APPENDIX A
ESTIMATION OF COSTS FOR NEW AND FORTHCOMING REGULATIONS

Cost estimates are included in this report for the individual regulations and programs listed in Table 2-3. This appendix lists the following information for each of these:

(a) Current rulemaking status and expected proposal or finalization date;
(b) Particular regulatory option for which costs were estimated if the regulation is not yet final;
(c) Data sources from which the basic cost estimates were derived; and
(d) Summary of the derivation of the cost estimates from the raw data and assumptions used to apportion costs over time.

The regulation summaries are categorized below according to environmental medium. The categories are numbered to correspond with the chapters and sections in the main text in which the regulations are discussed. A brief discussion of regulations for which cost estimates are not included in this report is included at the end of each media section. Estimates of capital and O&M expenditures over the period 1986-2000 for each of the included regulations are given in the tables following the regulation summaries.

3. AIR AND RADIATION REGULATIONS

3.1. Air

3.1.1. Stationary Source

Particulate Matter National Ambient Air Quality Standard (Revision)

(a) Status: Final rule (52 FR 24634; July 1, 1987).

(b) Regulatory option: See 52 FR 24634.

(c) Data sources:

(1) *Regulatory Impact Analysis on the National Ambient Air Quality Standards for Particulate Matter*, Second Addendum, US EPA Office of Air Quality Planning and Standards, December, 1986.

(2) *Regulatory Impact Analysis on the National Ambient Air Quality Standards for Particulate Matter*, US EPA Office of Air Quality Planning and Standards, February 21, 1984.

(d) Derivation and timing of estimates: Table 4 of Data Source 1 (no page number given) provides a 1983 present value estimate (calculated using a discount rate of 10 percent) for

incremental costs of the rule. We converted this into a 1989 present value (using the single payment present worth factor associated with a 10 percent rate over six years), and then re-annualized this estimate over 15 years. Data Source 1 did not provide sufficient information to enable us to dissagregate this annualized cost estimate into fixed and variable cost components. However, Data Source 2 provides information on the relationship between capital and annualized costs for a similar regulatory option. Although the costs estimates from Data Source 2 cannot be used directly because they are outdated, we used the ratio of capital to annualized costs provided by this source to dissaggregate the annualized cost estimate derived from Data Source 1 into fixed and variable cost components. We assumed that capital costs would be incurred in equal increments over the years 1987-1989. O&M costs were assumed to phase-in with each increment of capital with a one year lag.

Lead National Ambient Air Quality Standard (Revision)

(a) Status: Expected proposal date: October 1990.

(b) Regulatory option: 0.5 ug/m^3, averaged quarterly.

(c) Data source: *Costs Assessment of Regulatory Alternatives for Lead NAAQS*, U.S. EPA Office of Air Quality Planning and Standards, July 1985.

(d) Derivation and timing of estimates: Table 2 (no page number given) of the data source reports capital and annualized costs for the 0.5 ug/m^3 regulatory option. The data source also reports that annualized costs were calculated by amortizing capital costs at the rate of 10 percent over 15 years. This information and the capital and annualized costs data were used to back-out annual O&M costs. We assumed that the rule would be promulgated in 1991 and go into effect in 1993. Capital costs were divided into three equal increments and placed in years 1991, 1992, and 1993. The O&M costs were assumed to phase-in with each increment of capital expenditure after a one-year lag.

Acid Rain Control

(a) Status: These costs reflect the Administration's proposed strategy for controlling stationary source SO_x and NO_x set out in Tile V of H.R. 3030 and S. 1490 (101st Congress, 1st Session) which would amend the Clean Air Act.

(b) Regulatory option considered: The costs reflect the high baseline assumption about future emissions and are associated with annual reductions of 4.1 million tons of SO2 below 1980 levels in Phase I (1996-2000) and 8.2 million tons in Phase II (2001-2004). The costs also reflect the constrained implementation scenario which assumes that emissions trading will be utilized on an intra-utility basis in Phase II only.

(c) Data source: *Economic Analysis of Title V (Acid Rain Provisions) of the Administration's Proposed Clean Air Act Amendments (H.R. 3030/S. 1490),* Prepared for the US EPA by ICF Resources, Inc., September 1989.

(d) Derivation and timing of estimates: Data Source 1 (p. 14) reports year 1996 (Phase I) and year 2001 (Phase II) annualized costs. The Phase I requirements would become effective after December 31, 1995. The Phase I annualized cost estimate was thus used to show costs for years 1996 through 1999. We assumed that in year 1995 fifty percent of the Phase I annualized costs would be incurred as utilities geared up to meet the Phase I requirements. Also, we assumed that costs in year 2000 would be fifty percent greater than the Phase I annualized costs to reflect preparation by utilities to meet the Phase II requirements which begin in year 2001. Since the annualized costs could not be dissaggregated into fixed and variable cost components, no capital costs were reported, and the annualized cost estimates are reported under the O&M cost category starting in year 1995.

Toxic Substances Control (Stationary and Area Sources)

(a) Status: These costs reflect the Administration's strategy for controlling toxic air pollutants set out in Title III of H.R. 3030 and S. 1490 (101st Congress, 1st Session), which would amend the Clean Air Act.

(b) Regulatory option: The Title III strategy inlcudes a two-pronged control approach mandating technology-based standards for all source categories, and additional health-based standards for those source categories deemed to present unreasonable human health risks even after compliance with the technology-based standards. Only the former is costed here.

(c) Data source: *Analysis of Costs of Hazardous Air Pollutant Controls Under Administration Bill, H.R. 2585, and S. 816,* Prepared for the US EPA Office of Air Quality Planning and Standards by Energy and Environmental Analysis, Inc., October 27, 1989.

(d) Derivation and timing of estimates: The data source (p. 2-3) reports an annualized cost range for stationary and area source compliance with the technology- based standards in year 2003 (the year in which costs would be fully realized). We took the midpoint of the estimated year 2003 cost range and used it to derive annual costs according to the methodology discussed below. Title III sets out a schedule for the promulgation of the technology-based standards which requires that standards for ten source categories be promulgated within two years after enactment of the law, standards for 25 percent of source categories within four years, 50 percent of source categories within seven years, and a decision on final promulgation for the remaining source categories within seven years. We assumed that the law would be enacted in 1990, and that the percentage of source categories affected by each particular source category standard would correspond equally with the percentage of the year 2003 annualized cost incurred as a result of that standard. Title III

also specifies that existing sources will have three years to comply with their relevant standards. Using this information, we further assumed that the annualized costs for any particular standard would increase steadily over the three years following promulgation, reaching a peak in the third year and continuing at this annual level into the future. Using this methodolgy, we calculated that 3.33 percent of the year 2003 annualized cost would be incurred in year 1993, 6.66 percent in 1994, 15 percent in 1995, 20 percent in 1996, 25 percent in 1997, 33.33 in 1998, 41.66 percent in 1999, and 50 percent in year 2000. We did not have enough information to dissaggregate the annualized cost estimates into fixed and variable costs components; thus, the annualized cost estimates were used and reported under the O&M cost category.

Ozone National Ambient Air Quality Standard: Full Attainment (Stationary Sources)

(a) Status: These costs reflect the Administration's strategy for ozone NAAQS attainment set out in Title I of H.R. 3030 (101st Congress, 1st Session), which would amend the Clean Air Act.

(b) Regulatory option: The various stationary source VOC control measures for which cost data were collected include: 1) hazardous waste TSDF, 2) municipal landfills, 3) consumer and commercial use of solvents, 4) marine vessels, 5) new CTG, and 6) progress requirements. This last provision would require non-attainment areas to achieve a 15 percent reduction from 1990 baseline emissions within five years and, in each subsequent year, either attain or reduce emissions by an additional three percent. This requirement would involve certain additional controls that are identifiable at this time, as well as additonal controls that are yet unknown. These additional measures would involve both stationary and mobile sources.

(c) Data source: *Ozone Nonattainment: A Comparison of Bills*, Prepared for the US EPA Office of Air and Radiation by E.H. Pechan & Associates, Inc., January 1990.

