by the agricultural sector on environment protection amounted to $321.1 million (Table 3.2). The largest amount was spent by the meat cattle industry ($55.5 million), followed by the sheep/cereal grains and the sheep industries ($37.3 million and $34.9 million respectively). At $23.1 million, the cotton industry spent the most as a proportion of the industry's total turnover (2.5%), with the next most being spent by the meat cattle and sugar industries (2.4% and 2.3% of total industry turnover respectively) (Figure 3.3).

FIGURE 3.2 LAND DEGRADATION EXPENDITURE AS A PERCENTAGE OF INDUSTRY TURNOVER, AUSTRALIA, 1991-92

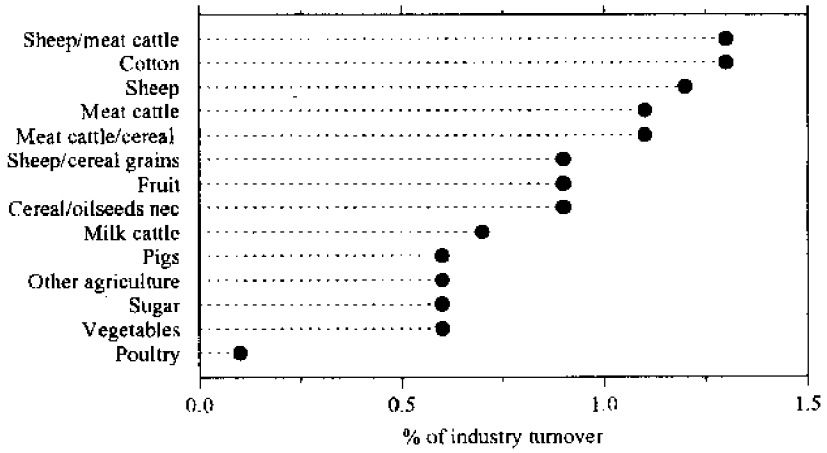
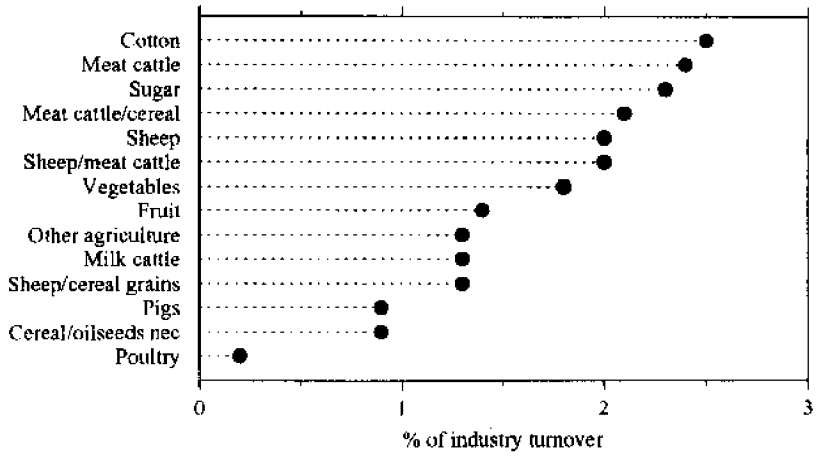


FIGURE 3.3 TOTAL ENVIRONMENT PROTECTION EXPENDITURE AS A PERCENTAGE OF INDUSTRY TURNOVER, AUSTRALIA, 1991-92



3.5 Grants and subsidies

The survey estimates in Table 3.4 are subject to comparatively high standard errors and the following comments should be interpreted in this light.

New South Wales farm businesses received 44 per cent ($1.3 million) of the total soil conservation grants/subsidies reported by the agricultural sector in 1991-92. The remaining soil conservation grants/subsidies were evenly distributed between Victoria and Western Australia ($0.8 million each), with this amount comprising 1.9 per cent and 2.9 per cent respectively of this sector's expenditure on environment protection activities in these States.

Total flood or drought grants/subsidies reported by the agricultural sector in 1991-92 amounted to $32.7 million. Nearly all of this amount (96%) was received by New South Wales and Queensland, with New South Wales reporting $12.7 million and Queensland $18.7 million. These grants and subsidies may be spent on a range of preventative and rehabilitative measures, both economic and environmental. As such, the total of these amounts is not necessarily on measures to protect the environment. They are presented however, as indicative of a proportion of the grants received by the agricultural sector for environmental protection.

TABLE 3.4 GRANTS AND SUBSIDIES RECEIVED, BY STATE

	NSW		*Vic.*		*Qld*		*SA*		*WA*		*Tas.*		*Australia*	
Description	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*	*$m*	*SE%*
Soil conservation grants/ subsidies	1.3	(47)	0.8	(34)	-	(-)	-	(-)	0.8	(53)	-	(-)	3.0	(27)
Flood or drought grants/ subsidies	12.7	(30)	0.4	(49)	18.7	(13)	-	(-)	0.5	(74)	-	(-)	32.7	(14)

Note: the standard error indicates the extent to which an estimate might have varied by chance because only a sample of agricultural establishments was included. There are about two chances in three that a sample estimate will differ by less than one standard error from the number that would have been obtained if all agricultural establishments had been included and about nineteen chances in twenty that the difference will be less than two standard errors. The relative standard error is obtained by expressing the standard error as a percentage of the estimate.

CHAPTER 4 MINING INDUSTRY ENVIRONMENT PROTECTION EXPENDITURE

4.1 Introduction

For the 1991-92 financial year, a number of questions were asked of mining establishments in order to determine their total expenditure on pollution abatement and control measures. These included: capital and current expenditure on environment protection; research and development expenditure on environment protection; expenditure on environmental impact assessments, audits, and energy audits.

Capital expenditure on environment protection in the mining industry was defined as: expenditure on any element of the production processes specifically concerned with protecting the environment by reduction or elimination of pollutants and wastes. This could be by either remedial (end of line) or preventative (change in production) measures. The former refers to the cost of treating pollutants after they have been produced by installing distinct abatement and control facilities; expenses to remove and dispose of wastes; construction of civil works and /or facilities to recreate ecosystems by ripping compacted surfaces or revegetation. Change in production, on the other hand, reduces or eliminates the production of pollution by preventing its occurrence. This can be achieved by improved mining techniques or equipment alteration including equipment converted to use fuels that generate less pollutants. These two methods are further elaborated by considering the pollution involved, i.e., water pollutants, hazardous and non-hazardous solid wastes, air pollutants, noise, other pollutants and land rehabilitation.

Current expenditure on environment protection in the mining industry was defined as: expenditure to operate or maintain plant and equipment to abate pollution; payments to contractors to remove and dispose of waste; costs associated with wind and water erosion; on-going site rehabilitation; regular sampling tests; related research and development expenditure; and outlays on either environmental impact assessments or audits.

Section 4.2 provides an overview of the expenditures of the mining industry in these various categories. More detailed data are presented in subsequent tables. Figures 4.1 (page 31) and 4.2 (page 36) provide background information about the impact of mining activities on the environment, and are a guide to the types of activities for which the pollution abatement and control expenditures reported in this chapter are incurred.

4.2 Overview of results

This section provides a brief overview of the environmental expenditures of the mining sector on environmental protection. For this sector, results were comprised entirely of pollution abatement expenditures. No additional data were available for grants and subsidies received by this sector. Table 4.1 indicates that costs borne by the mining sector for pollution abatement and control were $151.7 million. More detailed data are presented throughout the remainder of this chapter.

TABLE 4.1 MINING SECTOR ENVIRONMENTAL EXPENDITURES, AUSTRALIA, 1991-92

Expenditure	*$m*
Pollution abatement and control - capital expenditures	53.4
- current expenditures	98.3
Pollution abatement and control expenditures by the mining sector	151.7
Minus other environmental grants and subsidies received (a)	n.a.
Environmental expenditures by the mining sector (b)	**151.7**

(a) This figure is deducted, where known, to ensure there is no double counting in the final estimates for expenditures for all Australian industry and government.
(b) Expenditures by the mining sector on environmental expenditures not related to pollution abatement and control have yet to be investigated. Hence this figure is comprised entirely of pollution abatement expenditures and grants and subsidies for a range of environmental activities.

Figure 4.1 - Potential Impacts of Mining

Some environmental impact is an inevitable consequence of virtually all mining and mineral exploration activities, with the exception of remote sensing exploration.

On the evidence available environmental management technology and techniques exist to adequately control all these impacts under most operating conditions encountered in Australia. However, it is also apparent that best available technology is not applied consistently throughout the industry. As would be expected, operations which commenced before about 1970 generally operate to lower environmental standards than more modern operations. It also appears that operations close to population centres or in or near areas of conservation significance operate to higher standards than more remote operations less open to public scrutiny.

The magnitude of these impacts varies according to the area's climate, terrain and ecosystems. The potential impacts of mining and exploration on the environment are numerous but vary enormously according to the nature, stage and scale of activity, the environmental management practices adopted, the characteristics of the particular environment, including factors such as climate and topography, and the ecosystem. In some circumstances, impacts are transitory and relatively easily contained, although in others they can involve relatively large scale disturbance and sometimes irreversible change.

Among exploration activities, aerial surveys in particular have very little impact aside from the problem of noise and proximity to wildlife areas, when conducted at low level. Ground level activities however, can have significant impacts, particularly where ground access is gained for the first time in remote localities. The creation of transects or helipads cut in the forest, or roads or tracks to facilitate exploration, can have medium or long term effects on the environment, particularly if it is left unrehabilitated.

Activities such as fossicking and geochemical stream sampling have little impact aside from access routes. Other activities such as bulk sampling, costeans and drilling can be more significant. In some remote locations, bull-dozed seismic line activities conducted over extensive areas have resulted in habitat disturbance and erosion. Such activities are now increasingly being proscribed. In offshore areas the noise from seismic exploration and drilling can have an impact on marine animals which use sound communication. With all oil drilling there is the risk of oil spills or blow-outs, although the chances of these occurring can be minimised with the appropriate technology.

More apparent than exploration, are impacts of mine construction, ore extraction, mineral concentration and associated transport, provision of infrastructure (sometimes including new townships) and downstream processing.

The type of mining method used influences the extent of impacts. With open cut mining, entire sections of surface area are removed, involving removal of vegetation and destruction of soil profiles. During mining, dust from overburden dumps and haulage roads can be a problem. Acid materials can also be leached from waste rock. Generally some overburden dumps remain after mining in spite of back-fill. Underground mining usually causes fewer visible impacts but can lead to ground subsidence, which is important in regard to urban areas. Old mine shafts are a safety hazard if entrances are not sealed.

Dredging along stream beds can create turbidity, siltation and problems with the regulation of water flows which can have major impacts on aquatic environments. Offshore, dredging is a common technique employed to obtain construction gravel and sand. In shallow environments this can have an impact on sea floor plants, such as sea grass beds, and animals.

Waste materials produced by the concentration of mineral ores take the form of a sandy material referred to as tailings. These may contain residues of chemical reagents, heavy metals and other materials requiring containment, usually in appropriately lined tailings dams. Dams are normally capped and revegetated when full in order to prevent the escape of environmentally harmful materials.

Mining operations can produce large volumes of waste materials. Statistics are not readily available in Australia, unlike, for example, the United States, where detailed information on both hazardous and non-hazardous waste is kept.

Source: adapted from Ecologically Sustainable Development Working Groups - Final Report - Mining, November 1991, pp 25 - 27, Australian Government Publishing Service, 1991

4.3 Pollution abatement and control expenditure

For the 1991-92 financial year, total pollution abatement and control expenditure in the mining industry was $151.7 million. Current expenditure accounts for 65 per cent of total pollution abatement expenditure while capital expenditure accounts for 35 per cent.

Highest total pollution abatement and control expenditure was recorded by the non-ferrous metals ($82.4 million) and the coal ($44.3 million) industries. The former made up 53 per cent of total pollution abatement and control expenditure and the latter 29 per cent. This may reflect the environmental impact inherent in the extractive nature of these two industry sub groups which would require significantly more expenditure than some others.

TABLE 4.2 ENVIRONMENT PROTECTION EXPENDITURE BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, AUSTRALIA, 1991-92

		Expenditure				*Total*	
		Capital		*Current*		*Establishments*	*Expenditure*
Asic code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*
111	Ferrous metals	3	3.8	6	1.8	11	5.6
112	Non-ferrous	46	25.0	109	57.4	202	82.4
120	Coal	31	15.0	64	29.4	97	44.3
130	Oil and gas	5	9.7	9	9.6	55	19.3
Total		**85**	**53.4**	**188**	**98.3**	**365**	**151.7**

Note: where figures have been rounded, discrepancies may occur between totals and the sums of components items.

TABLE 4.3 CAPITAL EXPENDITURE ON ENVIRONMENT PROTECTION BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, STATE, 1991-92

		NSW		*Vic.*		*Qld.*		*SA*		*WA*		*Tas.*		*NT*		*Australia*	
Asic code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*
111	Ferrous metals	—	—	—	—	—	—	—	—	3	3.8	—	—	—	—	3	3.8
112	Non-ferrous	4	1.6	—	—	12	14.0	1	0.1	22	6.4	3	2.4	4	0.6	46	25.0
120	Coal	21	4.8	1	—	6	9.7	1	0.2	1	0.2	1	0.1	—	—	31	15.0
130	Oil & gas	—	—	1	6.3	1	0.3	1	0.3	2	2.8	—	—	—	—	5	9.7
Total		**25**	**6.4**	**2**	**6.3**	**19**	**24.0**	**3**	**0.5**	**28**	**13.1**	**4**	**2.5**	**4**	**0.6**	**85**	**53.4**

Note: where figures have been rounded, discrepancies may occur between totals and the sums of components items.

TABLE 4.4. CURRENT EXPENDITURE ON ENVIRONMENT PROTECTION BY MINING ESTABLISHMENTS, BY INDUSTRY GROUPS, STATE, AUSTRALIA, 1991-92

		NSW		Vic.		Qld.		SA		WA		Tas.		NT		Australia	
Asic code	Description	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m
111	Ferrous metals	—	—	—	—	—	—	—	—	6	1.8	—	—	—	—	6	1.8
112	Non-ferrous	11	3.4	3	0.4	21	19.5	3	0.9	58	21.7	4	1.5	9	10.1	109	57.4
120	Coal	42	10.7	1	—	18	17.8	1	0.6	1	0.2	1	—	—	—	64	29.4
130	Oil & gas	—	—	1	3.5	1	—	1	0.7	6	5.3	—	—	—	—	9	9.6
Total		**53**	**14.1**	**5**	**3.9**	**40**	**37.3**	**5**	**2.3**	**71**	**29.1**	**5**	**1.5**	**9**	**10.1**	**188**	**98.3**

Note: where figures have been rounded discrepancies may occur between totals and sums of component items.

TABLE 4.5 COMPONENTS OF CURRENT EXPENDITURE ON ENVIRONMENT PROTECTION BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, AUSTRALIA, 1991-92

		Payments to government		Payments to non-government		Other costs		Intramural R&D		Extramural R&D	
Asic code	Description	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m
111	Ferrous metals	4	—	2	0.2	3	1.0	1	0.2	—	—
112	Non-ferrous metals	14	0.1	34	12.8	94	39.3	19	2.4	11	0.7
120	Coal	25	0.4	27	3.5	52	21.1	5	0.3	7	0.3
130	Oil and gas	4	0.3	5	1.0	5	7.1	3	0.1	1	0.1
Total		**47**	**0.8**	**68**	**17.4**	**154**	**68.5**	**28**	**3.1**	**19**	**1.1**

		Environment Impact Assessment		Environmental Audits		Energy Audits		Total
Asic code	Description	No.	$m	No.	$m	No.	$m	$m
111	Ferrous metals	2	0.5	1	0.1	1	—	1.8
112	Non-ferrous metals	25	1.3	19	0.9	1	—	57.4
120	Coal	13	3.5	12	0.3	1	—	29.4
130	Oil and gas	5	0.8	3	0.2	1	—	9.6
Total		**45**	**6.1**	**35**	**1.4**	**4**	**0.1**	**98.3**

Note: where figures have been rounded discrepancies may occur between totals and sums of component items.

A substantial portion (70%) of current expenditure is in the 'other' category. This category includes the cost of mine site rehabilitation which is a significant environmental remediation measure undertaken by mining establishments. This table also illustrates the propensity of establishments to do their own research and development rather than contracting it out. In addition, it is clear that coal mining establishments spent the most on environmental impact statements in 1991-92 with 58 per cent of expenditure in this category.

TABLE 4.6 END OF LINE CAPITAL EXPENDITURE ON ENVIRONMENT PROTECTION BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, AUSTRALIA, 1991-92

		Land rehabilitation		*Water pollutants*		*Solid non-hazardous*		*Solid hazardous*		*Air pollutants*		*Noise pollutants*		*Total*
Asic code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*$m*
111	Ferrous metals	2	2.5	1	0.2	1	0.1	1	0.1	1	0.6	1	—	3.4
112	Non-ferrous	19	3.3	21	6.7	8	1.2	10	2.1	14	5.5	4	0.2	19.1
120	Coal	14	3.3	24	6.9	6	0.8	2	—	7	2.7	4	0.1	13.9
130	Oil and gas	2	1.3	3	7.5	1	—	1	0.4	2	0.3	1	—	9.5
Total		**37**	**10.4**	**49**	**21.3**	**16**	**2.1**	**14**	**2.6**	**24**	**9.1**	**10**	**0.3**	**45.9**

Note: where figures have been rounded discrepancies may occur between totals and sums of component items.