(d) Derivation and timing of estimates: Tables 3 and 4 of the data source (pp. 6 & 7) provide annualized costs for each control measure for the years 1995 and 2000. For each control measure, we subtracted the year 1995 cost estimate from the year 2000 cost estimate, and divided the result by five to figure the average annual increase in costs throughout the period 1995-2000. These average annual increases in costs were then used to figure costs for each year throughout the period 1993-2000 for each control measure (For the "progress requirements" measure, the average annual increase in cost was used to figure costs for the years 1995-2000 only; year 1993 and 1994 costs were assumed to be at the level of 1995 costs). The year 1993 was assumed to be the first year in which costs would be incurred. Since the annualized costs could not be dissaggregated into fixed and variable cost components, the annualized cost estimates were reported under the O&M cost category. These annualized costs were calculated by the data source using a 10 percent rate of capital amortization.

Stratospheric Ozone Protection Plan

(a) Status: Final rule (53 FR 30566; August 12, 1988).

(b) Regulatory option: See 53 FR 30566.

(c) Data sources:

(1) *Regulatory Impact Analysis: Protection of Stratospheric Ozone Depletion, Volumes I and II*, US EPA Office of Air and Radiation, December 1987.

(2) Profile of the regulation prepared by Stephen Seidel (Office of Policy Planning and Evaluation, Global Change Division) for the EPA Sector Study.

(d) Derivation and timing of estimates: Data Source 2 provides undiscounted *social cost* estimates derived using welfare analysis for each of the years 1989-1995, and year 2000 (these costs are associated with the moderate stretch-out scenario). Page 9-13 of the RIA (data source 1) provides present value cost estimates (calculated with a 2 percent discount rate) for the period 1989- 2000. The following assumptions were used together with the above data to derive undiscounted cost estimates over years 1996-1999, for which annual social costs data were missing. Data Source 2 indicates that the first big increase in social costs occurs in year 1994 following the rule's 20 percent CFC reduction requirement in 1993. Data Source 2 also indicates that social costs increase annually by only 6 percent over the period 1994-1996. We assumed that 1997 and 1998 social costs would also be 6 percent higher than the previous years' estimates, respectively. The rule requires a 50 percent CFCs reduction in year 1998, which implies that social costs will make a large jump in year 1999. To derive undiscounted social costs for year 1999, we took the RIA estimate of present value social costs for the period 1989-2000 (p. 9-13), and subtracted from it the present value (at 2 percent) of our supplied and derived estimates for years 1989-1998, and year 2000. The annual estimates are reported under the O&M costs category (no numbers are reported under the capital cost category).

3.1.2. Mobil Sources

Fuel Volatility Rule

(a) Status: Final rule (54 FR 11868; March 22, 1989).

(b) Regulatory option: See 54 FR 11868.

(c) Data sources: See Appendix C.

(d) Derivation and timing of estimates: See Appendix C.

NOx and Particulates Standards for Light-Duty Trucks and Heavy-Duty Engines

(a) Status: Final rule (50 FR 10606: March 15, 1985).

(b) Regulatory option: See 50 FR 10606.

(c) Data sources: See Appendix C.

(d) Derivation and timing of estimates: See Appendix C.

Diesel Fuel Quality Standards

(a) Status: Final rule (54 FR 11868; March 22, 1989).

(b) Regulatory option: See 54 FR 11868.

(c) Data sources: See Appendix C.

(d) Derivation and timing of estimates: See Appendix C.

Toxic Substances Control (Mobile Sources)

(a) Status: These provisions are part of the Administration's strategy for controlling hazardous air pollutants which are set out in Title III of H.R. 3030 and S. 1490 (101st Congress, 1st Session).

(b) Regulatory option: See Appendix C.

(c) Data sources: See Appendix C.

(d) Derivation and timing of estimates: See Appendix C.

Ozone National Ambient Air Quality Standard: Full Attainment (Mobile Sources)

(a) Status: These provisions reflect the Adminsistration's strategy for ozone NAAQS attainment set out in H.R. 3030 (101st Congress, 1st Session), which would amend the Clean Air Act.

(b) Regulatory option: See Appendix C.

(c) Data sources: See Appendix C.

(d) Derivation and timing of estimates: See Appendix C.

Air regulations not included in the data set.

Potential rules which were deemed too speculative at this time to include in the report or for which adequate cost data were not available include various NAAQS revisions (*e.g.*, fine particulates). Several new and forthcoming rules involving New Source Performance Standards (NSPS) were also excluded from the cost data set because adequate cost data was not available. These include various NSPS for synthetic organic chemical manufacturing industries, commercial steam generators, small boilers, and residential wood heaters. Forthcoming mobile source rules for which adequate cost data could not be obtained include cold-start carbon monoxide standards, and on-board diagnostic systems for emission controls.

3.2. Radiation Regulations

Radon Advisory

See Appendix G

4. WATER REGULATIONS

4.1. Water Quality

Treatment of Municipal Wastewater: Full Compliance

(a) Status: Established Program (40 CFR Part 35).

(b) Regulatory Option: The cost estimates provided for this program include the net costs (i.e. costs over and above expected future expenditures for wastewater treatment during the period 1990-2000) of bringing existing facilities into compliance with their permits as well as the costs of design needs for the year 2000. The costs reflect the following components of needs, some of which are Federal grant-eligible and some of which are not: 1) secondary treatment, 2) advanced treatment, 3) infiltration, including inflow and replacement, 4) new collector sewers and interceptors, and 5) combined sewer overflow.

(c) Data sources:

(1) *1988 Needs Survey Report to Congress: Assessment of Needed Publicly Owned Wastewater Treatment Facilities in the US*, US EPA Office of Municipal Pollution Control, EPA 430/09-89-001, February 1989.

(2) *State Revolving Fund Report to Congress: Financial Status and Operations of Water Pollution Control Revolving Funds*, Draft Report, US EPA Office of Municipal Water Pollution Control, February 1990.

(d) Derivation and timing of estimates: Data Source 1 reports one capital cost estimate (p. 8) representing the costs required to meet the total current needs of existing facilities with documented water quality or public health problems. This estimate was divided into 11 equal increments, and one increment attributed to each of the years 1990-2000. Data Source 1 reports another capital cost estimate (p. 8) representing the total capital needs for population growth over the period 1988-2008. This estimate was divided into 21 equal increments and one increment attributed to each year within this period. The two sets of capital cost estimates for each of the years 1990-2000 were then summed to calculate *total* "full compliance" capital needs in the amount of $6561 million for each year over this period. One final step was then used to derive *net* full compliance capital needs (i.e. capital needs over and above expected capital expenditures for municipal wastewater treatment) for the period 1990-2000. To derive net capital needs, combined projections for future wastewater treatment expenditures by EPA, state and local governments were subtracted from the total full compliance capital costs for each year within the period 1990-2000. This added step was required because the cost projections for future wastewater expenditures, which are based on recent trends in expenditures reported by national surveys, should incorporate a portion of the "full compliance" capital needs. This added step was thus required to isolate the costs for that portion of full compliance capital needs that are not expected to be met during the period 1990-2000. Costs estimates for full compliance O&M costs are based on information from Data Source 2 indicating that annual O&M costs are about one-tenth of capital costs for the average facility. Full compliance O&M costs were calculated as one-tenth of the annual net full compliance capital costs derived using the procedure discussed above.

Pretreatment Requirements

(a) Status: Final (40 CFR Part 403).

(b) Regulatory option: See 40 CFR Part 403.

(c) Data sources:

(1) Sector Study municipal cost data base developed by Brett Snyder (Office of Policy Analysis) with assistance from Denise Scott (Office of Water Enforcement and Permits, Permits Division).

(2) "Pretreatment Audit Summary System" (PASS).

(d) Derivation and timing of estimates: The cost estimates are based on data contained in "PASS" (Data Source 2) which shows annual budget and FTE expenses for pretreatment programs in those cities that have implemented such programs. These costs were treated as annual recurring costs. Data Source 1 derived total pretreatment costs for all cities by extrapolating the cost data to cities within specific city size categories that have not yet implemented the program. We aggregated the costs provided by Data Source 1 accross all city size categories to calculate national costs of the rule. We assumed that all cities have implemented or will implement pretreatment programs from 1988 and 1991; one-fourth of total annual costs were placed in year 1988, one-half in year 1989, three-fourths in 1990 and total annual costs in each of the years 1991-2000.

Sewage Sludge Use and Disposal—Technical Requirements

(a) Status: Proposed rule (54 FR 5646; February 6, 1989). Expected finalization date: October 1991.

(b) Regulatory option: This rule will establish technical standards setting allowable concentrations of pollutants in sewage sludge for each allowable sludge use and disposal method. The cost estimates are based on regulatory alternative 3, which would regulate critical sites based on Maximum Exposed Individuals.

(c) Data sources:

(1) Sector Study municipal cost data base developed by Brett Snyder (Office of Policy Analysis).

(2) *Draft Regulatory Impact Analysis of the Proposed Regulations for Sewage Sludge Use and Disposal*, Prepared for the US EPA by Eastern Research Group, Inc, July 1987.

(3) Memorandum from Debra Nicoll (Office of Municipal Pollution Control, Analysis and Evaluation Division) to Brett Snyder listing the revised RIA capital and O&M cost data for the technical regulatory option 3, dated January 13, 1988.

(d) Derivation and timing of estimates: The cost estimates were derived from data contained in Data Source 3, which provides capital and O&M costs for five different disposal methods associated with regulatory option 3, as well as the number of plants expected to use each disposal method. This data was used to develop regulatory costs for different city size categories, which are reported by Data Source 1. We aggregated the costs across city size categories to calculate total national capital and O&M costs. We assumed the rule would become effective in 1992, and all capital costs would be incurred in that year. O&M costs were assumed to begin in the following year.

Stormwater Management NPDES Application Requirements

(a) Status: Proposed rule (53 FR 49416; December 7, 1988). Expected finalization date: 1990.

(b) Regulatory option: The rule would establish stormwater permit application requirements for stormwater discharges from large- and medium-sized municipal stormwater systems.

(c) Data source: Sector Study municipal cost data base developed by Brett Snyder (Office of Policy Analysis) based on data from Jim Gallop (Office of Water Enforcement and Permits, Permits Division).

(d) Derivation and timing of estimates: The costs reflect one-time costs to municipalities with populations over 100 persons for developing and implementing stormwater management plans, as well as annual recurring monitoring/enforcement costs. The cost estimates provided by the data source are on a per person basis which were used to derive per city and total costs for large size cities (populations greater than 250 thousand) and medium size cities (populations between 100 and 250 thousand). Following the effective dates for the rule, we assumed that capital costs for large cities would be incurred in equal increments in years 1990 and 1991, with annual costs phased-in with each increment of capital. We assumed that medium size cities would incur capital costs in 1992, with annual costs also beginning in that year.

Effluent Limitation Guidelines: Organic Chemicals and Plastics and Synthetic Fibers Industry

(a) Status: Final Rule (52 FR 42522; November 5, 1987).

(b) Regulatory option: See 52 FR 42522.

(c) Data source: *Economic Impact Analysis of Effluent Limitation and Standards for the Organic Chemicals, Plastics and Synthetic Fibers Industry*, Prepared for the US EPA Office of Water Regulations and Standards by Abt Associates, Inc., September 1987.

(d) Derivation and timing of estimates: The data source (pp. 1-3) provides capital and O&M costs. We assumed the capital costs would be incurred in equal increments in years 1988, 1989, and 1990. O&M costs were assumed to phase-in with each increment of capital expenditure.

Effluent Limitation Guidelines: Offshore Oil and Gas Industry

(a) Status: Proposed Rule (50 FR 34592; August 26, 1985). Expected Finalization Date: July 1991.

(b) Regulatory option: This rule would establish BAT, BCT, and NSPS standards for drilling fluids and drill cutting waste streams from offshore oil and gas extraction facilities. The costs reflect Regulatory Approach A.

(c) Data source: *Economic Impact Analysis of Effluent Limitation Guidelines and Standards for the Notice of Data Availability for Drilling Fluids and Drill Cuttings for the Offshore Oil and Gas Industry*, Prepared for the US EPA Office of Water Regulations and Standards by Eastern Research Group, Inc., October 1988.

(d) Derivation and timing of estimates: The data source (p. 7) reports total annual costs for regulatory approach A. (No capital costs were reported for the rule.) We asumed that the rule would be promulgated in 1991 and that annual O&M costs would begin in that year.

4.2. Drinking Water

Volatile Organics

(a) Status: Final rule (52 FR 25690; July 8, 1987).

(b) Regulatory option: See 52 FR 25690.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Fluorides

(a) Status: Final rule (52 FR 11396; April 2, 1986).

(b) Regulatory option: See 52 FR 11396.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Total Coliforms

(a) Status: Final rule (54 FR 27544; June 29, 1989).

(b) Regulatory option: See 54 FR 27544.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Surface Water Treatment

(a) Status: Final Rule (54 FR 27486; June 29, 1989).

(b) Regulatory option: See 54 FR 27486.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Phase II Inorganics and Synthetic Organics

(a) Status: Proposed rule (54 FR 22062; May 22. 1989). Expected finalization date: December 1990.

(b) Regulatory option: This proposes National Primary Drinking Water Regulations for 30 synthetic organic chemicals (SOCs) and eight inorganic chemicals (IOCs). The regulations set maximum contaminant levels (MCLs) or treatment techniques for the SOCs and IOCs, as well as maximum contaminant level goals (MCLGs).

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Lead, Copper, and Corrosion Control

(a) Status: Proposed rule (53 FR 31516; August 16, 1988). Expected finalization date: December 1990.

(b) Regulatory option: The proposed regulation sets new MCLs and MCLGs for naturally occurring lead and copper in drinking water. The proposed rule also would require drinking water systems to install certain corrosion control treatments in all systems that exceed no-action levels for pH, alkalinity, or average lead content.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Mandatory Disinfection

(a) Status: Expected proposal date: September 1990. Expected finalization date: September 1991.

(b) Regulatory option: This rule would establish MCLs and monitoring and public reporting requirements for disinfectants in drinking water.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Radionuclides

(a) Status: Expected proposal date: February 1991. Expected finalization date: August 1992.

(b) Regulatory option: This rule would establish MCLs and monitoring and public reporting requirements for certain radionuclides, including radium, uranium, total alpha, and beta particle and photon emitters.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

Phase IV Inorganics and Synthetic Organics

(a) Status: Under development. Expected proposal date: 1991.

(b) Regulatory option: This rule will set drinking water MCLs and MCLGs for a set of IOCs and SOCs not covered in the Phase II contaminants rulemaking.

(c) Data sources: See Appendix F.

(d) Derivation and timing of estimates: See Appendix F.

5. LAND REGULATIONS

5.1. Solid Waste

Municipal Landfill Subtitle D Criteria (Revision)

(a) Status: Proposed rule (53 FR 33314; August 30, 1988). Expected finalization date: Spring 1990.

(b) Regulatory option: This rule would establish revisions to RCRA Subtitle D criteria for municipal solid waste landfills. The proposal establishes general facility standards, groundwater monitoring requirements, post-closure standards, and performance and operating requirements.

(c) Data source: *Draft Regulatory Impact Analysis of Proposed Revisions to Subtitle D Criteria for Municipal Solid Waste Landfills*, Prepared for the US EPA Office of Solid Waste by Temple, Barker & Sloan, Inc., August 15, 1988.

(d) Derivation and timing of estimates: The data source (p. V-15) reports total annualized costs of the rule as $691-$880 million (calculated at a 3 percent amortization rate over 20 years). We took the midpoint of this range, and assumed that 75 percent of it (or $590 million) represents annual capital costs based on the high percentage of landfills that require liners, covers, leachate collection systems, and recovery wells. The remaining $196 thus represents annual O&M costs. The annual capital estimate was then divided by the annualization factor to figure total capital costs of $8777 million. We assumed the rule would become effective in 1991, and attributed a tenth of total capital costs to each of the years 1991-2000. Annual O&M costs were assumed to begin in 1991 and remain at this level through year 2000.

Municipal Waste Combustors Air Standards

(a) Status: Advanced notice of proposal (52 FR 25399; July 7, 1987). Expected proposal date: December 1990.

(b) Regulatory option: This rule would regulate municipal waste combustor air emissions under CAA Sections 111(b) and (d).

(c) Data sources:

(1) Sector Study municipal cost data base developed by Brett Snyder (Office of Policy Analysis) from data supplied by Mike Johnston.

(2) *Municipal Waste Combustors Study: Report to Congress*, US EPA, EPA/530-500-87-021a, June 1987.

(d) Derivation and timing of estimates: Unit capital and O&M costs for three different types of existing and plannned facilities were calculated by Data Source 1 using data derived from Data Source 2 and discussion with Mike Johnston. Data Source 1 calculated total

costs for different city size categories by multiplying these unit cost estimates by data on the number of each different type of planned and existing facitilies provided by Data Source 2 (Appendix B tables). We aggregated costs for each city size category to derive national costs for both planned and existing facilities. We assumed that the regulation will not be promulgated until 1991 and by that time all planned facilities will have come on-line. We assumed that capital costs would be incurred in equal increments in years 1991 and 1992, and O&M costs associated with each capital increment would begin in the following years.