TABLE 4.7 CHANGE IN PRODUCTION CAPITAL EXPENDITURE ON ENVIRONMENT PROTECTION BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, AUSTRALIA, 1991-92

		Land rehabilitation		*Water pollutants*		*Solid non-hazardous*		*Solid hazardous*		*Air pollutants*		*Noise pollutants*		*Total*
Asic code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*$m*
111	Ferrous metals	1	0.1	1	0.1	—	—	—	—	2	0.1	1	0.1	0.4
112	Non-ferrous	5	0.7	3	0.5	2	0.1	2	0.9	5	3.8	—	—	5.9
120	Coal	3	0.1	7	0.9	—	—	—	—	3	0.1	2	0.1	1.1
130	Oil and gas	—	—	1	0.1	—	—	1	—	1	—	—	—	0.1
Total		**9**	**0.9**	**12**	**1.5**	**2**	**0.1**	**3**	**0.9**	**11**	**4.0**	**3**	**0.1**	**7.5**

Note: where figures have been rounded discrepancies may occur between totals and sums of component items.

TABLE 4.8 TOTAL CAPITAL EXPENDITURE ON ENVIRONMENT PROTECTION BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, AUSTRALIA, 1991-92

		Land rehabilitation		*Water pollutants*		*Solid non-hazardous*		*Solid hazardous*		*Air pollutants*		*Noise pollutants*		*Total*
Asic code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*$m*
111	Ferrous metals	3	2.6	1	0.2	1	0.1	1	0.1	2	0.7	2	0.1	3.8
112	Non-ferrous	22	4.0	22	7.1	8	1.3	11	3.0	17	9.3	4	0.2	25.0
120	Coal	16	3.4	27	7.8	6	0.8	2	—	10	2.8	4	0.2	15.0
130	Oil and gas	2	1.3	3	7.6	1	—	2	0.4	2	0.3	1	—	9.7
Total		**43**	**11.3**	**53**	**22.8**	**16**	**2.2**	**16**	**3.5**	**31**	**13.1**	**11**	**0.5**	**53.4**

Note: where figures have been rounded discrepancies may occur between totals and sums of component items.

Tables 4.6 and 4.7 separate capital expenditure on pollution abatement and control into two elements: end of line and change in production. End of line techniques account for 86 per cent of capital expenditure while change in production accounts for the remaining 14 per cent. This may be due to the fact that end of line measures are most appropriate for mining activity. The

ability to accurately report change in production expenditure specifically attributable to environmental protection is problematic as this may be undertaken for other reasons, including cost savings.

In the case of end of line measures, abatement of water pollutants exceeded other categories with a 46 per cent share of expenditure. The amount spent to rehabilitate mining sites accounted for a further 23 per cent of expenditure, while measures to abate air pollutants accounted for 19 per cent.

Protection of the atmosphere accounted for 53% per cent of change in production expenditure. Preventative measures applied to water pollutants accounted for 20 per cent.

In terms of total capital expenditure, spending on measures to abate water pollution accounted for 43 per cent of spending ($22.8 million). Measures to abate air pollution accounted for a further 24 per cent ($13.1 million) of capital expenditure while land rehabilitation represented 21 per cent ($11.3 million).

FIGURE 4.2 - POTENTIAL IMPACTS OF MINERAL AND PETROLEUM EXPLORATION AND DEVELOPMENT

Exploration	
Geological mapping, geophysical and geochemical exploration	Low impact, care needed to avoid disturbance by low flying aircraft, geochemical exploration
Ground access	Potential impact from track and road construction. Possible introduction of weeds, feral animals and diseases. Access roads should be closed and rehabilitated when no longer required.
Exploration camps	All equipment and litter should be removed and the site rehabilitated on abandonment to avoid fire and litter impacts
Drilling	Precautions required against spills of drilling mud. Drill holes should be plugged and site rehabilitated. Drill mud potentially impacts on aquatic fauna.
Surface excavations (costeans etc)	Should be back-filled and revegetated when no longer required.
Off-shore drilling and seismic activity	Noise impact on marine animals. Precautions required against minimal risk of oil blow-out.
On-shore seismic activity	Left considerable visual disturbance in the past. New minimal impact techniques now available.
Mining - open cut	
Pit	Sometimes back-filled, but usually left open. Should be shaped and made safe.
Waste rock dumps	Should be shaped and revegetated. Risk of acid mine drainage if dumps are not properly constructed. Aesthetic impacts can be minimised by screen planting.
Mining - strip	Involves larger areas of land, the creation of new land forms and may be visually dramatic. Involves complete clearance of all vegetation and breakdown of soil structure. Progressive rehabilitation and minimisation of open areas is essential. Care needed to avoid adverse impacts on groundwater.
Mining - dredging	Common technique for mineral sands mining. Potential impacts similar to strip mining except that replication of existing land forms is usually feasible due to the small volume of ore removed.
Mining - underground	Less visible impacts. Ground subsistence may be a problem in coal mining. Waste rock dumps require management as for open cut operations.
Heap leaching	Technique occasionally used for extracting high value minerals from low grade ores, especially gold. Main risks arise from leakage and disposal of the leaching solution. The spent heap will require revegetation or disposal into a pit.
Mineral concentrating	Generally involves crushing and grading of ore to fine particles, separation of minerals, and disposal of the remaining sandy material into a tailings dam. Tailings material may be toxic and it is therefore essential that dams are properly engineered, contamination of groundwater is avoided, and that dams are sealed and revegetated.
General	Impacts of varying intensity may occur in relation to air, land forms and soil, water systems, flora and fauna, species and habitat. Possible impacts on wilderness may also be relevant.

Source: Ecologically Sustainable Development Working Groups - Final Report - Mining, November, 1991, p 25, Australian Government Publishing Service, 1991

4.4 Comparison of 1990-91 and 1991-92 data

The 1991-92 expenditures were considerably lower than those recorded in 1990-91 ($152 million compared with $262 million). Most of the difference was accounted for by a significant fall in capital expenditures to abate pollution. Capital expenditure is irregular, fluctuating considerably as sites are established or re-equipped at varying rates. There is an insufficient time series to draw conclusions on trends (Figure 4.3).

The calculation of current expenditures differs between the two periods, further complicating comparisons. In 1990-91, the research and development component was not added to the current expenditure figures provided by respondents. In addition, the 1991-92 figures in this category contain additional expenditure for environmental impact assessments, environmental audits, and energy audits. These costs were not requested of mining establishments in 1990-91. The inclusion of these figures in the final current expenditure calculation accounts for discrepancies with those provided in *Mining Industry, Australia, 1991-92* (8402.0).

TABLE 4.9 ENVIRONMENT PROTECTION EXPENDITURE BY MINING ESTABLISHMENTS, BY INDUSTRY GROUP, AUSTRALIA, 1990-91 AND 1991-92

		1990-91 Expenditures					*1991-92 Expenditures*				
		Capital		*Current*		*Total PAC*	*Capital*		*Current*		*Total PAC*
Asic code	*Description*	*No.*	*$m*	*No.*	*$m*	*$m*	*No.*	*$m*	*No.*	*$m*	*$m*
111	Ferrous metals	3	9.6	5	3.6	13.3	3	3.8	6	1.8	5.6
112	Non-ferrous	63	90.5	78	34.8	125.2	46	25.0	109	57.4	82.4
120	Coal	43	67.8	62	52.6	120.4	31	15.0	64	29.4	44.3
130	Oil and gas	5	2.4	7	0.8	3.2	5	9.7	9	9.6	19.3
Total		**114**	**170.2**	**152**	**91.8**	**262.1**	**85**	**53.4**	**188**	**98.3**	**151.7**

FIGURE 4.3 MINING INDUSTRY ENVIRONMENT PROTECTION, CAPITAL EXPENDITURE, AUSTRALIA, 1990-91 AND 1991-92

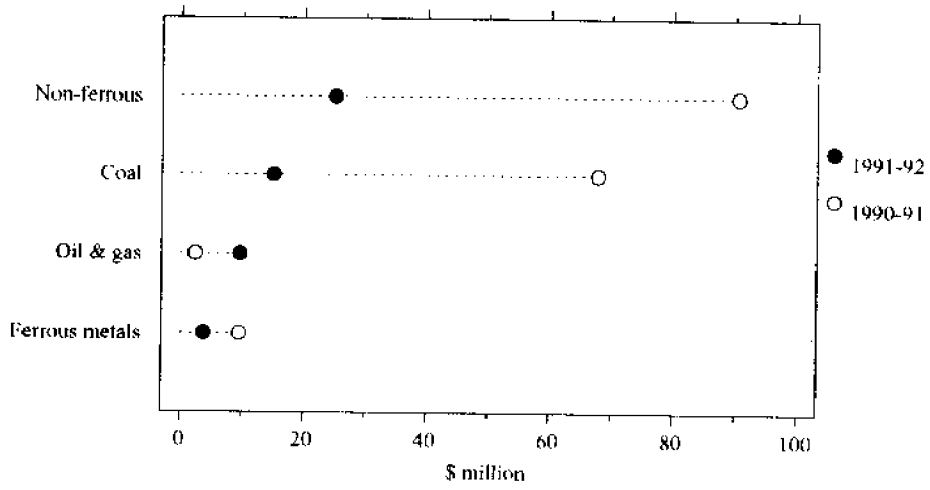
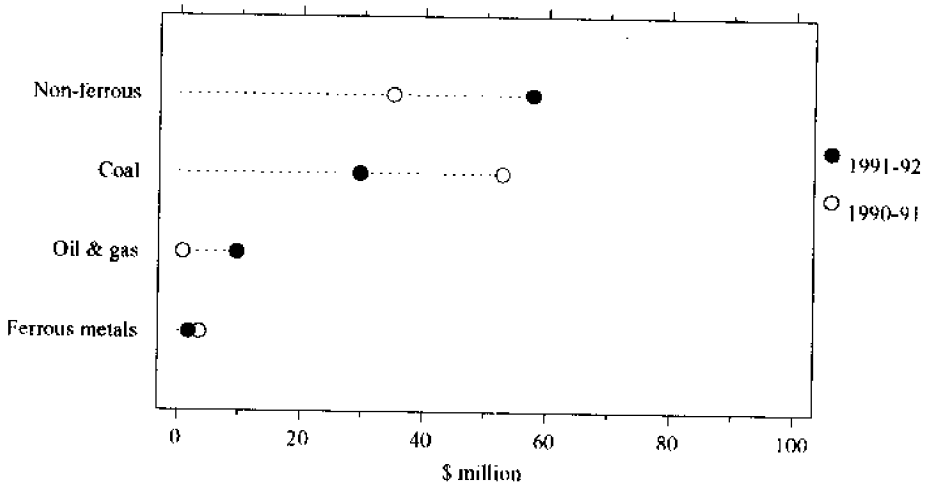


FIGURE 4.4 MINING INDUSTRY ENVIRONMENT PROTECTION CURRENT EXPENDITURE, AUSTRALIA, 1990-91 AND 1991-2



CHAPTER 5 MANUFACTURING INDUSTRY ENVIRONMENT PROTECTION EXPENDITURE

5.1 Introduction

For the 1991-92 financial year, a number of questions concerning environmental protection were asked of manufacturers with four or more employees. This comprised 28 513 establishments (69% of all manufacturers). Industries considered to be the most likely to undertake environmental protection activities were asked to provide dissections of their capital and current expenditures. This latter group comprised 3 695 establishments (9% of all establishments), but accounted for 70 per cent of all pollution abatement expenditures for the sector.

Capital expenditure on pollution abatement and control in the manufacturing sector is defined as *'expenditure on any element of the production processes specifically attributable to protecting the environment by reduction or elimination of pollutants and wastes'*. This expenditure could be by either remedial or preventative measures and was collected with respect to the water, hazardous and non-hazardous solid wastes, air, noise, and other environments. Current pollution abatement expenditure is defined as *'expenditure to operate or maintain plant and equipment to abate pollution; additional energy, wage and salary costs incurred to operate abatement processes; payment for waste removal; related research and development expenditure; and outlays on either environmental impact assessments or audits'*.

Additional information was collected on whether an establishment permitted and/or encouraged the return of its own packaging and whether it conducted any environmental impact assessments or audits.

Figures 5.1 (page 40) and 5.3 (page 51) provide background information on the impact of manufacturing activities on the environment, as reported by the Ecologically Sustainable Development Manufacturing Group in 1991. This background provides an overview of the types of activities for which the pollution abatement and control expenditures reported in this chapter may be incurred.

5.2 Overview of results

Table 5.1 provides a brief overview of the environmental expenditures of the manufacturing sector on environmental protection. For this sector, results were comprised entirely of pollution abatement expenditures, with some additional data on grants and subsidies for other environmental activities. Table 5.1 indicates the costs borne by the manufacturing sector, taking into account

known pollution abatement and environment subsidies, were $1 005.2 million. More detailed statistics are presented throughout the remainder of this chapter.

TABLE 5.1. MANUFACTURING ENVIRONMENTAL EXPENDITURES, AUSTRALIA, 1991-92

Expenditure	*$m*
Pollution abatement and control - capital expenditures	484.0
- current expenditures	522.4
Pollution abatement and control expenditures by the manufacturing sector	1 006.4
Minus environmental grants and subsidies received (a)	1.2
Environmental expenditures by the manufacturing sector (b)	1 005.2

(a) This figure is deducted, to ensure there is no double counting in the final estimates for expenditures for all Australian industry and government. The resultant data in this table represent 'own' expenditures by the manufacturing industry.
(b) Expenditures by the manufacturing sector on environmental expenditures not related to pollution abatement and control have yet to be investigated. Hence this figure is comprised entirely of pollution abatement expenditures and grants and subsidies for a range of environmental activities.

Figure 5.1 - Environmental Impacts of the Manufacturing Sector

At the broadest level, the environmental impact of manufacturing activity needs to be viewed in terms of its impact on biodiversity (that is, the variety of life on earth) and on the maintenance of ecological processes and systems (including our basic life support system).

The most readily perceived environmental impacts are the direct ones relating to, for example, the siting of manufacturing plants in areas of ecological sensitivity and the effects of pollution discharged from the sites. However, a more complete analysis reveals several other important, yet indirect sources of impact. These include:

- the extraction of resources from particularly environmentally sensitive locations, for example timber (from native forests), bauxite and mineral sands;
- the establishment of infrastructure to service manufacturing establishments (for example, roads, powerlines, water supplies, housing developments, waste disposal sites);
- production of products which are environmentally sensitive in their end use such as some fertilisers and pesticides;
- pollution problems arising incidentally during the use of products, such as release of gases or volatile liquids; and
- the final disposal of manufactured products which may involve finding waste sites and subsequently controlling discharges of pollutants from them.

The environmental impacts, however, are being reduced in some areas of the manufacturing sector; for example through the design of new products and processes which have fewer adverse negative impacts and through environmental goods and services which directly facilitate better management of the environment (for example, equipment to help in pollution monitoring/control, waste management, water and effluents treatment and land and water rehabilitation).

Australia has developed strengths in areas like water and waste-water purification, land remediation, solid waste management and environmental monitoring. In cases like liquid waste treatment technologies, the national geography and climate has meant that innovation in areas such as membrane technology, co-agulation processes, flotation and ultra-violet technologies has been driven by necessity.

Source: Ecologically Sustainable Development Working Groups Final Report - Manufacturing, 1991, pp 22-23, Australian Government Publishing Service, 1991

5.3 Capital and current pollution abatement and control expenditures

Figures 5.1 and 5.3 illustrate that there is a range of environmental impacts and effluent streams at which pollution abatement and control expenditures are likely to be targeted. In particular, the expenditures in this chapter encompass pollution problems arising during the use of products (such as release of gases or volatile liquids) and the final disposal of products which may involve finding waste sites and controlling discharges of pollutants from them (Figure 5.1).

Table 5.2 presents a summary of expenditure on pollution abatement and control for the financial year 1991-92. Total expenditure amounted to $1 006.4 million. Of the total, $484 million was capital expenditure (48%) and $522 million was current expenditure (52%). The basic metal products subdivision accounted for 35 per cent of total pollution abatement and control expenditure ($347.1 million) while the chemical, petroleum & coal products subdivision accounted for 24 per cent ($238.6 million). In terms of industry groups the basic non-ferrous metals industry spent $255 million which is a quarter of total pollution abatement and control expenditure. Other significant contributors include the basic chemical (11%), basic iron and steel (9%), and the petroleum refining industries (7%).

Highest levels of capital expenditure on environmental protection occurred in the basic non-ferrous metals ($168.3 million), basic iron and steel ($52.9 million) and the petroleum refining ($49.5 million) industries. Nearly half of total current pollution abatement expenditure was spent by manufacturers in just two industry subdivisions: chemical, petroleum and coal products ($131.2 million) and basic metal products ($124.4 million).

TABLE 5.2 POLLUTION ABATEMENT AND CONTROL EXPENDITURE BY MANUFACTURING ESTABLISHMENTS, BY INDUSTRY GROUP AND SUB-DIVISION, 1991-92

ASIC code	*Description*	*Capital expenditure*		*Current expenditure*		*Total*
		No.	*$m*	*No.*	*$m*	*$m*
211	Meat products	105	5.6	284	16.4	21.9
212	Milk products	58	10.7	103	9.5	20.2
213	Fruit & vegetable products	43	4.8	114	8.3	13.1
214	Margarine, oils & fats n.e.c.	12	1.8	17	2.3	4.1
215	Flour mill & cereal food products	29	24.5	72	3.6	28.0
216	Bread cakes, & biscuits	42	1.1	299	3.7	4.8
217	Other food products	108	10.9	337	13.4	24.3
218	Beverages & malt	62	5.0	151	12.0	17.0
219	Tobacco products	3	12.1	3	1.1	13.2
21	**Total food, beverages & tobacco**	**462**	**76.5**	**1 380**	**70.2**	**146.7**
234	Textile fibres, yarn & woven fabrics	36	2.5	113	7.8	10.2
235	Other textile products	28	1.0	175	2.4	3.4
23	**Total textiles**	**64**	**3.4**	**288**	**10.2**	**13.6**
244	Knitting mills	7		62	0.8	0.9
245	Clothing	37	1.2	306	1.9	3.1
246	Footwear	7	0.4	56	0.4	0.9
24	**Total clothing & footwear**	**51**	**1.7**	**424**	**3.2**	**4.9**
253	Wood & wood products	248	5.1	1 109	12.1	17.2
254	Furniture & mattresses	159	1.2	1 006	4.7	5.9
25	**Total wood, wood products & furniture**	**407**	**6.3**	**2 115**	**16.8**	**23.1**
263	Paper & paper products	39	19.1	136	38.4	57.5
264	Printing & allied industries	205	2.1	1 112	8.5	10.6
26	**Total paper products printing &**	**244**	**21.2**	**1 248**	**47.0**	**68.2**
275	Basic chemicals	80	42.7	177	71.3	114.0
276	Other chemical products	136	14.5	404	37.2	51.7
277	Petroleum refining	12	49.5	22	22.2	71.6
278	Petroleum & coal products	7	0.7	15	0.5	1.2
27	**Total chemical, petroleum & coal**	**235**	**107.4**	**618**	**131.2**	**238.6**
285	Glass & glass products	5	0.6	51	2.3	3.0
286	Clay products & refractories	29	1.6	105	6.4	8.0
287	Cement & concrete products	111	6.2	326	15.2	21.4
288	Other non-metallic mineral products	37	1.9	140	13.6	15.5
28	**Total non-metallic mineral products**	**182**	**10.3**	**622**	**37.6**	**47.9**
294	Basic iron & steel	65	52.9	231	33.5	86.5
295	Basic non-ferrous metals	34	168.3	69	86.9	255.1
296	Non-ferrous metal basic products	34	1.5	90	4.0	5.5
29	**Total basic metal products**	**133**	**222.7**	**390**	**124.4**	**347.1**
314	Structural metal products	105	1.2	716	5.1	6.3
315	Sheet metal products	113	2.7	472	4.7	7.4
316	Other fabricated metal products	254	2.9	841	9.7	12.6
31	**Total fabricated metal products**	**472**	**6.8**	**2 029**	**19.6**	**26.4**
323	Motor vehicles & parts	122	9.2	497	10.6	19.8
324	Other transport equipment	50	1.0	189	2.2	3.2
32	**Total transport equipment**	**172**	**10.3**	**686**	**12.7**	**23.0**
334	Photographic, professional & scientific	47	2.2	144	3.7	5.9
335	Appliances & electrical equipment	152	3.8	540	9.8	13.5
336	Industrial machinery & equipment	172	2.7	967	7.0	9.7
33	**Total other machinery & equipment**	**371**	**8.7**	**1 651**	**20.5**	**29.2**
345	Leather & leather products	28	2.7	65	5.1	7.8
346	Rubber products	22	0.5	129	4.6	5.0
347	Plastic & related products	98	4.1	572	13.1	17.2
348	Other manufacturing	86	1.4	405	6.4	7.8
34	**Total miscellaneous manufacturing**	**234**	**8.7**	**1 171**	**29.1**	**37.8**
21-34	**TOTAL MANUFACTURING**	**3 027**	**484.0**	**12 622**	**522.4**	**1006.4**

Tables 5.3 and 5.4 provide capital and current expenditure by State for all manufacturers with four or more employees.

New South Wales and Victoria were the major contributors to manufacturing industry turnover in 1991-92 with the former accounting for 34 per cent of the total manufacturing turnover and the latter 32 per cent. Pollution abatement spending in New South Wales exceeded that of any other State with $381.6 million, which represents 38 per cent of total pollution abatement expenditure. Victoria was next with a total expenditure of $254.1 million or 25 per cent. Western Australian establishments contributed $163.3 million or 16 per cent of Australia's total.

Significant pollution abatement and control current expenditure occurred in New South Wales' basic iron and steel ($20 million) and basic chemicals ($16 million) industries. Other notable spending levels occurred in Western Australia in basic non-ferrous metal ($37.7 million) and basic chemical ($15.8 million) groups.

TABLE 5.3 CAPITAL EXPENDITURE ON PAC BY MANUFACTURING ESTABLISHMENTS, BY INDUSTRY GROUP AND STATE, 1991-92

		NSW		*Vic.*		*Qld.*		*SA*		*WA*		*Tas.*		*Australia* (a)	
ASIC code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*
211	Meat products	**28**	1.2	26	1.6	19	1.3	6	0.5	21	0.6	5	n.p.	105	5.6
212	Milk products	19	1.3	24	8.2	5	0.3	n.p.	n.p.	n.p.	n.p.	n.p.	0.4	58	10.7
213	Fruit & vegetable products	15	1.7	14	1.1	7	n.p.	n.p.	0.5	n.p.	n.p.	1	n.p	43	4.8
214	Margarine, oils & fats n.e.c.	6	n.p.	1	n.p.	n.p.	0.3	n.p.	n.p.	1	n.p.	1	n.p.	12	1.8
215	Flour mill & cereal food products	14	24.0	6	0.1	6	0.3	2	n.p.	1	n.p.	—	—	29	24.5
216	Bread, cakes, & biscuits	15	0.5	8	0.2	8	0.1	7	0.1	2	n.p.	—	—	42	1.1
217	Other food products	32	3.2	34	2.5	23	2.9	7	0.1	6	0.2	6	2.1	108	10.9
218	Beverages & malt	16	1.9	21	1.2	7	0.7	n.p.	0.2	n.p.	1.0	n.p.	n.p.	62	5.0
219	Tobacco products	2	n.p.	1	n.p.	n.p.	n.p.	—		—	—	—	—	3	12.1
21	**Total food, beverages & tobacco**	**147**	**46.9**	**135**	**15.1**	**78**	**6.3**	**45**	**1.8**	**37**	**2.3**	**18**	**4.1**	**462**	**76.5**
234	Textile fibres, yarn & woven fabrics	7	1.0	22	1.3	n.p.	n.p.	3	0.1	n.p.	n.p.	n.p.	n.p.	36	2.5
235	Other textile products	10	0.4	11	0.5	n.p.	n.p.	5	n.p.	n.p.	n.p.	n.p.	n.p.	28	1.0
23	**Total textiles**	**17**	**1.4**	**33**	**1.9**	**4**	—	**8**	**n.p.**	**n.p.**	**n.p.**	**n.p.**	n.p.	**64**	**3.4**
244	Knitting mills	n.p.	n.p.	n.p.	—	n.p.	n.p.			—	—	n.p.	n.p.	7	
245	Clothing	18	0.7	14	0.5	n.p.	n.p.	1	n.p.	n.p.	n.p.	n.p.	n.p.	37	1.2
246	Footwear	n.p.	n.p.	n.p.			—	—	—	n.p.	n.p.		—	7	0.4
24	**Total clothing & footwear**	**23**	**1.1**	**22**	**0.6**	**n.p.**	**n.p.**	**1**	**n.p.**	**2**	**n.p.**	**n.p.**	**n.p.**	**51**	**1.7**
253	Wood & wood products	85	2.2	54	1.0	53	1.3	22	0.2	15	0.1	15	0.5	248	5.1
254	Furniture & mattresses	40	0.3	47	0.6	31	0.2	22	0.1	16	—	3		159	1.2
25	**Total wood, wood products & furniture**	**125**	**2.4**	**101**	**1.5**	**84**	**1.4**	**44**	**0.3**	**31**	**0.1**	**18**	**0.5**	**407**	**6.3**
263	Paper & paper products	14	6.6	14	7.6	5	0.5	3	2.5	2	n.p.	1	n.p.	39	19.1
264	Printing & allied industries	74	0.6	68	1.1	25	0.2	18	0.2	13	n.p.	2	n.p.	205	2.1
26	**Total paper products printing & publishing**	**88**	**7.2**	**82**	**8.7**	**30**	**0.7**	**21**	**2.6**	**15**	**0.4**	**3**	**1.6**	**244**	**21.2**
275	Basic chemicals	30	21.2	34	n.p.	7	3.5	2	n.p.	4	1.0	3	n.p.	80	42.7
276	Other chemical products	67	7.9	38	3.7	14	1.7	3	0.1	11	n.p.	2	n.p.	136	14.5
277	Petroleum refining	2	n.p.	4	n.p.	3	2.4	2	n.p.	1	n.p.		—	12	49.5
278	Petroleum & coal products	3	n.p.	1	n.p.	—	—	1	n.p.	2	n.p.		—	7	0.7
27	**Total chemical, petroleum & coal products**	**102**	**44.8**	**77**	**21.9**	**24**	**7.7**	**8**	**16.2**	**18**	**6.6**	**5**	**10.1**	**235**	**107.4**
285	Glass & glass products	1	n.p.	3	0.6		—	1	n.p.		—	—		5	0.6
286	Clay products & refractories	18	1.3	6	0.1	2	n.p.	1	n.p.	2	n.p.	—	—	29	1.6
287	Cement & concrete products	48	2.8	20	1.0	14	1.3	6	n.p.	13	0.5	8	n.p.	111	6.2
288	Other non-metallic mineral products	10	n.p.	7	0.8	6	n.p.	6	0.3	7	n.p.	1	n.p.	37	1.9
28	**Total non-metallic mineral**	**77**	**4.7**	**36**	**2.6**	**22**	**1.5**	**14**	**0.6**	**22**	**0.6**	**9**	**0.3**	**182**	**10.3**
294	Basic iron & steel	30	34.1	11	6.8	10	0.3	7	n.p.	6	0.4	1	n.p.	65	52.9
295	Basic non-ferrous metals	10	50.7	6	10.6	6	18.9	5	n.p.	5	78.6	1	n.p.	34	168.3
296	Non-ferrous metal basic products	14	0.8	10	0.5	4		1	n.p.	3	0.1	2	n.p.	34	1.5
29	**Total basic metal products**	**54**	**85.6**	**27**	**17.9**	**20**	**19.3**	**13**	**14.8**	**14**	**79.1**	**4**	**5.1**	**133**	**222.7**

For footnotes, see end of table.

TABLE 5.3 CAPITAL EXPENDITURE ON PAC BY MANUFACTURING ESTABLISHMENTS, BY INDUSTRY GROUP AND STATE, 1991-92 - *(continued)*

		NSW		*Vic.*		*Qld*		*SA*		*WA*		*Tas.*		*Australia* (a)	
ASIC code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*
314	Structural metal products	36	0.6	29	0.3	22	0.1	6	—	10	0.1	1	n.p.	**105**	**1.2**
315	Sheet metal products	43	0.9	43	1.4	10	0.3	7	0.1	9	0.1		—	**113**	2.7
316	Other fabricated metal products	87	0.9	79	1.0	30	0.5	32	0.3	22	0.1	3	n.p.	**254**	2.9
31	**Total fabricated metal products**	**166**	**2.5**	**151**	**2.6**	**62**	**0.9**	**45**	**0.5**	**41**	**0.3**	**4**	**0.1**	**472**	**6.8**
323	Motor vehicles & parts	27	0.3	50	7.7	n.p.	0.1	13	0.7	15	0.3	n.p.	n.p.	122	9.2
324	Other transport equipment	18	0.5	11	0.3	n.p.	0.1	5	—	5	—	n.p.	n.p.	50	1.0
32	**Total transport equipment**	**45**	**0.8**	**61**	**8.0**	**n.p.**	**0.3**	**18**	**0.8**	**20**	**0.4**	**n.p.**	**n.p.**	**172**	**10.3**
334	Photographic, professional & scientific equipment	22	0.1	16	2.0	6	—	2	n.p.	1	n.p.	—	—	47	2.2
335	Appliances & electrical equipment	66	1.4	41	1.3	15	0.4	19	n.p.	10	0.1	—	—	152	3.8
336	Industrial machinery & equipment	59	1.1	54	0.4	25	0.2	19	1.0	12	n.p.	3	n.p.	172	2.7
33	**Total other machinery & equipment**	**147**	**2.6**	**111**	**3.8**	**46**	**0.6**	**40**	**1.5**	**23**	**0.2**	**3**	**n.p.**	**371**	**8.7**
345	Leather & leather products	10	1.0	11	1.1	2	n.p.	2	n.p.	n.p.	n.p.	n.p.	n.p.	28	2.7
346	Rubber products	7	—	9	0.4	2	n.p.	2	n.p.	n.p.	n.p.	n.p.	n.p.	22	0.5
347	Plastic & related products	29	0.9	41	2.7	11	0.3	11	0.1	6	0.1	—	—	98	4.1
348	Other manufacturing	26	0.4	28	0.7	16	0.1	7	0.2	7	—	1	n.p.	86	1.4
34	**Total miscellaneous manufacturing**	**72**	**2.2**	**89**	**4.9**	**31**	**0.7**	**22**	**n.p.**	**n.p.**	**0.2**	**n.p.**	**n.p.**	**234**	**8.7**
21-34	**TOTAL MANUFACTURING**	**1 063**	**202.3**	**925**	**89.4**	**431**	**39.3**	**279**	**39.9**	**242**	**90.3**	**66**	**21.8**	**3 027**	**484.0**

(a) Australian total includes NT and ACT

Note: where figures have been rounded, discrepancies may occur between totals and sums of component items.

TABLE 5.4 CURRENT EXPENDITURE ON PAC BY MANUFACTURING ESTABLISHMENTS BY INDUSTRY GROUP AND STATE, 1991-92

		NSW		*Vic.*		*Qld*		*SA*		*WA*		*Tas*		*Australia (a)*	
ASIC code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*
211	Meat products	80	3.8	81	4.7	47	4.2	26	1.3	38	1.9	9	0.4	284	16.4
212	Milk products	36	4.7	33	2.2	n.p.	1.1	n.p.	n.p.	4	0.9	6	0.3	103	9.5
213	Fruit & vegetable products	37	1.8	35	2.4	16	n.p.	12	0.5	8	0.3	5	1.6	114	8.3
214	Margarine, oils & fats n.e.c.	7	n.p.	4	n.p.	n.p.	0.2	n.p.	n.p.	2	n.p.	1	n.p.	17	2.3
215	Flour mill & cereal food products	26	2.3	18	0.9	14	0.3	7		6	n.p.	1	n.p.	72	3.6
216	Bread, cakes, & biscuits	76	1.4	89	0.9	67	0.6	37	0.3	22	0.4	3	—	299	3.7
217	Other food products	104	4.9	92	3.5	76	3.8	20	0.5	26	0.3	17	0.5	337	13.4
218	Beverages & malt	32	5.5	39	1.2	16	2.3	38	0.6	19	2.3	6	n.p.	151	12.0
219	Tobacco products	2	n.p.	1	n.p.	n.p.	n.p.		—	—	—	..		3	1.1
21	**Total food, beverages & tobacco**	**400**	**26.7**	**392**	**16.5**	**247**	**14.1**	**154**	**3.5**	**125**	**6.3**	**48**	**2.9**	**1 380**	**70.2**
234	Textile fibres, yarns, & woven fabrics	29	1.2	64	5.3	5	0.1	7	0.6	4	0.5	4	n.p.	113	7.8
235	Other textile products	59	0.7	68	1.2	16	0.1	18	0.1	11	0.2	2	n.p.	175	2.4
23	**Total textiles**	**88**	**2.0**	**132**	**6.5**	**21**	**0.1**	**25**	**0.7**	**15**	**0.7**	**6**	**0.2**	**288**	**10.2**
244	Knitting Mills	14	0.2	41	0.6	2	n.p.	3		n.p.	n.p.	n.p.	n.p.	62	0.8
245	Clothing	135	0.9	112	0.5	33	0.2	19	0.2	n.p.	n.p.	n.p.	n.p.	306	1.9
246	Footwear	17	0.2	27	0.2	4	n.p.	6	—	n.p.	n.p.	n.p.	n.p.	56	0.4
24	**Total clothing & footwear**	**166**	**1.2**	**180**	**1.3**	**39**	**0.2**	**28**	**0.2**	**n.p.**	**0.2**	**2**	**n.p.**	**424**	**3.2**
253	Wood & wood products	390	4.1	273	2.2	222	2.6	102	0.8	69	0.5	35	1.7	1 109	12.1
254	Furniture & mattresses	259	1.7	314	1.3	185	0.8	102	0.4	114	0.4	21	0.1	1 006	4.7
25	**Total wood, wood products & furniture**	**649**	**5.9**	**587**	**3.5**	**407**	**3.4**	**204**	**1.2**	**183**	**0.8**	**56**	**1.8**	**2 115**	**16.8**
263	Paper & paper products	49	13.8	48	16.6	18	3.6	10	2.0	8	n.p.	3	n.p.	136	38.4
264	Printing & allied industries	439	2.8	351	2.8	125	1.9	85	0.6	72	n.p.	20	n.p.	1 112	8.5
26	**Total paper products printing & publishing**	**488**	**16.7**	**399**	**19.4**	**143**	**5.4**	**95**	**2.6**	**80**	**1.3**	**23**	**1.5**	**1 248**	**47.0**
275	Basic chemicals	62	16.3	66	n.p.	21	3.2	12	2.2	12	15.8	4	n.p.	177	71.3
276	Other chemical products	182	11.9	129	22.1	44	2.2	17	0.3	29	n.p.	2	n.p.	404	37.2
277	Petroleum refining	5	10.6	8	n.p.	4	n.p.	3	n.p.	2	n.p.	–	—	22	22.2
278	Petroleum & coal products	5	0.2	4	0.2	1	n.p.	2	n.p.	3	n.p.		—	15	0.5
27	**Total chemical, petroleum & coal products**	**254**	**38.8**	**207**	**62.4**	**70**	**7.1**	**34**	**3.3**	**46**	**18.6**	**6**	**1.2**	**618**	**132.0**
285	Glass & glass products	20	1.1	15	0.8	5	0.1	3		6	0.2	2	n.p.	51	2.3
286	Clay products & refractories	47	5.0	29	0.7	11	0.2	7	0.1	9	0.5	2	n.p.	105	6.4
287	Cement & concrete products	111	6.0	68	3.3	59	2.9	27	1.2	35	1.4	14	0.4	326	15.2
288	Other non-metallic mineral products	49	10.1	34	1.5	17	0.5	14	0.2	22	1.2	3	—	140	13.6
28	**Total non-metallic mineral products**	**227**	**22.3**	**146**	**6.3**	**92**	**3.7**	**51**	**1.4**	**72**	**3.3**	**21**	**0.4**	**622**	**37.6**
294	Basic iron & steel	88	20.0	71	6.7	35	1.2	17	4.4	15	0.8	4	n.p.	231	33.5
295	Basic non-ferrous metals	23	12.9	18	9.0	10	7.9	7	n.p.	7	37.7	3	12.5	69	86.9
296	Non-ferrous metal basic products	37	2.2	29	0.6	10	0.3	6	n.p.	6	0.2	2	n.p.	90	4.0
29	**Total basic metal products**	**148**	**35.1**	**118**	**16.4**	**55**	**9.5**	**30**	**10.7**	**28**	**38.7**	**9**	**13.0**	**390**	**124.4**

For footnotes see end of table.