Municipal Waste Combustors Ash Management

(a) Status: Expected proposal date: September 1990. Expected finalization date: November 1991.

(b) Regulatory option: Land disposal management standards for controlling releases from municipal combustion ash corresponding to the most stringent landfill diposal option.

(c) Data sources:

(1) Sector Study municipal cost data base developed by Brett Snyder (Office of Policy Analysis) with assistance from Sharon Stahl (Pollution Prevention Office).

(2) *Draft Regulatory Impact Analysis of Proposed Revisions to Subtitle D Criteria for Municipal Solid Waste Landfills*, US EPA Office of Solid Waste, December 11, 1987.

(d) Derivation and timing of estimates: The RIA provides estimates of the tonnage of waste produced by municipal incinerators. Data Source 1 derived costs by multiplying this estimate of waste produced by an efficiency factor of 20 percent to represent the portion of incinerated waste that ends up as ash. This estimate of ash produced was then multiplied by capital and O&M cost/ton estimates from the RIA associated with the most stringent landfill disposal option. We assumed that capital costs would be incurred in equal increments in years 1991 and 1992, and O&M costs would begin in year 1993.

Management of Used Oil

(a) Status: Proposed rule (50 FR 49212; November 29, 1985). Expected finalization date: 1990.

(b) Regulatory option: The option imposes modified hazardous waste regulations on all facilities in the used oil mangement system, including generators, intermediate facilities, and end users of used oil. Facilities generating less than 1,000 kilograms of used oil per month would be exempt from this regulatory option.

(c) Data source: *Regulatory Impact Analysis of Proposed Standards for the Management of Used Oil*, Temple, Barker & Sloan, Inc., November 1985.

(d) Derivation and timing of estimates: The data source (pp. 1-5) reports an annualized cost for the regulatory option of $167 million per year in 1984 dollars. The data source (Table V-18 on p. V-21) also indicates that approximately 43 percent of annualized costs are annual O&M costs, and 57 percent are annual capital costs. The next step was to back out the effect of annualization on the capital costs, producing a present value estimate for capital costs of $2008 million. We assumed that the rule would become effective in 1992, and one-fourth of total capital costs would be incurred over each of the first four years (1992-1995). Annual O&M costs were assumed to begin in 1992 and remain constant for a 20 year period.

5.2. Hazardous Waste

Land Disposal Restrictions—California List Wastes

(a) Status: Final rule (52 FR 25760; July 8, 1987).

(b) Regulatory option: See 52 FR 25760.

(c) Data source: *Regulatory Impact Analysis of Restrictions on the Land Disposal of California List Wastes*, Prepared for the US EPA Office of Solid Waste by ICF, Inc., July 1987.

(d) Derivation and timing of estimates: The data source reports total annualized costs (calculated using a 5.5 percent amortization rate over a 20 year period) of the rule as $94 million in 1986 dollars, but did not include enough information to dissaggregate costs into fixed and variable cost components. Therefore, it was assumed that the division of annualized costs between capital and O&M cost components would be similar to that of the California list wastes underground injection control rule (The underground injection rules are discussed later in this appendix.) The ratio of annual O&M costs to total annualized costs for the California list underground injection rule is 90.5 percent. Multiplying this ratio by the $94 million annualized cost produces an annual O&M cost estimate of $85 million and an annual capital cost estimate of $9 million. We then divided the annual capital cost estimate by the annualization factor to figure a total capital cost of $108 million. One-half of the capital cost estimate was placed in the year the rule went into effect (1987), and the other half two years later. Annual O&M costs were assumed to begin in year 1987.

Land Disposal Restrictions—Solvent and Dioxin Wastes

(a) Status: Final rule (51 FR 4057; November 7, 1986).

(b) Regulatory option: See 51 FR 4057.

(c) Data sources:

(1) *Regulatory Analysis of Restrictions on Land Disposal of Certain Solvent Waste*, Prepared for the US EPA Office of Solid Waste by Industrial Economics, Inc., November 1987.

(2) *Regulatory Analysis of Restrictions on Land Disposal of Certain Dioxin-Containing Wastes*, Prepared for the US EPA Office of Solid Waste by Industrial Economics, Inc., November 1987.

(d) Derivation and timing of estimates: The estimation procedure corresponds to the methodolgy discussed above for California list wastes.

Land Disposal Restrictions—First Third Wastes

(a) Status: Final rule (53 FR 17578; August 17, 1988).

(b) Regulatory option: See 53 FR 17578.

(c) Data source: *Regulatory Impact Analysis of the Land Disposal Restrictions on First Third Wastes*, Prepared for the US EPA Office of Solid Waste, by ICF, Inc., August 1988.

(d) Derivation and timing of estimates: The estimation procedure corresponds to the methodology discussed above for the California List waste rule.

Land Disposal Restrictions—Second Third Wastes

(a) Status: Final rule (54 FR 26594; June 23, 1989).

(b) Regulatory option: See 54 FR 26594.

(c) Data source: *Results of the Preliminary Analysis of the Proposed Second Third LDR Rule*, Memorandum from Ralph Braccio, Dan Pyne, Jean Tilly (ICF) and Barbara Hendricks (DPRA) to Bill Vocke (EPA), December 18, 1988.

(d) Derivation and timing of estimates: The derivation procedure corresponds to the methodology discussed above for the California list waste rule.

Land Disposal Restrictions—Third Third Wastes

(a) Status: Proposed rule (54 FR 48372; November 22, 1989). Expected finalization date: May 1990.

(b) Regulatory option: The rule will establish land disposal restrictions and treatment standards for the Third Third of scheduled wastes.

(c) Data source: *Regulatory Impact Analysis for Third Third Scheduled Wastes Proposed Rule*, Prepared for the US EPA Office of Solid Waste by ICF Inc., November 5, 1990.

(d) Derivation and timing of estimates: The derivation procedure corresponds to the methodology discused above for the California list waste rule.

Underground Injection Control: Land Disposal Restrictions (LDR) for Solvents and Dioxins, California List, First Third, Second Third, and Third Thirds Wastes

(a) Status: Solvents and Dioxins—Final rule (53 FR 28118; July 26, 1988). Cal. List and First Thirds—Final rule (53 FR 30908; August 16, 1988). Second Thirds—Final Rule (54 FR 26594: June 23, 1989). Third Thirds—Proposed Rule (54 FR 48372; November 22, 1989).

(b) Regulatory option: See 53 FR 28118, 53 FR 30908, 54 FR 26594 and 54 FR 48372.

(c) Data sources:

(1) *Regulatory Impact Analysis of Underground Injection Control Program: Proposed Hazardous Waste Disposal Injection Restricitions*, Prepared for the US EPA Office of Drinking Water by Temple, Barker & Sloan, Inc., July 24, 1987.

(2) *Regulatory Impact Analysis of Proposed Hazardous Waste Disposal Restrictions for Class I Injection of California List and First Third Wastes*, Prepared for the US EPA Office of Drinking Water by the Cadmus Group, Inc., December 4, 1987.

(3) *Draft Regulatory Impact Analysis of The Proposed Hazardous Waste Disposal Restrictions For Class I Injection of Third Third Wastes*, Prepared for the US EPA Office of Drinking Water by the Cadmus Group, Inc., August 18, 1989.

(4) *Second and Third Third Cost Estimates*, Memorandum to Bruce Kobelski (EPA) from Beverly Brown Cadorette (Cadmus), December 12, 1988.

(d) Derivation and timing of estimates: The methodology and data discussed below were used to derive costs for California List wastes underground injection restrictions. It corresponds

to the methodology used to calculate costs for each of the other underground injection provisions, which are not discussed.

Data Source 2 reports annual O&M costs as $5 million and capital and petition cost of $3 million for California list wastes. Capital costs were combined with petition costs to calculate total fixed costs. We assumed that half of the wastes affected would be granted a two year variance, and capital costs associated with these provisions would thus not be incurred until two years after the rule goes into effect. Total capital costs were then divided equally and one half was assumed to be incurred in the year the provision went final (1988) and the other half incurred two years later (1990).