TABLE 5.4 CURRENT EXPENDITURE ON PAC BY MANUFACTURING ESTABLISHMENTS BY INDUSTRY GROUP AND STATE, 1991-92 *(continued)*

		NSW		*Vic.*		*Qld*		*SA*		*WA*		*Tas*		*Australia (a)*	
ASIC code	*Description*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*	*No.*	*$m*
314	Structural metal products	264	2.0	165	1.0	122	1.3	63	0.4	78	0.5	17	—	716	5.1
315	Sheet metal products	183	1.5	150	1.7	56	0.7	29	0.3	42	0.3	8	—	472	4.7
316	Other fabricated metal products	319	4.3	264	3.1	106	1.3	74	0.7	70	0.4	7	—	841	9.7
31	**Total fabricated metal products**	**766**	**7.9**	**579**	**5.7**	**284**	**3.2**	**166**	**1.3**	**190**	**1.2**	**32**	**0.1**	**2 029**	**19.6**
323	Motor vehicles & parts	119	1.4	191	6.4	80	0.6	54	1.8	n.p.	0.2	n.p.	n.p.	497	10.6
324	Other transport equipment	59	0.4	47	1.1	48	0.4	9	..	n.p.	0.3	..	n.p.	189	2.2
32	**Total transport equipment**	**178**	**1.9**	**238**	**7.5**	**128**	**1.0**	**63**	**1.8**	**67**	**0.5**	**n.p.**	**n.p.**	**686**	**12.7**
334	Photographic, professional & scientific equipment	59	0.8	57	2.8	11	—	9	—	8	—	—	—	144	3.7
335	Appliances & electrical equipment	216	4.8	177	2.5	47	1.0	56	1.1	34	0.3	6		540	9.8
336	Industrial machinery & equipment	361	2.6	314	2.8	112	0.6	91	0.4	77	0.5	11		967	7.0
33	**Total other machinery & equipment**	**636**	**8.2**	**548**	**8.1**	**170**	**1.7**	**156**	**1.5**	**119**	**0.9**	**17**	—	**1 651**	**20.5**
345	Leather & leather products	21	1.3	26	3.1	6	0.3	4	0.2	n.p.	n.p.	n.p.	n.p.	65	5.1
346	Rubber products	47	0.6	44	2.1	15	0.1	10	1.8	n.p.	n.p.	2	n.p.	129	4.6
347	Plastic & related products	212	5.7	210	5.3	69	1.0	45	0.6	30	0.5	4	—	572	13.1
348	Other manufacturing	149	5.2	112	0.5	71	0.4	32	0.2	34	0.1	5	n.p.	405	6.4
34	**Total miscellaneous manufacturing**	**429**	**12.7**	**392**	**11.0**	**161**	**1.8**	**91**	**2.8**	**81**	**0.7**	**11**	**0.1**	**1 171**	**29.1**
21-34	**Total manufacturing**	**4 429**	**179.3**	**3 918**	**164.7**	**1 817**	**51.3**	**1 097**	**31.0**	**1 015**	**73.1**	**237**	**21.2**	**12 622**	**522.4**

(a) Australian total includes NT and ACT.

Note: where figures have been rounded, discrepancies may occur between totals and sums of component items.

5.4 Capital expenditure for environment protection by technique

Tables 5.5.1 and 5.5.2 separate capital expenditure on pollution abatement and control into two elements: end of line and change in production. The former refers to the treatment of pollutants after they have been produced by installing distinct abatement facilities. Change in production, on the other hand, reduces or eliminates the production of pollution by preventing its occurrence. This can be achieved by material substitution, modified production processes, or equipment alteration. These two methods are further investigated by considering the media to which they apply. Figure 5.3 provides some background information on the nature of pollutants produced by some of the major manufacturing industries and the environmental media upon which they impact.

End of line techniques account for 78 per cent of capital expenditure while change in production accounts for the remaining 22 per cent for those selected industries providing this disaggregation of capital expenditure. This may be due to the fact that end of line measures are simpler and less expensive to install. This is particularly so in the early stages of pollution abatement and control activity. International literature suggests that over time, expenditures will move from the simpler approach of controlling pollution at the end of the production process (end-of-line techniques) to investing in production processes which are inherently less polluting (change-in-production techniques). Time series data will be necessary to determine whether this trend is emerging in the Australian data. This difference may also be due in part to an inability of respondents to accurately report change in production expenditure specifically attributable to environmental protection as this type of capital works often has multiple purposes such as increased efficiencies and cost savings.

End-of-line measures to protect the air exceeded measures to protect other environmental media with a 48 per cent share of expenditure. The amount spent to abate solid hazardous waste pollutants accounted for a further 26 per cent of expenditure while measures to protect water accounted for 20 per cent. In industry terms, the basic non-ferrous metals industry ($77.3 million) was the major spender on end of line expenditures to abate pollutants to the air.

In the case of change-in-production expenditure, measures intended to control water pollution accounted for 62 per cent of expenditure. Measures applied to air pollution accounted for 29 per cent of expenditure. The highest level of spending to abate water pollution occurred in the petroleum refining industry ($20.2 million) while the highest level spent on abating air pollution occurred in the basic iron and steel industry ($9.9 million).

TABLE 5.5.1 END-OF-LINE CAPITAL EXPENDITURE BY SELECTED (a) MANUFACTURING ESTABLISHMENTS (b), AUSTRALIA, 1991-92

ASIC code	Description	Air		Water		Solid non-hazardous		Solid hazardous		Noise		Other (c)		Total End of Line		Total estabs
		No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.
2 631	Pulp, paper & paperboard	2	n.p.	9	4.3	3	n.p.	1	—	3	0.4	5	1.7	14	7.1	63
275	Basic chemicals	44	19.5	52	8.9	14	0.5	16	8.7	12	0.4	10	0.6	74	38.7	274
276	Other chemical products	55	1.4	79	5.5	34	0.3	19	0.9	12	0.5	21	0.3	119	8.9	617
277	Petroleum refining	8	15.8	9	7.5	1	..	2	n.p.	3	n.p.	5	0.8	12	25.3	22
278	Petroleum & coal products	2	n.p.	5	0.1	2	—	1	n.p.		—	2	n.p.	7	0.7	24
285	Glass & glass products	2	n.p.	1	..	..	—	—	—	1	n.p.	1	n.p.	3	n.p.	113
286	Clay products & refractories	15	0.7	13	0.4	3	0.2	—	—	4	—	4	0.1	26	1.5	245
287	Cement & concrete products	72	1.9	68	2.2	21	n.p.	1	n.p.	19	0.3	12	n.p.	103	4.6	618
288	Other non-metalic mineral products	22	0.7	14	0.7	9	0.1			10	0.1	5	0.1	32	1.7	253
294	Basic iron & steel	35	12.5	22	13.4	16	2.9	2	n.p.	17	0.7	4	n.p.	60	32.2	434
295	Basic non-ferrous metals	22	77.3	18	10.8	8	3.5	10	60.3	3	0.1	6	0.7	30	152.7	91
346	Rubber products	10	n.p.	3	—	3	—	1	—	3	..	3	n.p.	17	n.p.	202
347	Plastic & related products	44	1.6	19	0.9	29	1.1	4	—	14	0.1	3	..	83	3.8	996
Total		**333**	**132.7**	**312**	**54.7**	**143**	**9.0**	**57**	**72.7**	**101**	**3.8**	**81**	**5.0**	**580**	**277.9**	**3 952**

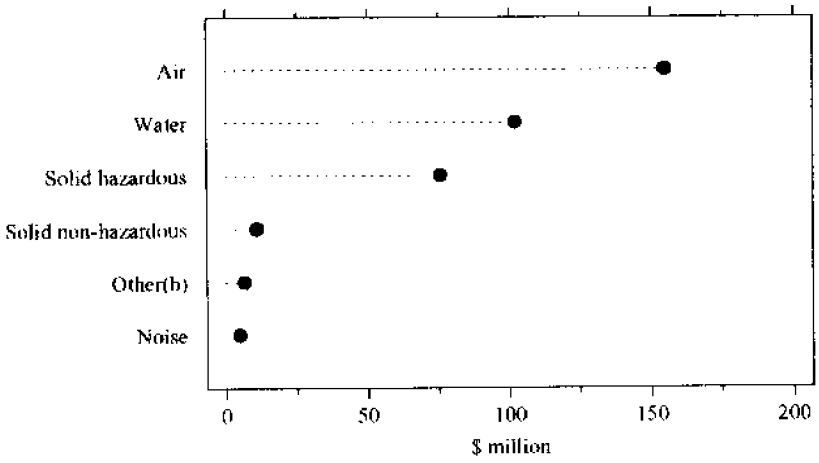
(a) Establishments considered most likely to undertake environment protection activities.
(b) The separate cells in this table are not mutually exclusive as an establishment may have capital expenditure to protect, for example, air only, water only or both air and water.
(c) This category includes estimates of costs to protect nature and landscapes as well as to control non-radioactive radiation.

TABLE 5.5.2 CHANGE IN PRODUCTION CAPITAL EXPENDITURE BY SELECTED (a) MANUFACTURING ESTABLISHMENTS (b), AUSTRALIA, 1991-92

Asic code	Description	Air		Water		Solid non-hazardous		Solid hazardous		Noise		Others (c)		Total Change in Production		Total estabs
		No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.	$m	No.
2 631	Pulp, paper & paperboard			6	3.5	4	n.p.					1	n.p.	9	4.2	63
275	Basic chemicals	17	0.9	21	2.6	7	0.3	5	0.2	6	n.p.	2	n.p.	34	4.1	274
276	Other chemical products	19	0.7	43	4.4	14	0.2	4	0.2	4	0.1	10	0.1	51	5.6	617
277	Petroleum refining	4	3.8	5	20.2	..	..	..	..	2	n.p.	1	n.p.	6	24.2	22
278	Petroleum & coal products n.e.c.	2	..	1	—	—	—	—	—	..	..	1	..	3		24
285	Glass & glass products	1	n.p.	1	..	—	—	—	—	—	—	—	—	2	n.p.	113
286	Clay products & refractories	7	0.1	—	—	—	—	1	—	2	—	—	—	7	0.1	245
287	Cement & concrete products	14	1.0	12	0.4	8	0.1	1	—	4	—	3	—	23	1.6	618
288	Other non-metalic mineral products	5	n.p.	2	..	3	n.p.	—	—	1	—	2	—	12	0.2	253
294	Basic iron & steel	13	9.9	9	9.1	5	0.4	1	n.p.	6	0.4	5	n.p.	20	20.7	434
295	Basic non-ferrous metals	8	5.6	6	7.3	4	0.1	1	n.p.	—	—	1	n.p.	12	15.6	91
346	Rubber products	5	n.p.			2		1		3		1		7	n.p.	202
347	Plastic & related products	14	0.2	3	—	8	0.1	2	—	5	0.1	4	0.1	27	0.4	996
Total		**109**	**22.1**	**109**	**47.4**	**55**	**1.9**	**16**	**2.9**	**33**	**0.9**	**31**	**1.6**	**213**	**76.8**	**3 952**

(a) Establishments considered most likely to undertake environment protection activities.
(b) The separate cells in this table are not mutually exclusive as an establishment may have capital expenditure to protect, for example, air only, water only or both air and water.
(c) This category includes estimates of costs to protect nature and landscapes as well as to control non-radioactive radiation.

FIGURE 5.2 MANUFACTURING INDUSTRY CAPITAL EXPENDITURE BY MEDIA, AUSTRALIA, 1991-92, SELECTED INDUSTRIES(a)



(a) Establishments most likely to undertake environment protection activities.
(b) This category includes estimates of costs to protect nature and landscapes as well as to control non-radioactive radiation.

Figure 5.3 - Pollution and waste disposal in the Manufacturing Industry

The main pollutant sources from manufacturing are predominantly in the form of

- air pollution by either noxious gases, vapours, fumes or particulates such as smoke or grit;
- aqueous or non-aqueous liquid discharges in which organic including microbiological organisms and/or inorganic materials are dissolved or suspended which may have a deleterious effect on receiving waters or groundwaters;
- solid wastes which present problems of disposal because of the volume generated, waste of potential recyclables, and the possibility of groundwater contamination;
- hazardous wastes which by their nature need to be disposed of in an environmentally responsible manner; and
- noise and odour which can present local problems in the vicinity of some manufacturing establishments.

Various industries have different potentially polluting effluent streams and few generalisations can be made which cover manufacturing as a whole. The broad manufacturing activities whose effluent streams are considered to pose higher than average threats to the environment are (in no particular order) chemicals and petroleum refining, iron and steel, non-ferrous metals, cement, pulp and paper and the processing of certain mineral and rural products.

The table below indicates the contents of the effluent streams emitted by some of the potentially environmentally damaging manufacturing processes. It is emphasised that these effluents have the *potential* to pollute. Their actual impact on the environment depends on a host of factors including the rates of discharge and concentrations of the contaminants, the control technologies used by the manufacturer, the type of receiving medium and its quality, topographical and climatic characteristics, the types of flora and fauna which do or may come into contact with contaminants, and last, but not least, the type of management practices.

Because of this, there is rarely a simple and general rule that can be applied to industry pollution problems. Each industry, and in many cases each particular operation has to be looked at on a case-by-case basis, with specific solutions being tailored according to the nature of the problem.

Typical potential effluent streams from some major manufacturing activities

	Major Potential Pollutants			
Production Activity	Air	Water	Solid	Other
Iron & steel	particulates dust, sulphur and nitrogen oxides, polycyclic hydrocarbons, odours	oils, greases, suspended soils, iron scale and salts, acids, alkalies, chromates, cyanides, phosphates, ammonia, thermal	slag ash coal washery rejects, insulating	noise, vibration, night lighting, visual
Petro-chemicals and petroleum refining	volatile organics including odours. particulates, dust, sulphides and sulphur oxides chlorine and halogenated hydrocarbons	residual oils phenols, emulsions acids and alkalies, boiler blow downs, scrubber water, organic and inorganic salts, sludges, thermal	containers, sludges, spent catalysts, filter residues, heavy metals, tars and residues	as above
Pulp and paper manufacture	particulates, odours, sulphur dioxide, chlorine	suspended and dissolved solids, pigments, dyes, salt, acids and alkalies, mercury dioxin and furan type materials	timber wastes, waste paper and fibres, filter sludges	as above
Cement making	particulates, dust, sulphur dioxide	oils and fats, lost product, wash waters, surfactants, fillers and colourants, catalysts	spoil and waste rock, ash, dam tailings	as above
Mineral processing	particulates, metal dusts and vapours, sulphur oxides, fluorides	washery and concentrator waste-waters, scrubber water, heavy metals, acids, alkalies, dissolved inorganic salts, boiler blow downs	slags and refining wastes, red mud, low level radioactives, gangue	as above
Rural products processing	odours, dust, sulphur dioxide, smoke	fats and greases, proteinaceous material, suspended and dissolved solids, animal and vegetable table wastes	process wastes of animal or vegetable matter	as above

Source : Adapted from Ecologically Sustainable Development Working Groups, Final Report - Manufacturing, 1991, pp 24-26, Australian Government Publishing Service, 1991.

5.5 Components of current expenditures on environment protection

Table 5.6 shows components of current expenditure on environment protection for the same industries covered in Section 5.4. These represent 13 per cent of all manufacturing establishments with four or more employees and account for 63 per cent of all current pollution abatement expenditure.

The table provides current expenditure in three parts. The first three columns refer to expenditure incurred while operating or maintaining pollution abatement and control measures. The payments to government column includes government and council fees, charges, and taxes relating to pollution abatement and control. Also included in this category are penalties paid to government agencies resulting from excessive waste emissions.

The manufacturers reporting these dissections spent 48 per cent of their current expenditure on government or non-government fees and charges ($158.2 million).

Another significant element of current expenditure is the 'other' category which includes the cost of labour, materials, electricity and fuel required to operate and maintain pollution abatement and control plant and equipment. This category was the largest component of total current expenditure for these industries with a 36 per cent share ($117.9 million). This figure should be treated with caution because of the difficulty of separately identifying work on environmental protection.

Research and development (R&D) directly related to pollution abatement and control accounted for 12 per cent of current expenditure ($39.1 million). Of this amount, 84 per cent was research carried out within the establishments themselves while the remaining 16 per cent was carried out by another business for the manufacturer. These figures should also be treated with caution due to the inherent difficulty of separating research and development with a mainly environmental purpose from other R&D.

Expenditure on environmental impact assessment, environmental audits, and energy audits accounted for only 4 per cent of current pollution abatement expenditures. ($13.5 million). More was spent on environmental audits and energy audits ($9.1 million) which are for existing processes than on environmental impact assessments ($4.4 million) which are for proposed new production.

TABLE 5.6 CURRENT EXPENDITURE ELEMENTS BY SELECTED (a) MANUFACTURING ESTABLISHMENTS (b), AUSTRALIA, 1991-92

ASIC code	Description	Payments to government		Payments to non-government		Other costs (c)		Intramural R&D (d)		Extramural R&D (d)	
		No.	$m	No.	$m	No.	$m	No.	$m	No.	$m
2 631	Pulp, paper & paperboard	18	9.8	27	3.6	12	6.3	5	1.2	4	0.2
275	Basic chemicals	111	18.5	138	25.2	78	19.6	33	3.5	14	0.7
276	Other chemical products	211	5.2	341	10.4	180	4.0	84	15.0	37	0.9
277	Petroleum refining	18	3.3	21	7.6	15	9.6	6	0.6	8	0.4
278	Petroleum & coal products n.e.c.	5	..	14	0.4	7		5	..	—	—
285	Glass & glass products	22	0.6	41	0.8	10	0.8	3	0.1	—	—
286	Clay products & refractories	51	4.1	80	n.p.	37	n.p.	13	—	1	
287	Cement & concrete products	168	2.0	225	6.0	124	5.9	26	0.4	19	0.2
288	Leather & leather substitute goods	55	5.1	107	3.7	52	4.1	12	0.2	3	
294	Basic iron & steel	120	2.9	184	11.9	87	8.4	22	6.9	17	2.5
295	Basic non-ferrous metals	42	1.3	53	23.6	43	55.1	17	2.7	14	0.7
346	Rubber products	38	0.5	120	n.p.	25	n.p.	8	1.2	3	0.1
347	Plastic & related products	211	2.5	476	5.9	168	2.7	37	1.1	12	0.5
Total		**1 070**	**55.7**	**1 827**	**102.5**	**838**	**117.9**	**271**	**32.8**	**132**	**6.3**

ASIC code	Description	Environment Impact		Environmental Audits		Energy Audits		Total expenditure		Total establishments
		No.	$m	No.	$m	No.	$m	No.	$m	No.
2 631	Pulp, paper & paperboard	4	0.7	8	0.3	3	—	35	22.0	63
275	Basic chemicals	24	2.0	36	1.5	11	0.1	175	71.2	274
276	Other chemical products	33	0.4	65	1.1	30	0.2	404	37.2	617
277	Petroleum refining	5	0.2	9	0.5	—		22	22.2	22
278	Petroleum & coal products n.e.c.	..	.	3		1		15	0.5	24
285	Glass & glass products	1	—	3	.	1		51	2.3	113
286	Clay products & refractories	8	0.1	21	0.2	9	0.1	104	6.4	245
287	Cement & concrete products	17	0.2	38	0.5	12	0.1	325	15.2	618
288	Leather & leather substitute goods	3	—	13	0.4	3	—	139	13.6	253
294	Basic iron & steel	9	0.4	22	0.4	11	0.1	228	33.5	434
295	Basic non-ferrous metals	8	0.3	13	3.2	5	0.1	69	86.9	91
346	Rubber products	1	..	5	.	5	..	127	4.6	202
347	Plastic & related products	8		25	0.3	21	0.1	567	13.1	996
Total		**121**	**4.4**	**261**	**8.3**	**112**	**0.8**	**2 261**	**328.9**	**3 952**

(a) Industries considered most likely to undertake environment protection activities.
(b) The separate cells in this table are not mutually exclusive as an establishment may have, for example, R&D expenditure on an environmental audit only, an energy audit only or both an environmental audit and an energy audit.
(c) This category contains an estimate of labour, materials, electricity, and fuel costs which are attributable to operating and maintaining pollution abatement and control processes by the establishment.
(d) Intramural refers to R&D carried out by an establishment for itself while extramural refers to R&D carried out for an establishment by other establishments.

5.6 Comparison of 1990-91 and 1991-92 results

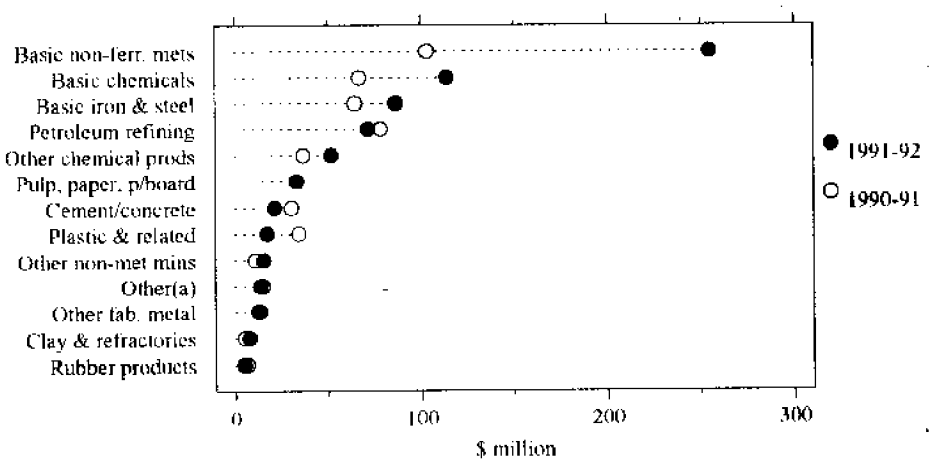
Table 5.7 provides a comparison between 1990-91 and 1991-92 for the group of industries selected for the 1990-91 survey. (The second collection was extended to cover all manufacturers with four or more employees). It is interesting to note that these industries, which cover only 9 per cent of all manufacturing establishments, account for 70 per cent of total pollution abatement and control spending.

For industries for which data were available for both 1990-91 and 1991-92, higher levels of expenditure were recorded overall in 1991-92 (Figure 5.4). Whilst the higher figure in 1991-92 partly reflects increased coverage and number of units reporting expenditures, it may also reflect an improved ability to report the data on this second survey. It will be necessary to further develop the time series before there can be meaningful interpretation of changes in reported levels of expenditure.

TABLE 5.7 POLLUTION ABATEMENT AND CONTROL EXPENDITURE: COMPARISON BETWEEN 1990-91 AND 1991-92, SELECTED INDUSTRIES
($ million)

ASIC		*1990-91 PAC expenditure*			*1991-92 PAC expenditure*		
code	*Description*	*Capital*	*Current*	*Total*	*Capital*	*Current*	*Total*
2 631	Pulp, paper & paperboard	14.2	19.0	33.3	11.3	22.0	33.3
275	Basic chemicals	36.2	30.7	66.9	42.7	71.3	114.0
276	Other chemical products	16.4	20.5	36.9	14.5	37.2	51.7
277	Petroleum refining	57.4	21.2	78.6	49.5	22.2	71.6
278	Petroleum & coal products n.e.c.	n.p.	n.p.	1.0	0.7	0.5	1.2
285	Glass & glass products	1.3	2.7	4.0	0.6	2.3	3.0
286	Clay products & refractories	3.2	2.3	5.5	1.6	6.4	8.0
287	Cement & concrete products	11.5	19.2	30.6	6.2	15.2	21.4
288	Other non-metallic mineral products	3.7	7.2	10.9	1.9	13.6	15.5
294	Basic iron & steel	35.3	29.4	64.7	52.9	33.5	86.5
295	Basic non-ferrous metals	47.2	56.3	103.4	168.3	86.9	255.1
3 141	Fabricated structural steel	0.8	2.1	3.0	0.7	3.0	3.7
3 142	Architectural aluminium products	0.4	1.9	2.3	0.3	1.4	1.7
3 151	Metal containers	1.6	2.9	4.5	1.8	2.1	3.9
316	Other fabricated metal products	4.4	8.9	13.3	2.9	9.7	12.6
3 452	Leather and leather substitute goods n.e.c.	n.p.	n.p.	0.2	0.1	—	0.1
346	Rubber products	3.2	3.6	6.8	0.5	4.6	5.0
347	Plastic & related products	19.4	15.1	34.4	4.1	13.1	17.2
Total		**256.7**	**243.5**	**500.2**	**360.5**	**345.2**	**705.7**

FIGURE 5.4 POLLUTION ABATEMENT AND CONTROL EXPENDITURES, AUSTRALIA, 1990-91 AND 1991-2, SELECTED INDUSTRIES



(a) Includes expenditure by Metal containers; Fabricated structural steel; Glass & glass products; Architectural aluminium products; Petroleum and coal products nec; and Leather and leather substitute goods nec industries.

5.7 Impact assessments, audits and recycling of packaging

Table 5.8 summarises responses to questions that were asked of all manufacturers regardless of the number of employees (41 480 establishments). The questions were as follows:

- During 1991-92, did this business conduct any environmental impact assessment (for proposed new production) or any environmental audits (on existing production processes)?
- Does this business permit and/or encourage the return of its own containers or packaging (eg returnable bottles, cardboard boxes, polystyrene, etc.)?

The overall proportion of establishments which conducted an environmental impact assessment or audit is 5 per cent. The industries showing the highest proportion of establishments undertaking these activities include the tobacco products (40%), petroleum refining (37%) and margarine, oils and fats (36%) industries. The largest proportion of establishments which specifically said that they did not undertake these activities occurred in the glass and glass products (93%) and rubber products (92%) industries.

Overall, 22 per cent of all manufacturing establishments permitted and/or encouraged the return of their own packaging. The greatest proportion of establishments which said they did encourage the returns occurred in the beverages and malt (44%) and basic chemicals (43%) industries. The highest proportion of establishments which answered 'no' to the question were in the tobacco products (80%) and the wood and wood products (69%) industries. The variations in responses to this question would reflect the levels of packaging in various industries, as much as any perceived 'willingness' to recycle.

TABLE 5.8 SPECIFIED ENVIRONMENTAL ACTIVITIES (a) BY MANUFACTURING ESTABLISHMENTS BY INDUSTRY GROUP, 1991-92

		Impact assessments and audits				*Encouraged the return of own packaging*			
		Yes		*No*		***Yes***		*No*	
ASIC code	*Description*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
211	Meat products	75	13	398	67	116	19	377	63
212	Milk products	57	27	116	54	72	34	109	51
213	Fruit & vegetable products	33	18	119	64	62	34	101	55
214	Margarine, oils & fats n.e.c.	12	36	21	64	13	39	19	58
215	Flour mill & cereal food products	20	14	103	71	48	33	80	55
216	Bread, cakes, & biscuits	51	3	786	41	309	16	592	31
217	Other food products	115	15	524	69	207	27	458	60
218	Beverages & malt	56	14	255	65	171	44	164	42
219	Tobacco products	2	40	2	40	1	20	4	80
21	**Total food, beverages & tobacco**	**421**	**10**	**2 324**	**54**	**999**	**23**	**1 904**	**45**
234	Textile fibres, yarns, & woven fabrics	50	17	188	64	99	34	162	55
235	Other textile products	29	4	485	73	142	21	400	60
23	**Total textiles**	**79**	**8**	**673**	**70**	**241**	**25**	**562**	**58**
244	Knitting mills	9	4	192	77	49	20	165	66
245	Clothing	33	2	1 665	76	404	18	1 405	64
246	Footwear	7	3	156	76	42	20	126	61
24	**Total clothing & footwear**	**49**	**2**	**2 013**	**76**	**495**	**19**	**1 696**	**64**
253	Wood & wood products	147	4	2 657	78	491	14	2 335	69
254	Furniture & mattresses	56	2	2 611	79	466	14	2 204	67
25	**Total wood, wood products & furniture**	**203**	**3**	**5 268**	**79**	**957**	**14**	**4 539**	**68**
263	Paper & paper products	42	13	232	73	125	39	140	44
264	Printing & allied industries	156	3	3 848	82	1 379	29	2 749	59
26	Motor vehicles & parts	**198**	**4**	**4 080**	**82**	**1 504**	**30**	**2 889**	**58**
275	Basic chemicals	56	16	287	80	155	43	153	43
276	Other chemical products	100	12	686	83	295	36	407	49
277	Petroleum refining	11	37	18	60	13	43	12	40
278	Petroleum & coal products	3	9	28	88	8	25	20	63
27	**Total chemical, petroleum & coal products**	**170**	**14**	**1 019**	**82**	**471**	**38**	**592**	**48**
285	Glass & glass products	5	2	199	93	63	29	123	57
286	Clay products & refractories	32	8	331	87	158	41	168	44
287	Cement & concrete products	51	6	724	88	172	21	450	55
288	Other non-metallic mineral products	17	5	333	91	96	26	208	57
28	**Total non-metallic mineral products**	**105**	**6**	**1 587**	**89**	**489**	**27**	**949**	**53**
294	Basic iron & steel	35	6	552	90	117	19	393	64
295	Basic non-ferrous metals	22	19	91	78	36	31	60	52
296	Non-ferrous metal basic products	22	13	114	65	52	30	96	55
29	**Total basic metal products**	**79**	**9**	**757**	**84**	**205**	**23**	**549**	**61**
314	Structural metal products	68	3	1 957	80	412	17	1 638	67
315	Sheet metal products	71	6	1 007	78	319	25	803	63
316	Other fabricated metal products	140	5	2 331	81	636	22	1 880	66
31	**Total fabricated metal products**	**279**	**4**	**5 295**	**80**	**1 367**	**21**	**4 321**	**65**

for footnotes, see end of table.

TABLE 5.8 SPECIFIED ENVIRONMENTAL ACTIVITIES (a) BY MANUFACTURING ESTABLISHMENTS BY INDUSTRY GROUP, 1991-92 *(continued)*

		Impact assessments and audits				*Encouraged the return of own packaging*			
ASIC		*Yes*		*No*		*Yes*		*No*	
code	*Description*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
323	Motor vehicles & parts	75	6	1 000	75	289	22	794	60
324	Other transport equipment	32	4	645	81	173	22	493	62
32	**Total transport equipment**	**107**	**5**	**1 645**	**77**	**462**	**22**	**1 287**	**61**
334	Photographic, professional & scientific	34	3	424	40	172	16	289	28
335	Appliances & electrical equipment	114	6	1 445	79	456	25	1 144	63
336	Industrial machinery & equipment	110	4	2 452	79	599	19	2 029	66
33	**Total other machinery & equipment**	**258**	**4**	**4 321**	**73**	**1 227**	**21**	**3 462**	**58**
345	Leather & leather products	17	7	181	77	36	15	145	61
346	Rubber products	6	2	235	92	70	27	132	52
347	Plastic & related products	52	4	1 257	91	470	34	679	49
348	Other manufacturing	50	2	1 670	83	396	20	1 337	67
34	**Total miscellaneous manufacturing**	**125**	**3**	**3 343**	**86**	**972**	**25**	**2 293**	**59**
21-34	**Total manufacturing**	**2 073**	**5**	**32 325**	**77**	**9 389**	**22**	**25 043**	**60**

(a) Establishments which did not respond to the environmental activities questions are treated as not engaging in the relevant activity.

Table 5.9 demonstrates that manufacturing establishments which encourage the return of their own packaging do so in fairly consistent proportions across all States and Territories. The division which responded affirmatively to this question in the greatest proportion and most consistently across all States and Territories was the chemical, petroleum & coal products industry.

TABLE 5.9 MANUFACTURING ESTABLISHMENTS (a) WHICH ENCOURAGED THE RETURN OF THEIR OWN PACKAGING BY INDUSTRY DIVISION AND STATE, 1991-92

Asic		*New South Wales*				*Victoria*				*Queensland*			
		Yes		*No*		*Yes*		*No*		*Yes*		*No*	
code	*Description*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
21	Food, beverages & tobacco	257	22	537	45	250	21	541	45	183	22	346	42
23	Textiles	71	25	169	59	111	29	213	55	17	15	74	63
24	Clothing & footwear	155	17	580	63	228	18	788	64	64	23	176	63
25	Wood, wood products & furniture	310	15	1 356	67	283	15	1 269	67	162	12	904	69
26	Paper, paper products, printing & publishing	574	29	1 161	58	461	31	863	58	195	30	384	58
27	Chemical, petroleum, & coal products	163	35	237	51	163	40	199	49	65	39	71	43
28	Non-metallic mineral products	159	28	296	52	128	27	268	57	95	30	146	46
29	Basic metal products	70	22	195	61	74	25	174	59	35	27	77	59
31	Fabricated metal products	498	20	1 629	66	405	23	1 108	63	207	20	711	67
32	Transport equipment	132	22	364	60	146	24	356	59	76	18	271	63
33	Other machinery & equipment	446	21	1 271	59	403	22	1 111	59	141	19	405	55
34	Miscellaneous manufacturing	317	24	798	60	355	29	691	57	136	22	384	61
Total		**3 152**	**22**	**8 593**	**60**	**3 007**	**23**	**7 581**	**59**	**1 376**	**21**	**3 949**	**59**

Asic		*South Australia*				*Western Australia*				*Tasmania*			
		Yes		*No*		*Yes*		*No*		*Yes*		*No*	
code	*Description*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
21	Food, beverages & tobacco	145	33	198	45	107	26	186	45	44	30	75	52
23	Textiles	15	22	42	62	25	33	44	59	2	10	16	76
24	Clothing & footwear	25	20	81	66	20	22	59	66	2	20	7	70
25	Wood, wood products & furniture	75	15	345	69	82	12	460	69	30	14	153	71
26	Paper, paper products, printing & publishing	108	34	174	55	111	30	211	57	22	27	48	59
27	Chemical, petroleum, & coal products	39	48	26	32	34	33	50	48	6	33	6	33
28	Non-metallic mineral products	40	29	77	55	48	24	119	60	11	22	26	51
29	Basic metal products	13	21	38	62	11	14	51	67	2	13	10	63
31	Fabricated metal products	132	26	294	58	100	16	432	71	14	11	95	76
32	Transport equipment	50	28	99	56	49	20	162	65	6	16	21	57
33	Other machinery & equipment	111	23	276	58	104	19	327	59	13	14	53	58
34	Miscellaneous manufacturing	73	24	189	61	67	24	171	60	16	25	39	60
Total		**826**	**26**	**1 839**	**58**	**758**	**21**	**2 272**	**62**	**168**	**19**	**549**	**63**

Asic		*Northern Territory*				*Australian Capital Territory*			
		Yes		*No*		*Yes*		*No*	
code	*Description*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
21	Food, beverages & tobacco	7	27	14	54	6	22	7	26
23	Textiles	–	..	3	60	—	—	1	100
24	Clothing & footwear	—	.	1	100	1	20	4	80
25	Wood, wood products & furniture	4	13	21	70	11	22	31	62
26	Paper, paper products, printing & publishing	2	10	18	90	31	44	30	43
27	Chemical, petroleum, & coal products	1	33	2	67	—		1	100
28	Non-metallic mineral products	2	12	8	47	6	30	9	45
29	Basic metal products		—	2	50	—	..	2	100
31	Fabricated metal products	3	7	33	77	8	27	19	63
32	Transport equipment	2	13	10	67	1	11	4	44
33	Other machinery & equipment	3	15	10	50	6	17	9	26
34	Miscellaneous manufacturing	4	22	11	61	4	21	10	53
Total		**28**	**14**	**133**	**66**	**74**	**28**	**127**	**47**

(a) Establishments which did not respond to the environmental activities questions were treated as not participating in the relevant activity.