Unlike the other underground injection provisions, the RIA for the Second Third wastes did not break costs into capital and O&M cost components, but rather only reported an annualized cost. Thus, the following methodolgy was used to derive capital and O&M costs for this rule. First, the average ratio between annual O&M costs and total annualized costs for the four other UIC rules was calculated. Annual O&M costs were found to be roughly 80 percent of the total annualized costs for these provisions. We then calculated O&M costs by taking 80 percent of the total annualized cost for the Second Third wastes as reported by Data Source 4. We then subtracted the resulting O&M cost estimate from the reported annualized cost to figure annual capital cost. The effect of amortization was eliminated to calculate total capital costs. As with the other underground injection provisions, capital cost was divided by two, and one-half placed in the year the rule was finalized and one-half two years later.

Toxicity Characteristics Rule

(a) Status: Proposed Rule: (51 FR 21648; June 13, 1986). Supplemental proposal: (53 FR 18024; May 19, 1988). Expected finalization date: 1990.

(b) Regulatory option: This rule would amend the hazardous waste identification regulations by introducing a new extraction procedure based on chronic toxicity reference levels combined with a compound-specific dilution/attenuation factor to calculate the regulatory level concentrations for individual toxicants.

(c) Data source: *Toxicity Characteristic Regulatory Impact Analysis, Final Report*, prepared for the US EPA by ICF Inc., March 1990.

(d) Derivation and timing of estimates: The data source reports annualized costs (calculated at 3 percent over 20 years) for compliance as $250 million, and annualized cost for surface impoundment closure as $150 million in 1988 dollars (or $236 and $141 million, respectively, in 1986 dollars). Using the professional judgement of Mark Ralston (EPA) and Chris Lough (DPRA), we assumed that 75 percent of the annual compliance cost estimate ($177 million) represents annual O&M costs, and the remainder ($59 million) represents annual capital costs. Based on the OPPE definition of capital, closure costs were assumed

to be annual O&M costs. Also, compliance capital costs were assumed to occur over a 20 year period and closure costs over the first five years after the rule goes into effect (assumed to be 1991). We then calculated the present value of compliance capital costs as $875 million. One-twentieth of this total capital cost estimate was used to represent compliance capital costs in each of the years 1991-2000. Annual compliance O&M costs of $177 million were assumed to begin in 1991 and remain at this level through year 2000. The present value of closure costs were computed as $2098 million. One-fifth of this estimate was attributed to O&M costs and placed in each of the years 1991-1995.

Location Standards Rule

(a) Status: Expected proposal date: Spring 1990.

(b) Regulatory option: Will set standards for the proper citing of hazardous waste treatment, strorage and disposal facilties, as well requirements for storage, transport, and removal of wastes, and facility closure.

(c) Data source: *Summary Regulatory Impact Analysis/Background Information Document for the Development of Subtitle C Location Standards Under Section 3004(o)(7) of RCRA*, Prepared for the US EPA by ICF, Inc., January 26, 1990.

(d) Derivation and timing of estimates: We characterized location standards cost components into capital and O&M costs as follows: Capital costs components were assumed to include site characterization; engineering demonstration; storage, transport and removal of wastes; closure of container storage units, and faciltiy closure. O&M costs include offsite disposal of wastes and extended post-closure care. For closure costs, we determined the lower- and upper-bound proportion of capital and O&M costs (based on the breakdown of closure cost components). We then determined the timing of when facilities will get their operating permits reviewed (location standards are imposed at the time of permit renewal) using a study of the review cycle for facilities on the permit track and on the closure track. Land based facilities are on a 5 year permit review cycle and non-land based facilities are on 10 year permit review cycle. We assumed that location standards would not go into effect until 1994, and that 80 percent of the costs are attributable to land based units and 20 percent to non-land based units (based on the breakdown of the costs of closure with waste removal). Based on the these assumptions, the timing of the imposition of location standards were determined. Using data on unit costs from the data source, we then multiplied the capital costs by the percentage of facilties assumed to comply with the location standards in each year using the estimated schedule. We assumed that facilities performing closure with waste removal took an average of 6 years to redispose wastes, and that for closure with wastes in place, facilities performed 15 years of off-site disposal in the lower bound and 5 years in the upper-bound. Using these assumptions, we spread O&M costs for closure with waste removal over six years, and O&M costs of closure with waste in place over 15 years in the lower-bound, and 5 years in the upper-bound. We assumed that no extended

post-closure care costs would be incurred prior to the year 2000 because all facilties affected by the location standards are assumed to undertake 30 years of post-closure care prior to starting extended post-closure care. Thus, these costs will be incurred well after the year 2000. We then took the mid-point of the cost ranges computed for capital and O&M costs under the lower- and upper-bound assumptions.

Corrective Action for Solid Waste Management Units (SWMU)

(a) Status: Expected proposal date: 1990.

(b) Regulatory option: The rule would set technical standards and procedures for conducting corrective action for injury to groundwater, soil, air and surface waters caused by significant releases from SWMUs at operating, closed, or closing RCRA facilities. For the cost estimates presented in this report, a mid-pint between the costs for regulatory option B and C were used. Under regulatory option B, corrective action would be triggered if pollutant concentrations were detected above health-based standards. This option requires the use of four remedies (excavation, excavation with recovery wells, capping, and recovery wells), one of which is simulated for every facilty that triggeres corrective action, regardless of the practicality or feasibility of the remedy. Regulatory option C differs from option B in that owners and operators would have considerable flexibility in choosing corrective action remedies.

(c) Data source: *Draft Regulatory Impact Analysis for the Proposed Rulemaking on Corrective Action for Solid Waste Management Units*, Prepared for the US EPA Office of Solid Waste by ICF, Inc., September 1988.

(d) Derivation and timing of estimates: Agency progress to date with corrective action indicates the initiation of an estimated 10 facilities in each of the years 1988-1990, an estimated 25 facilities in 1991, and 50 facilities in 1992. We assumed that the number of facilities initiating corrective action would increase by five percent per year from the year 1992 level. This produced a schedule of facility initiation for the years 1988- 2000 encompassing a total of 685 facilities. The data source (p. 7-7) gives the distribution of remedies selected under both regulatory options B and C. We averaged remedy selections for both options to produce the distribution chosen in a hypothical mid-case scenario. This procedure indicated that 6.1 percent of facilities would utilize excavation, 51.3 percent would use capping, 24.7 percent would use recovery wells, 15.2 percent would use excavation and recovery wells, and 2.9 percent would do nothing because clean-up is not feasible. Based on information from the data source on typical costs for each remedy allocated among capital costs, first year O&M costs, and ongoing O&M costs, we calculated mean costs for each cost component by remedy for the hypotheical mid-case scenario. Based on the distribution of remedies for the mid-case scenario, we created weighted average costs for each corrective action initiated. This produced per- facility capital costs of $1.2 million (primarily caps and well installation), year one O&M costs of $23.4 million (exclusively excavation), and

recurring O&M costs of $59 thousand (for ongoing operation of recovery wells). We then added $400 thousand as year one O&M costs to reflect investigative expenses. We then applied per-facility costs to the estimated schedule of facility corrective action initiations to produce capital and O&M cost estimates for each year over the period 1988-2000.

Minimum Technology Rule

(a) Status: Final codification rule (50 FR 28702; July 15, 1985).

(b) Regulatory option: See 50 FR 28702.

(c) Data source: *Hazardous Waste Management System; Final Codification Rule*, 50 FR 28702, July 15, 1985.

(d) Derivation and timing of estimates: For landfills, the preamble to the RIA section gave the following costs in 1984 dollars: annualized costs of $10.2 million (calculated at 3 percent over 20 years) and initial costs of $9.7 million. Costs were converted into 1986 dollars. We then calculated present value costs by backing out the annualization procedure, and then subtracted initial costs from the resulting estimate to isolate present value O&M costs. This estimate was then reannualized to figure annual O&M costs of $10 million per year for landfills. Capital costs were assumed to occur before 1986. For surface impoundments, the preamble to the RIA section says that total annualized costs are $53.2 million in 1984 dollars (calculated at 3 percent over 20 years). This was converted into a present value estimate in 1986 dollars ($845.7 million). The preamble also indicates that 46-79 percent of the inital cost is for early closure of of unlined surface impoundments, and the remaining for construction of new surface impoundments. Based on this and information indicating that few new surface impoundments are being built, we attributed 75 percent of the present value cost estimate to early closure and assumed these are O&M costs, and attributed 25 percent to new construction which were assumed to be capital costs. We then annualized closure costs to calculate annual O&M costs of $43 million for surface impoundments. This was added to the estimate of annual O&M costs for landfills and placed in each of the years 1986-2000. We assumed that one-fifth total capital costs for surface impoundments would be incurred in each of the years 1986-1990.