5.8 Environmental grants and subsidies

The following table shows government funding to manufacturing enterprises considered likely to be carrying out research and development for environmental protection.

TABLE 5.10 - GOVERNMENT SUBSIDIES FOR ENVIRONMENTAL PURPOSES TO MANUFACTURING BUSINESS ENTERPRISES (a), 1991-92

Source of funding	*Subsidy $ 000*
GIRD scheme (b)	476.0
Other Commonwealth Government	572.0
State and local government	193.0
Total	**1 241.0**

(a) Excludes enterprises in ASIC Division 'A', which covers, agriculture, forestry and fishing
(b) Grants to Industry Research and Development Scheme

GIRD is the source of 38 per cent of government subsidies. This scheme was administered by the Department of Industry, Technology and Commerce (DITAC), now the Department of Industry, Science and Technology. It provided discretionary funds of up to 50 per cent of the cost of research and development projects. Other Commonwealth Government grants account for a further 46 per cent of subsidies and State and local government provided the remaining 16 per cent of funding.

In addition to these grants are those provided by the Energy Research and Development Corporation (ERDC). The objectives of their programme are inter-related and those which address the following criteria are given the highest priority: increase efficiency of energy use; increase Australian industry's competitiveness; increase the diversity of energy supply, reduce environmental impacts, reduce energy requirements, and reduce energy costs. Since Australia generates 80 per cent of electricity from coal (Bush et al, 1993), an increase in the energy efficiency of the manufacturing sector will provide considerable environmental gains by reducing the amount of greenhouse gases to the atmosphere. The ERDC annual report for 1991-92 indicated $6.2 million total expenditure for ongoing projects which were given to industry for energy related research and development projects.

CHAPTER 6 RETAIL AND WHOLESALE INDUSTRIES ENVIRONMENT PROTECTION EXPENDITURE

6.1 Introduction

Major pollution abatement and control expenditures in the wholesale and retail industries were identified as payments to government contractors and private contractors for waste removal. Pollution abatement capital expenditure was considered negligible and not collected, as the increased respondent load of collecting the data from these industries was not justified. Only current expenditure data was therefore collected. Business units in the wholesale industry were also asked to indicate whether they re-used or recycled packaging they received with their goods, and whether they encouraged the return of their own packaging despatched with goods.

The data were collected from the periodic surveys of both these industries undertaken by the ABS. The data were collected from the management unit (i.e. broadly relatable to the legal entity level) rather than establishments (broadly relatable to physical locations).

In accordance with ANZSIC, the standard industry classification used by the ABS, the retail industry encompasses businesses involved in the resale of new or used goods for personal or household consumption, and some repair activities such as repair of household equipment and motor vehicles. It consists of a range of businesses such as department stores and other shops, motor vehicle retailers and a range of other operators involved in retail activities as defined. It excludes cafes, restaurants and motels.

The wholesale industry includes businesses engaged in the resale of new or used goods to businesses or institutional clients, and includes government, separate sales branches operated by manufacturing businesses (other than retail stores), commission agents, import and export agents and purchasing agents, petroleum products distributors, and co-operatives and marketing boards engaged in marketing farm products.

6.2 Overview of results

Total expenditure in these two industries on waste removal expenses was $27.2 million in 1991-92. Seventy-nine per cent of waste removal expenses ($21.4 million) were paid to private contractors. This ratio was similar for both the retail and the wholesale sector. The exception was in the farm produce wholesaling group, where waste removal expenses where split fairly evenly between private and government contractors. This group includes wool wholesaling, cereal grain wholesaling and farm produce and supplies wholesaling.

Within the wholesale industry, the highest level of expenditure on waste removal expenses occurred in machinery and equipment wholesalers, ($5.7 million), food, drink and tobacco wholesalers ($5.3 million) and the minerals, metals and chemicals wholesalers ($4.0 million).

In the retail sector, much lower levels of expenditure on waste removal were recorded. Highest levels occurred in the specialised food retailing, and the clothing and soft good retailing groups.

TABLE 6.1 WHOLESALE AND RETAIL INDUSTRIES WASTE REMOVAL EXPENSES, AUSTRALIA, 1991-92

		Waste levies paid to government		*Waste levies paid to private contractors*		*Total waste levies paid*	
ANZSIC code	*Description*	*$m*	*SE %*	*$m*	*SE %*	*$m*	*SE %*
	Wholesale Industries						
451	Farm produce	0.7	(19.0)	0.8	(5.0)	1.5	(9.4)
452	Minerals, metals & chemicals	0.5	(9.0)	3.5	(3.0)	4.0	(2.9)
453	Builders supplies	0.4	(26.0)	2.9	(29.0)	3.3	(25.4)
461	Machinery & equipment	1.0	(14.0)	4.6	(5.0)	5.7	(4.8)
462	Motor vehicles	0.1	(54.0)	0.7	(12.0)	0.8	(13.0)
471	Food drink & tobacco	1.9	(25.0)	3.4	(8.0)	5.3	(10.5)
472	Textiles, clothing & footwear	0.1	(18.0)	0.5	(10.0)	0.6	(9.2)
473	Household goods	0.2	(17.0)	0.5	(7.0)	0.7	(6.9)
479	Other wholesaling	0.3	(17.0)	2.2	(5.0)	2.5	(4.8)
	Total wholesale	**5.3**	(10.0)	**19.2**	(5.0)	**24.8**	(4.5)
	Retail Industries						
511	Supermarket & grocery stores	-	n.a.	0.2	n.a.	0.2	n.a.
512	Specialised food retailing	-	n.a.	0.2	n.a.	0.2	n.a.
521	Department stores	0.3	n.a.	0.2	n.a.	0.5	n.a.
522	Clothing & soft good retailing	-	n.a.	0.1	n.a.	0.1	n.a.
523	Furniture houseware & appliance retailing	0.1	n.a.	0.4	n.a.	0.5	n.a.
524	Recreational good retailing	-	n.a.	-	n.a.	-	n.a.
525	Other personal and household good retailing	-	n.a.	-	n.a.	-	n.a.
526	Household equipment repair services	-	n.a.	-	n.a.	-	n.a.
531	Motor vehicle retailing	-	n.a.	0.1	n.a.	0.1	n.a.
532	Motor vehicle services	-	n.a.	0.6	n.a.	0.6	n.a.
	Total Retail	**0.5**	(17.0)	**2.2**	(7.0)	**2.7**	n.a.
	Total Retail and Wholesale	**5.8**	n.a.	**21.4**	n.a.	**27.2**	n.a.

Note: where figures have been rounded, discrepancies occur between totals and the sums of the component items.

n.a - not available

The standard error indicates the extent to which an estimate might have varied by chance because only a sample of units was included. There are about two chances in three that a sample estimate will differ by less than one standard error from the number that would have been obtained if all units had been included and about nineteen chances in twenty that the difference will be less than two standard errors. The relative standard error is obtained by expressing the standard error as a percentage of the estimate.

6.3 Wholesale industries and return and re-use of packaging

Management units in the wholesale industry were asked two additional questions: whether the company re-used or re-cycled the containers and packaging material received with incoming goods (such as cardboard boxes, polystyrene etc) and whether the company permitted or encouraged the return of containers or packaging it supplied (such as returnable bottles, cardboard boxes, etc).

A higher proportion of units reported recycling packaging they received with incoming goods than reported accepting return of their own packaging. Companies in the machinery and equipment wholesaling group, the other wholesaling group, textile clothing and footwear wholesalers and household goods wholesalers were most likely to re-use packaging which was received with the supply of their goods. The lowest levels of packaging re-use was in the motor vehicle wholesaling group, where there is minimal packaging of the final product. Those units in this group involved in re-use of packaging were in the 'new parts' sector of the motor vehicle wholesaling group, where higher levels of packaging occur.

A different profile emerged for the groups more likely to be encouraging the return of their own packaging. Mineral, metal and chemical wholesalers were more likely to encourage the return of their containers than other wholesalers (39%). At the other end, 4 per cent of businesses in the motor vehicle wholesaling group encouraged the return of packaging, reflecting the minimal level of packaging return for this sector. The demand was generated by the new parts section of the group.

TABLE 6.2 - WHOLESALE INDUSTRIES AND RETURN AND RE-USE OF PACKAGING, AUSTRALIA, 1991-92

ANZSIC code	Description	*Re-use packaging received* No.	%	*Permit return of packaging* No.	%
4 511	Wool	93	34.4	66	24.4
4 512	Cereal grains	33	34.7	20	21.1
4 519	Farm produce and supplies	594	40.8	518	35.6
451	Farm produce	720	39.6	604	33.2
4 521	Petroleum products	156	26.2	191	32.1
4 522	Metals and minerals	151	34.6	119	27.3
4 523	Chemicals	290	59.1	283	57.6
452	Minerals, metals & chemicals	597	39.2	594	39.0
4 531	Timber	156	34.2	69	15.1
4 539	Building supplies	1 223	35.3	751	21.7
453	Builders supplies	1 379	35.2	820	20.9
4 611	Farm & construction machinery	518	38.1	286	21.1
4 612	Professional equipment	570	71.1	232	28.9
4 613	Computers	798	63.5	432	34.4
4 614	Business machines nec	344	60.8	146	25.8
4 615	Elec & electronic equipment	1 188	65.3	487	26.8
4 619	Machinery & equipment nec	1 736	72.7	712	29.8
461	Machinery & equipment	5 154	62.9	2 295	28.0
4 621	Cars	-	-	-	-
4 622	Commercial vehicles	-	-	-	-
4 623	Motor vehicle new parts	497	20.0	161	6.5
4 624	Motor vehicle dismantling / used parts	-	-	-	-
462	Motor vehicles	497	12.2	161	3.9
4 711	Meat	98	26.8	49	13.4
4 712	Poultry & small goods	98	43.8	49	30.6
4 713	Dairy produce	127	41.6	139	45.6
4 714	Fish	135	39.4	128	37.3
4 715	Fruit & vegetables	238	37.7	233	36.9
4 716	Confectionary and soft drinks	172	55.3	119	38.3
4 717	Liquor	83	51.9	51	31.9
4 718	Tobacco products	10	100.0	5	50.0
4 719	Groceries nec	558	50.7	369	33.6
4 721	Textile products	449	58.8	177	23.2
4 722	Clothing	567	57.2	204	20.6
4 723	Footwear	55	40.1	47	34.3
472	Textiles, clothing & footwear	1 072	56.7	428	22.6
4 731	Household appliances	158	62.9	72	28.7
4 732	Furniture	178	40.9	96	22.1
4 733	Floor coverings	65	47.8	22	16.2
4 739	Household goods nec	274	63.7	129	30.0
473	Household goods	675	53.9	320	25.6
4 791	Photographic equipment	49	45.4	17	15.7
4 792	Jewellery & watches	222	48.1	116	25.1
4 793	Toys & sporting goods	431	73.5	157	26.8
4 794	Books & magazines	243	61.8	52	13.2
4 795	Paper products	356	61.3	143	24.6
4 796	Pharmaceuticals & toiletries	230	60.2	113	29.6
4 799	Wholesalers nec	816	63.3	402	31.2
479	Other wholesaling	2 347	61.8	1 001	26.3
Wholesale trade total		**13 977**	**46.6**	**7 393**	**24.7**

CHAPTER 7 HOUSEHOLD SECTOR ENVIRONMENT PROTECTION EXPENDITURE

7.1 Introduction

This chapter considers how expenditures in the household sector can contribute to pollution abatement and control and other environmental expenditure estimates. In terms of the OECD model, the household sector can undertake activities aimed at the prevention, reduction and elimination of pollution and nuisances. The sector may also contribute to pollution abatement activities undertaken by the public sector, through payments of charges for activities such as sewerage and garbage disposal services.

7.2 Methodology

The OECD has recommended that, based on the experience of member countries, household pollution abatement expenditure should include:

- purchase, operation and maintenance of air pollution control devices for motor vehicles and
- sewerage treatment costs of private households.

Purchase, operation and maintenance expenditure for vehicles would include such items as price differentials for unleaded petrol or service costs for proper adjustment of engines.

The OECD indicates that other environmental costs may also be included. These costs could include items such as fees paid by households to governments for waste collection and other environmental services, as well as environmental fees and levies paid to governments. In practice, the availability of such data and the number of countries collecting it is limited. Table 7.1 indicates the scope of items collected by countries, published by the OECD in 1993 as household environment protection expenditure.

TABLE 7.1 HOUSEHOLD EXPENDITURES IDENTIFIED BY OECD MEMBER COUNTRIES, 1985-1990 (VARIOUS YEARS)

USA	restricted to purchase and operation of motor vehicle emission control devices.
Austria	the difference between a motor vehicle fitted with an emission control device and one without.
France	emission control devices for motor vehicles, private sewerage treatment, noise protection, waste bags.
Netherlands	phosphate free washing powders and low sulphur fuel.
Portugal	air pollution equipment and fees paid for wastewater treatment and solid waste disposal.

Source: OECD, 1993

This chapter explores, and where possible, develops experimental estimates for both pollution abatement and other environmental expenditures undertaken by households under the categories of transport, dwellings, fees and charges, energy reduction and economising in use of water.

As discussed above, the OECD recommends that the price differential between leaded and unleaded petrol be included in household expenditure estimates. However, in Australia in 1991-92, these fuels were similarly priced in the market. In 1993 fiscal measures by the Commonwealth Government resulted in unleaded petrol being sold more cheaply than leaded fuel as a result of differences in the excise tax applied. A similar difficulty exists in relation to dual flush toilets, which are now competitive in price with ordinary systems. It appears that adopting the cost differential approach between an environmental expenditure and an alternative product is becoming problematic as the market competitiveness of environmental goods has increased, and as governments increasingly intervene in the market to stimulate increased purchase of environmentally preferred alternatives.

7.3 Overview of results

Table 7.2 provides a brief overview of the environmental expenditures of the household sector on environmental protection. The partial estimate on this first occasion indicates this sector financed environmental protection activities to the value of $828.5 million.

TABLE 7.2. HOUSEHOLD ENVIRONMENTAL EXPENDITURES (a), AUSTRALIA, 1991-92

Expenditure	*$m*
Catalytic converters for vehicles	65.5
Charcoal filters for vehicles	8.7
Septic systems (a)	44.5
Pollution abatement and control expenditures by the household sector	118.7
Environmental component of local government rates	495.0
Special environment levies (b)	92.8
Insulation (c)	122.0
Environmental expenditures by the household sector	828.5

(a) Partial estimate only. See section 7.2
(b) Not complete estimate. See section 7.3.3.
(c) Derived from 1988-89 HES data, CPI adjusted and adjusted for number of households in 1991-92.

7.3.1. Transport

Motor vehicles are a major source of atmospheric pollutants, contributing nearly one half of human-caused NO_x, two-thirds of the carbon monoxide, and approximately one-half of the hydrocarbons in industrialised countries (World Resources Institute, 1993).

A catalytic converter can reduce emissions of carbon monoxide by approximately 85 per cent and NO_x by about 60 per cent (World Resources Institute, 1993). Catalytic converters vary considerably in price due to the precious metals used as a coating. After consultations with manufacturers of converters and motor vehicles, a figure of $150 was selected as an average price for these items. Multiplying this figure by the number of new passenger vehicles registered during 1991-92 (437 075) an amount totalling $65.5 million was determined.

Another mandatory pollution abatement device is a charcoal filter which is designed to reduce emissions of fuel vapours. Industry investigations with producers and car retailers indicated an average cost of $20, representing a total expenditure by households of $8.7 million in 1991-92. This figure is actually likely to be an overestimate of the costs to households as a proportion of passenger vehicles will be fleet purchases by industry and government sectors, however it has not been possible to split out the household sector of this estimate on this occasion.

There is also a legal requirement in some States that limits exhaust emissions from motor vehicles. Those cars which are not fitted with a catalytic converter must be well maintained in order to comply with this legislation. There are, however, no figures available for 'tune-ups' for this purpose. The ABS Household Expenditure Survey has an item for 'vehicle servicing' which does not distinguish between types of services and is therefore an overestimation of services conducted to comply with exhaust gas limits for environmental purposes. Consequently, there are no estimates for this item from that survey.

7.3.2 Dwellings

The cost of private sewerage treatment systems is one which is specifically identified by the OECD as a pollution abatement expenditure. Industry investigations determined an approximate cost for such systems at $3 500. Aerobic systems are more expensive and, although becoming increasingly popular, account for only 10 per cent of the market. An estimate for the number of systems approved by the relevant authorities across Australia is difficult to obtain because the jurisdiction lies, in most States, with individual councils. The environmental health departments in most States, however, have provided estimates. The figures for the 1991-92 financial year were obtained where available, with a calendar year estimate being used when this was not possible.

TABLE 7.3 HOUSEHOLD EXPENDITURE ON PRIVATE SEWERAGE TREATMENT FACILITIES, AUSTRALIA, 1991-92

State/Territory	*No. of approvals*	*$ million*
NSW	3 000	10.5
Vic.	4 000	14.0
Qld.	n.a	n.a
SA	2 700	9.4
Tas.	2 000	7.0
NT	1 000	3.5
WA	n.a	n.a.
Total	(a) 12 700	**44.5**

(a) Excludes WA and Qld for which estimates were not available.

Source: Various State health departments, environmental health departments, building departments / branches, plumbing inspectors.

Insulation is required in all new dwellings in a number of States under the Building Code of Australia Part F6. The ABS Household Expenditure Survey (1988-89) reports that households spent an average of 37 cents per week on insulation. This equates to $104.3 million in 1988-89. Adjusted for CPI increases and the number of households in 1991-92, this represents $122 million for the reference period of this publication.

Another method of arriving at this figure might be to use housing construction statistics and multiply by an average insulation cost based on size of dwelling unit. The difficulty with applying this method is that the regulation only specifies a certain R-value. It does not specify how to conform to it. It can be achieved by either a high ceiling application or a moderate level in the ceiling and additional insulation in the walls and/or floor. Various combinations have different costs. It was therefore decided to adopt the estimate of $122 million derived from the ABS Household Expenditure Survey.

7.3.3 Fees and charges

Table 7.4 indicates government fees and charges received from households for provision of environment-related services (as defined in Chapter 2), obtained through ABS Public Finance data. It represents those expenditures incurred by households for the provision of services provided by local government. The Government Purpose Classification (GPC) code listed in the table reflects the same set of codes as used in Chapter 2, which analyses government expenditure on these items.

TABLE 7.4 GOVERNMENT FEES AND CHARGES FROM HOUSEHOLDS FOR ENVIRONMENT PROTECTION ACTIVITIES, AUSTRALIA, 1991-92

GPC' code	*$ million*
0731 Household garbage	443
0733 Sewerage	40
0734 Urban stormwater drainage	12
Total	**495**

Source: ABS Public Finance Statistics, unpublished data.

In addition to the fees and charges recorded in Table 7.4 a number of local governments use 'precept rating' powers to raise funds for special purposes. One example of this is a levy imposed by the Brisbane City Council. All ratepayers were levied $20 to raise funds for the purchase of environmentally sensitive land for permanent preservation. The total amount raised in the financial year 1991-92 was $4.5 million of which 91 per cent ($4.1 million) was from the residential sector.

In the near future, the Brisbane City Council will rebate a $20 levy to residents who agree to make their property a conservation zone and a discount of up to 50 per cent on one's rate notice will be available to residents who enter into a binding conservation agreement. The conditions of this agreement will vary depending on the location of the property. Households in a koala habitat reserve area, for instance, may be eligible for the discount if they fence their property to control their domestic pets.

A number of Public Trading Enterprises (PTEs) are also putting 'special environment levies' on their rate notices. The Sydney Water Board, for example, collected $80 from each of their customers for a 'clean waterways program' which amounted to $94 million in the financial year 1991-92. Of this amount, 87 per cent ($81.8 million) is attributable to the residential sector.

Since July 1991, the water board in Geelong, Victoria, has also collected a special environment levy. They have charged their customers up to $120 per year to raise money to meet Victorian EPA guidelines. In the financial year 1991-92 they raised a total of $7.7 million. They have yet to determine how much of this is attributable to the household sector but using the above two examples as an indication, it is likely to be in the vicinity of 90 per cent. This would total $6.9 million. This range of different levies amount to $92.8 million, however it should be noted that this is only an experimental estimate, and will fall far short of the total expenditures Australia-wide.

7.3.4 Energy reduction

The Department of Primary Industry (1990) has determined that nearly one third (31%) of household energy consumption is spent on heating the home. An example of an environmentally positive household purchase would be programmable thermostats, because they contribute to more efficient use (and therefore conservation of resources) of home heating systems. No figures are available for household expenditure on this item.

Solar hot water heaters are another way a household can reduce energy consumption. Leichardt City Council in Sydney has made them mandatory for any new home or sizeable extension. The ABS does not have production or trade figures for solar hot water heaters. This is an example of the need to modify existing commodity and other classifications in order to provide environmentally relevant data.

7.3.5 Water use reduction

Items that could be collected under this heading include low flow shower heads, dual flush toilets, and programmable watering systems, as all contain a component of resource conservation in their design. Expenditure on such items would be subject to the price differential approach as they represent alternatives to items already on the market, assuming a higher cost is attached to the water conserving item. Research by Melbourne Water (Melbourne Water, 1992, p 49) indicates that water efficient shower heads were at that stage penetrating the market at a rate of 3 per cent per year. However, no reliable figures were available which established expenditure by the household market on these items. In the case of dual flush toilets, which are mandatory for new installations in Brisbane, Adelaide, Perth, and Melbourne, they are generally less expensive than conventional systems. Programmable watering and micro jet spray sales figures for the household sector were similarly unavailable. Given the difficulty in determining the levels of household expenditure on these water conserving items, Table 7.2 contains no estimates for expenditure on water use reduction.

Technical Appendix - The OECD Pollution Abatement and Control Framework and its Application

1. Overview of the OECD pollution abatement and control framework

The pollution abatement and control framework developed by the OECD was used as a basis for data collection from industry and the public sector in relation to pollution abatement costs for this publication. The OECD's definition of pollution abatement and control is *'... purposeful activities aimed at the prevention, reduction and elimination of pollution or nuisances that could have a harmful effect on the environment'* (OECD, 1993). The OECD PAC questionnaire of January 1994 includes a slight clarification and extension of this original definition, as follows: *'... pollution control and abatement are all purposeful activities directly aimed at the prevention, reduction and elimination of pollution or nuisances arising as a residual from production processes or from the consumption of goods and services.'* (OECD, 1994, p 2).

Table 1 (page 73) presents the Pollution Abatement and Control framework, as presented in the OECD literature. In this framework, total pollution abatement and control costs comprise capital and current expenditures incurred by the public and private sectors. The 1994 OECD PAC questionnaire states that current expenditure is to include:

- provision of environmental services for own use (including costs of wages, salaries, rents, energy, maintenance expenditure and intermediate inputs), and
- environmental services and specific goods bought in from the market.

Public sector current expenditure is also to include administrative, monitoring and enforcement costs.

Capital (or investment) expenditures are to include purchases and own-account production, and additions of new durable goods to the stock of fixed assets for pollution abatement and control purposes. In line with National Accounting standards, household expenditure on durable goods is not considered an investment expenditure but is counted as a current expenditure.

The OECD notes that data on capital expenditure for pollution abatement and control can be divided into two components: expenditures for end-of-line techniques and expenditures for change-in-production (or integrated) techniques.

End-of-line techniques treat pollutants after generation in production processes, by the use of separately identifiable abatement facilities. These are installed for the purpose of abating pollutant streams, and do not affect the production process itself. Change-in-production processes reduce or

eliminate the generation of pollutants by employing material substitution, improved catalysts, re-use of water or equipment alteration. These changes may involve converting equipment to handle the use of substitute fuels that generate less pollutants. Typically, industry undertakes end-of-line expenditures in the initial stages of expenditure on pollution abatement facilities, and moves to change-in-production processes as the industry's pollution abatement activity progresses, and particularly as re-equipment becomes due for other reasons.

Income generated directly as receipts from by-products of pollution abatement and control expenditure is also required by the model to be off-set against the expenditures incurred. An example would be where a business invests in capital equipment which enables it to avoid releasing industrial wastes into waterways, with the waste being sold to chemical companies for re-processing. The resulting income should offset the costs of the pollution abatement activity. However, this component is expected to be small in most cases, while significantly increasing the burden on respondents providing the data. Hence most countries, including Australia, do not collect this figure.

The framework also explicitly requires that capital and current expenditures be added together to determine a single dollar value in a particular period. Although this is not standard 'accrual' accounting practice (in which capital expenditures would normally be amortised across time), it is consistent with National Accounting conventions for the derivation of GDP estimates.

The framework also identifies monetary flows between the private and public sectors. These inter-sectoral flows occur in the form of government subsidies to the private sector for undertaking pollution abatement and control activities, and fees and charges in the form of purely financial transfers (such as rates, environmental licence fees and fines) from the private to the public sector.

According to the OECD, the identification of these intersectoral flows assists in identifying two bases of compilation: the level of 'abatement activity' executed by each sector (the abater principle) and the 'financial burden' or costs borne *by* each sector (regardless of which sector the actual pollution abatement occurs in), the financer principle (OECD, 1993). The framework for these two bases of compilation is set out in Table 1.

The OECD notes that data availability can make calculations in accordance with the financer principle difficult, although the ABS experience is that, in the Australian context, the financer basis is the easier to derive and explain. Where this work has occurred, in the Netherlands for example, it has emerged that the differences between the value of the two estimates can be substantial, indicating significant levels of transfer payments and subsidisation.

TABLE 1. THE OECD POLLUTION ABATEMENT AND CONTROL FRAMEWORK

Public Sector	Private Sector
investment expenditure	investment expenditure
+	+
current expenditure	current expenditure
-	-
PAC by-products	PAC by-products
=	=
PAC, Abater Principle	**PAC, Abater Principle**
+	-
subsidies to the private sector	subsidies from the public sector
-	+
fees / charges from the private sector	fees / charges to the public sector
=	=
PAC, Financer Principle	**PAC, Financer Principle**

2. Estimating pollution abatement and control costs in Australia - some problems and adjustments

A combination of problems make it very difficult to estimate on either the 'abater' or 'financer' basis. The difficulties associated with the implementation of the OECD framework can be summarised under two headings:

- lack of clarity in the PAC framework in relation to 'abater' estimates;
- subsequent confusion and data constraints in separately identifying the flows which account for the transition from 'abater' to 'financer' estimates.

Although these are related problems, there are a number of specific issues which are discussed in more detail below.

2.1 What does the PAC framework mean in relation to abater estimates?

The OECD has described the abater principle in two ways. Originally, in 1993, it was described as representing the sector 'executing' the PAC activity. The ABS interpreted this to mean that abater estimates reflect the level of PAC activity undertaken *in* each sector. Discussions with the Netherlands Statistical Office (January 1995) confirmed this was also their understanding of the OECD framework.

In 1994, the OECD described the abater estimate as representing the sector 'demanding' the PAC services, i.e. the level of PAC activity which is generated by the sector.

There appear to be three possible data presentations based on the Pollution Abatement and Control framework, as follows:

- a 'financer' estimate, which indicates the financial burden borne by each sector;
- an 'abater' estimate which indicates the level of PAC activity undertaken *in* each sector. This estimate indicates the level of PAC goods and services being consumed in the public and private sectors.
- an 'abater' estimate which indicates gross expenditures, including expenditure of grants and subsidies, on PAC goods and services *by* each sector.

In comparison, the framework proposed for use by the European Community, namely, the Collection of Economic Information on the Environment (SERIEE) generates three somewhat more clearly defined tabulations of environmental expenditures:

- Table A of SERIEE details the national expenditure for environmental protection by type of expenditure and users / beneficiaries of that expenditure.
- Table B of SERIEE describes the output of environmental services. This table enables analysis of which economic activities are induced by environmental protection.
- Table C describes the way in which national expenditure on environmental services is financed. It is supplemented by a table which presents the components of environment related burden for the different sectors of the economy.

The estimates for the cost of environmental protection in Australia presented in Chapter 1 most closely align with the 'financer' concept of the PAC model (and therefore Table C of SERIEE). However, it must be stressed that these data have been compiled purely on the basis of removing double counting as reflected in the form of grants and subsidies and fees and charges paid and received, not with the objective of implementing the SERIEE accounts outlined above.

2.2 Data constraints in accurately and separately identifying the flow of funds between and within sectors.

The difference between 'gross expenditures' and 'outlays' as defined in government finance statistics is illustrated in Figure 1. Outlays indicate the final costs borne by the public sector in terms of the extent of subsidisation of a range of services provided by the public sector.

FIGURE 1 - RELATIONSHIP BETWEEN EXPENDITURES AND OUTLAYS

Current	
	Gross Current Expenditure
	less sales of goods and services (a)
	equals Final Consumption Expenditure
	plus interest payments (b)
	plus subsidies paid to Public Trading Enterprises (b)
	plus other transfer payments (b)
	equals Total Current Outlays
Capital	
	Expenditure on new fixed assets
	plus expenditure on second-hand assets
	equals Gross Fixed Capital Expenditure
	plus capital grants to Public Trading Enterprises (c)
	plus advances paid to Public Trading Enterprises (net)
	plus other capital outlays
	equals Total Capital Outlays

(a) This item provides an indication of the extent of government charges levied. The charges are off-set against gross expenditure in calculating final consumption expenditure and comprise mainly sales to the private sector.
(b) Current transfer payments include payment for property rights (e.g. interest payments) and unrequited transfers for which there is no return for payment, such as subsides, personal benefit payments and current grants.
(c) Unrequited payments intended to contribute towards the cost of capital expenditure of the recipients.

However, the process is complicated by the fact that not all of the difference between the gross and net expenditures of government in relation to pollution abatement are funded by the private sector. Some of the difference is funded by the public sector itself, be it the general government sector or the Public Trading Enterprises sector. Further work would have to be undertaken to separately identify the flows within the public sector. This would also enable a more accurate estimate of flows between the private and public sectors, from the public sector side of the account.

The estimates of inter-sectoral flows have also been complicated by difficulties in collecting reliable estimates from industry for grants and subsidies received from government for pollution abatement and control. Estimating the value of environmental grants is part of the larger problem the ABS has been addressing of obtaining accurate estimates of the total

value of all grants and subsidies received from government. In part, the problem appears to be definitional, in that what government may classify as a 'grant' may be considered a 'tax concession' or on-going income which industry does not consider as a grant or subsidy (such as the diesel fuel rebate scheme). Work is continuing on this problem in the ABS, and it is hoped to translate some of the outcomes to improving industry estimates of the value of environmental grants and subsidies received from government. In the interim, however, the use of industry estimates for grants and subsidies is likely to result in an under-estimate of the true value of the grants, with the consequence of some double counting of these expenditures by both public and private sectors.

3. Summary - the ABS approach to estimating environmental expenditures in this publication

In compiling the data presented in Chapter 1 of this publication, and dealing with the issues outlined in the previous sections, the ABS has taken the approach of ensuring the 'bottom line' is correct, i.e. obtaining an unduplicated estimate for total environmental expenditures in Australia, using whatever approach to the sector estimates would best prevent double counting or omission. As a result the estimate produced by the ABS is in accord with the 'financer' principle outlined in the PAC framework, and the intermediate estimates at the abater level are not attempted for reasons outlined previously.

Pollution abatement and control estimates in Chapter 1 have also been supplemented with estimates of 'other environmental expenditures' which are not pollution related. On this occasion, these 'other environmental expenditures' primarily represent the public sector expenditures in this area. Section 4 below discusses the SERIEE approach, which integrates pollution abatement costs with other environmental expenditures within a single framework.

4. International work in environment protection expenditures

In 1994, Eurostat (the statistical agency of the European Community) released the second edition of the European System for the Collection of Economic Information on the Environment - SERIEE. The scope of SERIEE is all environmental protection expenditures, not just pollution abatement expenditures. Within this framework, environmental protection is defined as 'all actions and activities that are aimed at the prevention, reduction and elimination of pollution, *as well as* any other degradation of the environment'. (Eurostat, 1994).

4.1 SERIEE general framework

SERIEE comprises two accounts: the Environment Protection Expenditure Account (EPEA) and the Resource Use and Management Account. Of these, the EPEA is more developed. The objective of the EPEA is to answer the following questions:

- how much a nation spends on environmental protection expenditure;
- how and by which units the expenditure is financed;
- which economic activities are induced by environmental protection activities.

As discussed in section 2.1, SERIEE generates three central tables which address the three issues listed above. Table A details and values the national expenditure for environmental protection by users / beneficiaries, Table B describes the output of environmental services and Table C describes the way in which national expenditure is financed.

Ideally, the EPEA (including Tables A, B and C described above) is drawn up by aggregation of sub-accounts. The sub-accounts provided within SERIEE are:

- ambient air and climate protection account;
- waste water management account;
- waste management account;
- protection of soil and groundwater account;
- noise and vibration abatement account;
- protection of biodiversity and landscape account;
- other environmental protection activities account.

SERIEE also indicates that a range of more detailed sub-accounts can be developed to suit individual countries requirements and data availability situations.

SERIEE has addressed a number of methodological issues associated with estimating environmental expenditures. It is much more detailed in its data requirements than the OECD Pollution Abatement and Control framework, and its implementation in Australia is not feasible at this stage. The ABS will continue to monitor, explore and contribute to such international developments in the emerging area of environmental expenditure statistics.

SERIEE Tables A, B and C are included on the following pages. Definitions of key terms used in these tables are listed below.

Characteristic Activities, Services and Products: activities whose purpose is environmental protection. The activities so defined are specified in the Single European Standard Statistical Classification of Environmental Protection Activities (CEPA). Their output consists of characteristic services. Characteristic product use contributes to environmental protection. The overall grouping of characteristic services and products is designated by the term specific products.

Characteristic activities may be executed as principal, secondary or ancillary activities. Principal and secondary activities may be either sold on the market (market output) or at prices that are not economically significant (non-market output). Characteristic activities are also executed as ancillary activities. A producer may execute on its own and for its own use environmental protection activities (reduction of emissions, treatment of pollutants) made necessary in order to limit the negative effects of its activity on the environment. In this case the services produced are qualified as ancillary.

Specialised Producers: execute a characteristic activity as their principal activity. Specialised producers belonging to general government and non-profit institutions serving households are distinguished from specialised producers belonging to other sectors.