Small Quantity Generators Rule

(a) Status: Final rule (51 FR 10146; March 24, 1986).

(b) Regulatory option: See 51 FR 10146.

(c) Data source:

(1) *Hazardous Waste Management System: Final Codification Rule*, 50 FR 28702, July 15, 1985.

(2) *Report to Congress on Small Qunatity Generators of Hazardous Waste: Volume III*, US EPA, September 1986.

(d) Derivation and timing of estimates: Data Source 2 (Exhibits 6-1,6-2, and 6-3) reports initial and annualized costs for each of three parts of the rule: Part 262, Part 265, and Subpart I. We annualized the initial costs for each part (at 3 percent over 20 years) and then subtracted the resulting estimates from their corresponding total annualized cost estimates to compute annual O&M costs for each part of the rule. These were summed to figure total annual O&M costs, which were placed in each of the years 1986-2000. Initial costs were assumed to occur before 1986 and were thus not included.

Hazardous Waste Tanks

(a) Status: Final rule (51 FR 25422; July 14, 1986).

(b) Regulatory option: See 51 FR 25422.

(c) Data sources:

(1) *Cost Analysis of RCRA Regulations for Hazardous Waste Tank Facilities*, Prepared for the US EPA by ICF, Inc., June 1986.

(2) *Cost and Economic Impact Analysis of Proposed RCRA Hazardous Waste Accumulation Tank Regulations for 100-1,000 kg/mo. Generators*, Prepared for the US EPA by ICF, Inc., August 1986.

(d) Derivation and timing of estimates: Data Source 1 reports total annualized costs as $30 million (calculated using a 3 percent interest rate over 20 years). Using information from the 1986 RIA for the Small Quantity Generators rule, we estimated that 27 percent of total annualized cost, or $8 million, is annual capital cost, and the remaining $22 million is annual O&M cost. We assumed the one-fifth of total capital costs would be incurred in each of the years 1986-1990, and that constant annual O&M costs would be incurred in years 1986-2000.

5.3. Underground Storage Tanks

Underground Storage Tanks Containing Petroleum—Financial Responsibility Requirements

(a) Status: Final Rule (53 FR 43322; October 26, 1988).

(b) Regulatory option: See: 53 FR 43222.

(c) Data source: *Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks*, US EPA Office of Underground Storage Tanks, October 1988.

(d) Derivation and timing of estimates: See Appendix H.

Underground Storage Tanks Containing Petroleum or Hazardous Substances—Technical Requirements

(a) Status: Final rule (53 FR 37082; September 23, 1988).

(b) Regulatory option: See: 53 FR 37082.

(c) Data source: See Appendix H.

(d) Derivation and timing of estimates: See Appendix H.

5.4. Superfund

Superfund Site Clean-ups

(a) Status: This is an ongoing program. Revisions to the National Contingency Plan (NCP), which directs clean-up activities, were proposed on December 21, 1988 (53 FR 51394). Expected finalization date: 1990.

(b) Regulatory option: The cost estimates for future years reflect the new emphasis on treatment versus containment remedies set out in the proposed revisons to the NCP. The cost estimates for past years reflect the actual mix of treatment versus containment remedies used in those years.

(c) Data sources: See Appendix H.

(d) Derivation and timing of estimates: See Appendix H.

Land pollution rules not included in the data set.

Various new and forthcoming rules pursuant to Subtitle C of RCRA were excluded from the cost data set because adequate cost data could not be obtained. These include rules for which

cost analyses may have been performed, but detailed documentation of these analyses were not available. For the most part, however, these rules impose minor costs to the private sector. Such rules include, for example, the hazardous waste burning rule and amendments to emission standards for hazardous waste incinerators.

Other forthcoming Subtitle C rules for which cost data were not obtained include the UST containing hazardous substances financial responsibility rule and the corrective action rule for regulated hazardous waste management units, among others.

6. CHEMICAL REGULATIONS

6.1. Toxic Substances

Asbestos in Schools Rule

(a) Status: Final rule (52 FR 41826; October 30, 1987).

(b) Regulatory option: See 52 FR 41826.

(c) Data source: Sector Study municipal cost data base developed by Brett Snyder (Office of Policy Analysis) with assistance from Brian Muehling (Office of Toxic Substances, Economics and Technology Division).

(d) Derivation and timing of estimates: Cost tables prepared by Brian Muehling using Tables 14a,b, and c from the RIA were used by Data Source 1 to derive costs for different city size categories. These costs include per school capital costs for develoment of a management plan and asbestos removal and containment, and per school annual costs for inspection and sampling, operation and maintenance, and re-inspection. We aggregated the costs for different city size categories to calculate national capital and annual costs for the rule. We assumed the sampling and inspection costs would be incurred in years 1988 and 1989, and all capital costs would be incurred in equal increments over the years 1989-1992. O&M costs are assumed to phase-in with each increment of capital.

Asbestos in Products Ban/Phasedown

(a) Status: Final rule (54 FR 29460; July 12, 1989).

(b) Regulatory option: See 54 FR 29460.

(c) Data source: *Regulatory Impact Analysis of Controls on Asbestos and Asbestos Products: Volume I Technical Report*, Prepared for the US EPA Office of Toxic Substances by ICF, Inc., October 11, 1988.

(d) Derivation and timing of estimates: The data source (p. IV- 13) reports present value (3 percent over fifteen years) *social costs* derived using welfare analysis for Alternative J, low decline baseline scenario. (This regulatory option most closely resembles the final rule's requirements.) We derived annual industry costs for each year over the fifteen year period by eliminating the discounting factor and distributing the resulting cost estimates relating to specific product categories according to the various effective dates for their phasedown or ban.

7. MULTI-MEDIA REGULATIONS

Emergency Planning and Community Right to Know Program (EPCRA)

1. Emergency & Hazardous Chemical Inventory Forms and Community Right-to-Know Reporting Requirements; 2. Extremely Hazardous Substance List and Threshold Reporting Requirements; Emergency Planning and Release Quantification Requirements; 3. Toxic Chemical Release Reporting; and 4. Trade Secret Claims.

(a) Status: Final rules (52 FR 38344, October 15, 1987; 52 FR 13378, April 22, 1987; 53 FR 4500, February 16, 1988; and 53 FR 28772, July 29, 1988).

(b) Regulatory option: See above FR cites.

(c) Data source: *The Unified Title III Economic Analysis: Subject Paper on Facilities - Vol.1*, Prepared for the US EPA Office of Toxic Substances by ICF, Inc., January 8, 1988.

(d) Derivation and timing of estimates: The costs for all EPCRA regulations were derived from Tables G-1 to G-8 in Appendix G of Data Source 1. The capital costs represent one-time costs associated with regulation familiarity and recordkeeping setup; the annual costs are for annual reporting requirements. Following information from Data Source 1 (pp. 2-10 - 2-13), capital costs for the various EPCRA requirements were placed in years 1988, 1989, and 1990, and annual costs in years 1988 through year 2000.

Table A-1: AIR POLLUTION CONTROL CAPITAL COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
3.1	Air Pollution															
3.1.1	Stationary Sources															
	PM NAAQS		477	477	477											
	Lead NAAQS					106	106	106								
	Acid Rain (a)															
	Toxic Substances (a)															
	Stratospheric Ozone (b)															
	Total New Regs		477	477	477	106	106	106								
	Full Implementation															
	Ozone NAAQS: Attain (a)															
	TSDF															
	Muni. Landfills															
	Solvent Use															
	Marine Vessels															
	New CTG															
	Progress Req.															
	Full Implementation															
	Total Stationary		477	477	477	106	106	106								
3.1.2	Mobile Sources															
	New Regulations															
	Fuel Volatility															
	NOx and Particulates			96	97	97	147	151	156	186	191	197	203	210	216	223
	Diesel Fuel															
	Toxic Substances (a)															
	Total New Regs			96	97	97	147	151	156	186	191	197	203	210	216	223
	Full Implementation															
	Ozone NAAQS: Attain.															
	Fuel Volatility II															
	Evap./running losses															
	Tailpipe/useful life															
	Stage II															
	Basic I/M															
	Enhanced I/M															
	LDV NOx															
	Alt. Fuels															
	Full Implementation															
	Total Mobile			96	97	97	147	151	156	186	191	197	203	210	216	223
3.1.4	Total Air Pollution		477	573	574	203	253	257	156	186	191	197	203	210	216	223
3.2	Radiation															
	Radon Advisory	1	4	34	79	79	94	89	93	98	103	107	112	117	122	127
	Total Radiation	1	4	34	79	79	94	89	93	98	103	107	112	117	122	127
3.3	Total Air & Radiation	1	481	607	653	282	347	346	249	284	294	304	315	327	338	350

Footnotes to Table A-1

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

(a) Only annualized cost data that include amortized capital costs are available. These costs are reported in Table A-1A.