Other Producers: execute a characteristic activity as a secondary or ancillary to a principal non-characteristic activity. These producers are grouped according to non-characteristic activity.

Connected and Adapted Products: These are products which are not characteristic services but whose use serves an environmental protection purpose. Connected and adapted products may be durable or non-durable products. They may be used for final or intermediate consumption or for gross capital formation. Connected products directly serve an environmental purpose but are not characteristic services (e.g. catalytic converters, septic tanks, rubbish containers). Adapted products are defined as products that on one hand are less polluting at the time of their consumption and/or scrapping than equivalent normal products. (Equivalent normal products are those which furnish similar utility, irrespective of the impact on the environment). On the other hand they are more costly than equivalent normal products. Only the extra cost is considered as environmental protection expenditure

TABLE A NATIONAL EXPENDITURE BY COMPONENTS AND BY USERS/BENEFICIARIES

Components of national expenditure for environmental protection	*USERS / BENEFICIARIES*								
	Producers				*General government as collective consumer*				
	Specialised producers		*Other producers (by industry)*						
	General government and non-profit institutions servicing households	*Other*	*Non-specialised*	*Non-characteristic*	*Central govt*	*Local govt*	*Households as actual consumers*	*Rest of the world*	*Total*
1. Consumption of specific products									
1.1 Final consumption of characteristic services									
market	-	-	-	-	-	-	x	-	x
non-market	-	-	-	-	x	x	x	-	x
1.2 Intermediate consumption of characteristic services									
market	nr	nr	x	x	-	-	-	-	x
ancillary	nr	nr	x	-	-	-	-	-	x
1.3 Final consumption of									
connected products	-	-	-	-	-	-	x	-	x
adapted products	-	-	-	-	-	-	x	-	x
1.4 Intermediate consumption of									
connected products	nr	nr	x	x	-	-	-	-	x
adapted products	nr	nr	x	x	-	-	-	-	x
2. Gross capital formation [1] for characteristic activities	x	x	x	-	-	-	-	-	x
3. Gross capital formation in specific products									
in connected products	nr	nr	x	x	-	-	-	-	x
in adapted products	nr	nr	x	x	-	-	-	-	x
in characteristic services	nr	nr	x	x	-	-	-	-	x
4. Specific transfers (not counterpart of items 1, 2, 3).									
4.1 subsidies on production									
characteristic services	nr	nr	x	x	-	-	x	x	x
connected products		nr	x	x	-	-	x	x	x
adapted products	nr	nr	x	x	-	-	x	x	x
4.2 other specific transfers									
current	(-)	(-)	(-)	x	-	-	x	x	x
capital	(-)	(-)	(-)	x	-	-	-	x	x
5 Total of resident uses (1+2+3+4)									
current	-	-	x	x	x	x	x	x	x
capital	x	x	x	x	-	-	-	x	x
6. Financed by the rest of the world									
current uses	-	-	x	x	x	x	x	x	x
capital uses	x	x	x	x	-	-	-	x	x
7 National Expenditure for Environmental Protection (5-6)									
current	-	-	x	x	x	x	x	x	x
capital	x	x	x	x	-	-	-	x	x

(1) and their acquisitions less disposals of non-produced non-financial assets

In Table A, a cross (x) indicates that the transaction is recorded at this intersection. The sign "nr" indicates that the transaction may exist, but is not recorded at this intersection given the construction of national expenditure and the conventions of the EPEAs valuation system. A dash indicates that the transaction does not exist. A dash between brackets indicates that the transaction may exist but no example was found. Subsidies on specific products (characteristics services, adapted and connected products) are considered as going directly to the users of these products (as uses are valued at purchasers prices). Uses of specific products of specialised producers are not separately recorded, but they may exist. Hence specialised producers may benefit from subsidies on specific products. As these subsidies are passed through to other users, they are recorded in the column of these users.

Source: Eurostat (1994), page 58

TABLE B PRODUCTION OF CHARACTERISTIC SERVICES

Transactions	*Characteristic producers*				
	Specialised producers		*Non-specialised producers (by industry)*		
	General government / non-profit institutions serving households	*Other*	*Secondary output*	*Ancillary output*	*Total*
CURRENT TRANSACTIONS					
Current Uses					
Intermediate consumption	x	x	nr	x	x
of which characteristic services	x	x	nr	nr	x
of which adapted and connected products	x	x	nr	nr	x
Compensation of employees	x	x	nr	x	x
Consumption of fixed capital	x	x	nr	x	x
Other taxes on production	x	x	nr	-	x
Less other subsidies on production	x	x	nr	x	x
Net operating surplus	x	x	nr	x	x
Output (basic price or cost of production)	x	x	x	x	x
Non-environmental output					
related products	x	x	nr	x	x
other non-environmental output	x	x	nr	-	x
Environmental protection output					
non-market					
principal	x	-	-	-	x
secondary	x	-	x	-	x
market					
principal	x	x	-	-	x
secondary	x	x	x	-	x
ancillary	nr	nr	nr	x	x
Current environmental protection resources					
market output (including partial payments)	x	x	x	-	x
current transfers	x	-	x	x	x
CAPITAL TRANSACTIONS					
Gross fixed capital formation	x	x	nr	x	x
Other capital uses	x	x	nr	x	x
Investment grants received	x	x	nr	x	x
Other capital transfers received	x	(-)	nr	(-)	x
	x	x	x	x	x
FINANCING BY PRODUCERS (output plus balance of capital transactions minus resources)					
labour inputs	x	x	nr	x	x
Stock of fixed assets	x	x	nr	x	x

In Table B, a cross indicates that the transaction is recorded at this intersection. The sign "nr" indicates that the transaction may exist, but is not recorded at this intersection given the construction of national expenditure aggregate and the conventions of the EPEAs valuation system. A dash indicates that the transaction does not exist. A dash between brackets indicates that the transaction may exist but not example was found.

Secondary output is assumed to be of minor importance in the EPEA. Therefore for secondary output it is assumed that the only available information is output. As no gross capital formation is recorded, the financing by producers is nil. If secondary output is found to be important, efforts have to be made to gather or estimate (e.g. on the basis of physical data or by analogy to specialised producers with the same kind of output) the necessary data and to transform the corresponding units into specialised producers. In the case of non-market secondary producers - as no data for the calculation of the cost of production are available - it may be possible to identify the current transfers received by the producer from the labels given to them by the donor.

Source: Eurostat (1994), page 60.

TABLE B1 SUPPLY AND USE TABLE FOR CHARACTERISTIC SERVICES

	Non-market	*Market*	*Ancillary*	*Total*
1 Uses of resident units (purchasers' prices)				
Intermediate consumption	-	x	x	x
Specialised producers	-	x	nr	x
Other producers	-	x	x	x
Final consumption	x	x	-	x
Gross capital formation	x	x	-	x
(land improvement)				
2 Exports	-	x	-	x
Total uses (1+2) = total supply (3+4+5+6)	x	x	x	x
3 Output (basic prices)	x	x	x	x
4 Imports (customs prices)	-	x	-	x
5 Non-deductible VAT	x	x	-	x
6 Other taxes less subsidies on products (if any)	x	x	-	x

Source: Eurostat (1994), page 61

TABLE C FINANCING OF NATIONAL EXPENDITURE FOR ENVIRONMENT PROTECTION

	USERS / BENEFICIARIES									
	Producers				*General government as collective consumer* [3]					
	Specialised producers [1]		*Other producers (by industry)* [2]							
FINANCING UNITS	*General government and non-profit institutions servicing households*	*Other*	*Non-specialised*	*Non-characteristic*	*Central govt*	*Local govt*	*Households as actual consumers*	*Rest of the world*	*Total*	*of which current expenditure*
General government										
central government	x	x	x	x	x	x	x	x	x	x
local government	x	x	x	x	x	x	x	x	x	x
Non-profit institutions servicing households	x	-	-	-	-	-	x	-	x	x
Corporations										
specialised producers	t,x	t,x	t	t	t	t	t	t	x	x
other producers	t	t	t,x	t,x	t	t	t	t	x	x
Households	t	t	t,x	t,x	t	t	t,x	t	x	x
National Expenditure	x	x	x	x	x	x	x	x	x	x
Rest of the world	t,x	t,x	t,x	t,x	t,x	t,x	t,x	x	x	x
of which European Union Institutions	x	x	x	x	x	x	x	x	x	x
Uses of resident units	x	x	x	x	x	x	x	x	x	x

In Table C, a cross (X) indicates direct financing. A "t" indicates (usually indirect) financing through specific taxes (or voluntary contributions) of household or producers. A dash indicates that the financing does not exist at this intersection. Payments of specific taxes and voluntary contributions) by households or producers may appear as financing of many elements of national expenditure including the financing through transfers paid from specific funds and trusts.

Source: Eurostat (1994), page 64

TABLE C1 ENVIRONMENT-RELATED FINANCIAL BURDEN

Elements of environment related financial burden	*Sectors*				
	Corporations		*Households including non-profit institutions servicing households*	*General government*	*Total*
	Environmental industries	*Non-environmental industries*			
1 Financing of current national expenditure	x	x	x	x	x
2 Non-deductible VAT on current expenditure	-	-	-	-x	-x
3 Taxes on production	-	-	-	-x	-x
4 Net operating surplus	x	-	-	-	x
5 Any other profits	-	x	x	-	x
6 Interest on fixed capital	x	x	x	x	x
A Financial burden of environmental protection (1+2+3+4+5+6)	x	x	x	x	x
B Environment related tax burden	x	x	x	-x	0
Environment related financial burden (A+B)	x	x	x	x	x

Source: Eurostat (1994), page 65.

Single European Standard Statistical Classification of Environmental Protection Activities and Facilities

Classification of Environmental Protection Activities (CEPA)

1 Protection of ambient air and climate
- 1.1 Prevention of pollution through in-process modifications
  - 1.1.1 for the protection of ambient air
  - 1.1.2 for the protection of climate and ozone layer
- 1.2 Treatment of exhaust gases and ventilation air
  - 1.2.1 for the protection of ambient air
  - 1.2.2 for the protection of climate and ozone layer
- 1.3 Measurement, control laboratories and the like
- 1.4 Other activities

2 Waste water management
- 2.1 Prevention of water pollution through in-process modifications
- 2.2 Sewerage networks
- 2.3 Waste water treatment
- 2.4 Treatment of cooling water
- 2.5 Measurement, control laboratories and the like
- 2.6 Other activities

3 Waste management
- 3.1 Prevention of waste production through in-process modifications
- 3.2 Collection and transport of waste
- 3.3 Treatment and disposal of hazardous waste
  - 3.3.1 Thermal treatment
  - 3.3.2 Landfill
  - 3.3.3 Other treatment and disposal
- 3.4 Treatment and disposal of non-hazardous waste
  - 3.4.1 Incineration
  - 3.4.2 Landfill
  - 3.4.3 Other treatment and disposal
- 3.5 Measurement, control laboratories and the like
- 3.6 Other activities

4 Protection of soil and groundwater
- 4.1 Prevention of pollutant infiltration
- 4.2 Decontamination of soils
- 4.3 Measurement, control laboratories and the like
- 4.4 Other activities

5 Noise and vibration account
- 5.1 Noise and vibration from road and rail traffic
  - 5.1.1 Preventative in-process modifications at the source
  - 5.1.2 Construction of anti-noise vibration facilities
- 5.2 Air traffic noise
  - 5.2.1 Preventative in-process modifications at the source
  - 5.2.2 Construction of anti-noise vibration facilities
- 5.3 Industrial process noise and vibration
- 5.4 Measurement, control, laboratories and the like
- 5.5 Other activities

6 Protection of bio-diversity and landscape
- 6.1 Protection of species
- 6.2 Protection of landscapes and habitats, of which
  - 6.2.1 protection of forests
- 6.3 Rehabilitation of species, populations and landscapes
- 6.4 Restoration and cleaning of water bodies
- 6.5 Measurement, control, laboratories and the like
- 6.6 Other activities

7 Protection against radiation
(excluding nuclear power stations and military installations)
- 7.1 Protection of ambient media
- 7.2 Measurement, control laboratories and the like
- 7.3 Other activities

8 Research and Development
- 8.1 Protection of ambient air and climate
  - 8.1.1 for the protection of ambient air
  - 8.1.2 for the protection of atmosphere and climate
- 8.2 Protection of ambient water
- 8.3 Waste
- 8.4 Protection of soil and groundwater
- 8.5 Abatement of noise and vibration
- 8.6 Protection of species and habitats
- 8.7 Protection against radiation
- 8.8 Other research on the environment

9 Other environmental protection activities
- 9.1 General administration of the environment
- 9.2 Education, training and information
- 9.3 Activities leading to indivisible expenditure
- 9.4 Activities not elsewhere specified

Classification of Environmental Protection Facilities

1 Protection of Ambient Air and Climate
- 1.1 Dedusting equipment and filters
  Industrial establishments equipped for the treatment of exhaust gases
- 1.2 Air monitoring installations [number of measurement sites by type of compound monitored; number of measurements per year; number of mobile equipment]
  - 1.2.1 Stationary sites in built up areas
  - 1.2.2 Stationary sites in open areas
  - 1.2.3 Mobile sites

2 Water Management and Protection
- 2.1 Sewerage networks (in kilometres)
- 2.2 Waste water treatment installations [number; capacity in terms of population equivalents of COD]
  - 2.2.1 Mechanical treatment technology (excluding septic tanks)
  - 2.2.2 Biological treatment technology (excluding septic tanks)
  - 2.2.3 Advanced treatment technology
  - 2.2.4 Septic tanks
- 2.3 Monitoring installations [number of measurement sites; number of mobile equipments; number of measurements per year and by type of water body monitored]

3 Waste Management
- 3.1 Facilities for the treatment of hazardous waste [number; capacity in terms of weight that can be treated by year, by type of waste as applicable]
  - 3.1.1 Physical/chemical treatment technology
  - 3.1.2 Thermal treatment technology
  - 3.1.3 Biological treatment technology
  - 3.1.4 Conditioning of radioactive wastes
  - 3.1.5 Other treatment technologies
- 3.2 Facilities for the treatment of other than hazardous waste [number; capacity in terms of weight that can be treated by year, by type of waste as applicable]
  - 3.2.1 Physical/chemical treatment technology
  - 3.2.2 Incineration of municipal or similar wastes
  - 3.2.3 Incineration of industrial waste
  - 3.2.4 Biological treatment technology
  - 3.2.5 Other treatment technologies
- 3.3 Facilities for the disposal of waste [number of sites]
  - 3.3.1 Landfill for all types of wastes
  - 3.3.2 Landfill exclusively for hazardous waste
  - 3.3.3 Containment / underground waste
  - 3.3.4 Other disposal installations

4 Protection of soil and groundwater
  4.1 'End-of-pipe' facilities [number]
    4.1.1 Soil surface sealing including ditches and walls, drainage systems
    4.1.2 Catchments for run-offs, losses, leaks
    4.1.3 Improvement of underground storage and transport facilities in the interest of ground water and soil protection
    4.1.4 Removal of underground storage and transport facilities in the interest of ground water and soil protection
  4.2 Reservoir liners, reinforcement of transport systems for hazardous products and other integrated facilities [number]

5 Noise Abatement
  5.1 Noise barriers: roads, railroads, airports [in kilometres]
  5.2 Equipment for follow-up and control of noise [number of sites and measurement equipment]

Source: Eurostat (1994) pages 71 - 74

Notes

1. Symbols and Other Usage

ASIC	Australian Standard Industrial Classification
ANZSIC	Australian and New Zealand Standard Industrial Classification
n.e.c.	Not elsewhere classified
n.p.	Not available for publication but included in totals where applicable
–	Nil or rounded to zero. Note that for consistency between the various chapters, all monetary data is provided in millions, and has been rounded to one decimal place. In some cases, this has meant that expenditure less than $50,000 has been rounded to zero and expressed as with the '–' symbol. In such cases, the estimate is included in the total where applicable.
$ billion	$1 000 000 000 Australian dollars

2. Where figures have been rounded, discrepancies may occur between totals and the sums of the component items.

Bibliography

Australian Consumers Association, 'Water, Water Everywhere ... but is it fit to drink?' in Choice, August 1991, p 6-10

Australian Capital Territory (1992), Environmental Budget Statement, 1992-93, ACT Treasury

Australian Commonwealth and State Budget Papers (various), 1991-92 and 1992-93, Australian Government Publishing Service

Australian Science and Technology Council (1990), Environmental Research in Australia: A Review: Australian Government Publishing Service, Canberra.

Bush, S., Leonard, M., Bowen, B., Jones, B., Donaldson, K. and Ho Trie, L., (1993) Energy Demand and Supply Projections Australia, 1992-93 to 2004-05, ABARE Research Report 93.2, Canberra

Department of Primary Industries and Energy (1990), National Energy Management, Australian Government Publishing Service

Ecologically Sustainable Development Working Groups Final Report - Agriculture, November 1991, Australian Government Publishing Service

Ecologically Sustainable Development Working Groups Final Report - Manufacturing, November 1991, Australian Government Publishing Service.

Ecologically Sustainable Development Working Groups Final Report - Mining, November 1991, Australian Government Publishing Service

Energy Research and Development Corporation, Annual Report, 1991-92

Eurostat (1994), SERIEE 1994 version, Luxembourg, Office for Official Publications of the European Communities

Melbourne Water (1992), Melbourne Water Resources Review, Interim Report, Water for our Future

Industry Commission, (1992), Water Resources and Waste Water Disposal, Report no 26, July 1992, Australian Government Publishing Service

OECD (1993) Pollution Abatement and Control Expenditure in OECD Countries

OECD (1994) Group on State of the Environment Pollution Control Expenditures 1994 Questionnaire

Parliament of NSW (1994), Joint Select Committee upon the Sydney Water Board - Report.

World Resources Institute (1992), World Resources 1992-93, Oxford University Press, Oxford

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