(b) Only social cost data derived from welfare analysis are available. These costs are reported in Table A-1A.

Table A-1A: AIR POLLUTION CONTROL OPERATING COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
3.1	Air Pollution															
3.1.1	Stationary Sources															
	PM NAAQS			17	35	52	52	52	52	52	52	52	52	52	52	52
	Lead NAAQS						10	20	29	29	29	29	29	29	29	29
	Acid Rain (a)										327	654	654	654	654	1,308
	Toxic Substances (a)								124	247	557	743	929	1,239	1,548	1,858
	Stratospheric Ozone (b)							5	5	63	66	70	74	79	448	641
	Total New Regs			17	35	52	62	77	210	391	1,031	1,548	1,738	2,053	2,731	3,888
	Full Implementation															
	Ozone NAAQS: Attain. (a)															
	TSDF								1,624	1,624	1,643	1,662	1,681	1,701	1,720	1,739
	Muni. Landfills								62	62	63	63	64	64	65	65
	Solvent Use								378	382	386	390	394	398	402	406
	Marine Vessels								39	40	41	42	43	43	44	45
	New CTG								374	380	386	392	398	403	409	415
	Progress Req.								565	565	565	941	1,317	1,692	2,068	2,444
	Full Implementation								3,042	3,053	3,084	3,490	3,897	4,301	4,708	5,114
	Total Stationary			17	35	52	62	77	3,252	3,444	4,115	5,038	5,635	6,354	7,439	9,002
3.1.2	Mobile Sources															
	New Regulations															
	Fuel Volatility				134	134	134									
	NOx and Particulates						241	259	265	272	279	287	295	305	314	325
	Diesel Fuel							225	173	117	56	31	6	(22)	(49)	(76)
	Toxic Substances (a)										700	1,400	2,100	2,800	2,800	2,800
	Total New Regs				134	134	375	484	438	389	1,035	1,718	2,401	3,083	3,065	3,049
	Full Implementation															
	Ozone NAAQS: Attain.															
	Fuel Volatility II								222	228	232	236	240	243	247	251
	Evap./running losses								57	58	58	59	59	60	60	61
	Tailpipe/useful life								436	440	444	448	452	456	460	464
	Stage II								108	112	116	120	124	127	131	135
	Basic I/M								65	66	67	68	69	70	71	72
	Enhanced I/M								69	70	71	72	73	75	76	77
	LDV NOx								369	371	372	374	375	377	378	380
	Alt. Fuels										145	145	145	145	145	
	Full Implementation								1,326	1,345	1,505	1,522	1,537	1,553	1,568	1,440
	Total Mobile				134	134	375	484	1,764	1,734	2,540	3,240	3,938	4,636	4,633	4,489
3.1.4	Total Air Pollution			17	169	186	437	561	5,016	5,178	6,655	8,278	9,573	10,990	12,072	13,491
3.2	Radiation															
	Radon Advisory			3	8	14	20	25	31	36	42	48	53	59	65	71
	Total Radiation			3	8	14	20	25	31	36	42	48	53	59	65	71
3.3	Total Air & Radiation			20	177	200	457	586	5,047	5,214	6,697	8,326	9,626	11,049	12,137	13,562

Footnotes to Table A-1A

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

(a) Represent annualized cost data that include amortized capital costs and annual operating and maintenance costs.

(b) Represent social cost data derived from welfare analysis.

Table A-2: WATER POLLUTION CONTROL CAPITAL COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
4.1	Water Quality															
	By Regulation															
	Municipal Pretreatment															
	Municipal Sewage Sludge							95								
	Municipal Stormwater					19	19	21								
	ELG: Chem. & Plastics			314	314	314										
	ELG: Offshore Oil & Gas															
	Total by Regulation			314	314	333	19	116								
	By Sector															
	Local Government					19	19	116								
	Private			314	314	314										
	Total By Sector			314	314	333	19	116								
	Full Implementation (Municipal Wastewater)					6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561
4.2	Drinking Water (a)															
	VOCS															
	Fluoride															
	Surface Water Treatment															
	Coliform															
	Phase II: IOCS & SOCS															
	Lead, Copper & Corrosion															
	Radionuclides															
	Disinfection															
	Phase IV: IOCS & SOCS															
	Total Drinking Water			36	73	80	379	865	1,175	1,381	1,690	1,787	1,358	639	225	225
	Drinking Water By Sector															
	Local Government			29	59	65	310	707	960	1,128	1,380	1,460	1,109	522	184	184
	Private			7	13	15	69	158	215	253	309	327	249	117	41	41
	Total By Sector			36	73	80	379	865	1,175	1,381	1,690	1,787	1,358	639	225	225

Footnotes to Table A-2

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

(a) Cost estimates for individual drinking water regulations are not available because the same control of techniques are often utilized to meet different drinking water chemical standards (*i.e.*, co-control for several chemicals inhibits accurate isolation of costs for individual rules).

Table A-2A: WATER POLLUTION CONTROL OPERATING COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
4.1	Water Quality															
	By Regulation															
	Municipal Pretreatment			2	5	7	10	10	10	10	10	10	10	10	10	10
	Municipal Sewage Sludge								33	33	33	33	33	33	33	33
	Municipal Stormwater					10	20	30	30	30	30	30	30	30	30	30
	ELG: Chem. & Plastics				137	274	412	412	412	412	412	412	412	412	412	412
	ELG: Offshore Oil & Gas						77	77	77	77	77	77	77	77	77	77
	Total by Regulation			2	142	291	519	529	562	562	562	562	562	562	562	562
	By Sector															
	Local Government			2	5	17	30	40	73	73	73	73	73	73	73	73
	Private				137	274	489	489	489	489	489	489	489	489	489	489
	Total By Sector			2	142	291	519	529	562	562	562	562	562	562	562	562
	Full Implementation (Municipal Wastewater)															
4.2	Drinking Water (a)															
	VOCS															
	Fluoride															
	Surface Water Treatment															
	Coliform															
	Phase II: IOCS & SOCS															
	Lead, Copper & Corrosion															
	Radionuclides															
	Disinfection															
	Phase IV: IOCS & SOCS															
	Total Drinking Water			89	178	179	319	519	580	691	878	953	990	1,143	1,259	1,259
	Drinking Water By Sector															
	Local Government			73	146	146	260	424	474	565	717	779	808	934	1,029	1,029
	Private			16	33	33	58	95	106	126	161	174	181	209	230	230
	Total By Sector			89	178	179	319	519	580	691	878	953	990	1,143	1,259	1,259

Footnotes to Table A-2A

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

(a) Cost estimates for individual drinking water regulations are not available because the same control of techniques are often utilized to meet different drinking water chemical standards (*i.e.*, co-control for several chemicals inhibits accurate isolation of costs for individual rules).

Table A-3: LAND POLLUTION CONTROL CAPITAL COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
5.1	Solid Waste															
	By Regulation															
	Mun. Landfill						877	877	877	877	877	877	877	877	877	877
	Mun. Comb. Ash & Air Stds						1,228	1,228								
	Used Oil							502	502	502	502					
	Total by Regulation						2,105	2,607	1,379	1,379	1,379	877	877	877	877	877
	By Sector															
	Local Government						2,105	2,105	877	877	877	877	877	877	877	877
	Private							502	502	502	502					
	Total By Sector						2,105	2,607	1,379	1,379	1,379	877	877	877	877	877
5.2	Hazardous Waste															
	Solvents & Dioxins LDR	261		261												
	California List LDR		54		54											
	First Thirds LDR			940	940	940										
	Second Thirds LDR				29	29	29									
	Third Thirds LDR					244	244	244								
	Underground Injection LDR			59	69	88	29	19								
	Toxicity Characteristics						59	59	59	59	59	59	59	59	59	59
	Location Standards									280	84	307	755	55	55	55
	Corrective Action			12	12	12	30	60	66	72	78	84	90	96	102	108
	Min. Technology	52	52	42	42	42										
	Small Qty Generators															
	Hazardous Waste Tanks	24	24	24	24	24										
	Total Hazardous Waste	337	130	1,338	1,170	1,379	391	382	125	411	221	450	904	210	216	222
	By Sector															
	EPA															
	State Government															
	Private	337	130	1,338	1,170	1,379	391	382	125	411	221	450	904	210	216	222
	Total By Sector	337	130	1,338	1,170	1,379	391	382	125	411	221	450	904	210	216	222
5.3	LUST															
	By Regulation															
	Financial Responsibility															
	Municipal						41									
	Private						806									
	Technical Requirements															
	Municipal				473	473	473	473	473	23	23	23	23	602	5	5
	Private				4,777	4,777	4,777	4,777	4,777	433	433	433	433	11,153	95	95
	Total by Regulation				5,250	5,250	6,097	5,250	5,250	456	456	456	456	11,755	100	100
	By Sector															
	Local Government				473	473	514	473	473	23	23	23	23	602	5	5
	Private				4,777	4,777	5,583	4,777	4,777	433	433	433	433	11,153	95	95
	Total By Sector				5,250	5,250	6,097	5,250	5,250	456	456	456	456	11,755	100	100

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

Table A-3A: LAND POLLUTION CONTROL OPERATING COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
5.1	Solid Waste															
	By Regulation															
	Mun. Landfill						196	196	196	196	196	196	196	196	196	196
	Mun. Comb. Ash & Air Stds								122	243	243	243	243	243	243	243
	Used Oil							77	77	77	77	77	77	77	77	77
	Total by Regulation						196	273	395	516	516	516	516	516	516	516
	By Sector															
	Local Government						196	196	318	439	439	439	439	439	439	439
	Private							77	77	77	77	77	77	77	77	77
	Total By Sector						196	273	395	516	516	516	516	516	516	516
5.2	Hazardous Waste															
	Solvents & Dioxins LDR	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
	California List LDR		95	95	95	95	95	95	95	95	95	95	95	95	95	95
	First Thirds LDR			720	720	720	720	720	720	720	720	720	720	720	720	720
	Second Thirds LDR				23	23	23	23	23	23	23	23	23	23	23	23
	Third Thirds LDR					322	322	322	322	322	322	322	322	322	322	322
	Underground Injection LDR			54	62	107	107	107	107	107	107	107	107	107	107	107
	Toxicity Characteristics						635	635	635	635	635	177	177	177	177	177
	Location Standards									11	14	25	55	57	59	24
	Corrective Action			234	235	236	588	1,175	1,295	1,416	1,537	1,658	1,779	1,901	2,023	2,145
	Min. Technology			53	53	53	53	53	53	53	53	53	53	53	53	53
	Small Qty Generators	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
	Hazardous Waste Tanks	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	Total Hazardous Waste	167	262	1,323	1,355	1,723	2,710	3,297	3,417	3,549	3,673	3,347	3,498	3,622	3,746	3,833
	By Sector															
	EPA		3	3	3	3	3	3	3	3	3	3	3	3	3	3
	State Government		9	9	9	9	9	9	9	5	5	5	5	5	5	5
	Private	167	250	1,311	1,343	1,711	2,698	3,285	3,405	3,541	3,665	3,339	3,490	3,614	3,738	3,825
	Total By Sector	167	262	1,323	1,355	1,723	2,710	3,297	3,417	3,549	3,673	3,347	3,498	3,622	3,746	3,833
5.3	LUST															
	By Regulation															
	Financial Responsibility															
	Municipal					25	25	34	34	34	7	7	7	7	7	7
	Private					513	513	530	531	531	145	145	146	147	147	147
	Technical Requirements															
	Municipal				80	131	131	131	131	23	23	23	23	23	7	7
	Private				778	1,669	1,669	1,669	1,669	406	406	406	406	406	106	106
	Total by Regulation				858	2,338	2,338	2,364	2,365	994	581	581	582	583	267	267
	By Sector															
	Local Government				80	156	156	165	165	57	30	30	30	30	14	14
	Private				778	2,182	2,182	2,199	2,200	937	551	551	552	553	253	253
	Total By Sector				858	2,338	2,338	2,364	2,365	994	581	581	582	583	267	267

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

Table A-4: CHEMICAL POLLUTION CONTROL CAPITAL COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
6.1	Toxic Substances															
	By Regulation															
	Asbestos in Schools				830	830	830	830								
	Asbestos in Products (a)															
	Total by Regulation				830	830	830	830								
6.2	By Sector															
	Local Government				830	830	830	830								
	Private															
	Total By Sector				830	830	830	830								

Footnotes to Table A-4

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

(a) Only social cost data derived from welfare analysis are available. These costs are reported in Table A-4A.

Table A-4A: CHEMICAL POLLUTION CONTROL OPERATING COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
6.1	Toxic Substances															
	By Regulation															
	Asbestos in Schools	6		80	80	64	128	191	255	255	255	255	255	255	255	255
	Asbestos in Products (a)				4	4	4	4	50	52	53	94	97	100	103	106
	Total by Regulation	6		80	84	68	132	195	305	307	308	349	352	355	358	361
6.2	By Sector															
	Local Government	6		80	80	64	128	191	255	255	255	255	255	255	255	255
	Private				4	4	4	4	50	52	53	94	97	100	103	106
	Total By Sector	6		80	84	68	132	195	305	307	308	349	352	355	358	361

Footnotes to Table A-4A

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

(a) Represent social cost estimates derived from welfare analysis.

Table A-5: MULTI-MEDIA CONTROL CAPITAL COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7.1	Multi-Media															
7.4	SARA Title III															
	Municipal			149												
	Private			1,716	371	1,519										
7.6	Total Multi-Media			1,865	371	1,519										

Footnotes to Table A-5

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

Table A-5A: MULTI-MEDIA CONTROL OPERATING COSTS FOR NEW REGULATIONS*

(millions of 1986 dollars)

Rpt Sec	Program/Regulation	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7.1	Multi-Media															
7.4	SARA Title III															
	Municipal				24	24	24	24	24	24	24	24	24	24	24	24
	Private			101	310	216	538	538	538	538	538	538	538	538	538	538
7.6	Total Multi-Media			101	334	240	562	562	562	562	562	562	562	562	562	562

Footnotes to Table A-5A

* Documentation for these estimates is provided in the regulation summaries in previous sections of this appendix.

APPENDIX B
ESTIMATION OF STATIONARY SOURCE AIR POLLUTION CONTROL COSTS

This appendix provides documentation for the derivation of the private, state, and local stationary source air pollution control costs by funding source, and the private air costs by pollutant, which are presented in Chapter 3.

B.1. DATA SOURCES

Private, state, and local stationary source air pollution control costs were derived from two sources:

- A series of articles entitled, "Pollution Abatement and Control Expenditures" published annually in the *Survey of Current Business* by the Bureau of Economic Analysis (BEA), U.S. Department of Commerce. (This source is hereafter referred to as the "BEA data"); and

- A series of articles entitled, "Pollution Abatement Costs and Expenditures" published annually in the *Current Industrial Reports* by the Bureau of the Census, U.S. Department of Commerce. (This source is hereafter referred to as the "Census data.")

The BEA data contains stationary source air pollution control capital costs (capital account) and O&M costs (current account) for private manufacturing and non-manufacturing establishments, as well as state and local governments over each of the years 1972-1987. The BEA data served as the primary data source for the air pollution control costs by funding source presented in Chapter 3. Table B-1 presents the BEA estimates for private costs in current dollars, and Table B-9 shows state and local costs.

The Census data, on the other hand, is much more limited. Census gathered costs over the years 1973-1986 for private manufacturing establishments only. Additionally, the Census data contains capital costs but not O&M costs. The one feature of the Census data that makes it useful for the purposes of this report is that it breaks down air costs by pollutant controlled, which the BEA does not. Table B-2 shows the Census manufacturing capital costs estimates by pollutant in current dollars. The use of the Census data to break down total private air costs by pollutant is discussed below.

B.2. PRIVATE COSTS BY POLLUTANT

To break down private costs by pollutant controlled, several manipulations of both the BEA and Census data were required. First, the Census data needed to be standardized due to inconsistency in the way Census reports costs by pollutant for different years. For years 1983-1986, costs are broken down into the following pollutant categories:

- Particulates;
- Sulfur oxides;
- Nitrogen oxides and carbon monoxide;
- Hydrocarbons (volatile organic compounds);
- Lead;
- Toxics; and
- Other pollutants.

For years prior to 1983, however, costs are broken out separately for only two of the above pollutants—particulates and sulfur oxides. Two other categories are also included, but both of these combine costs for more than one pollutant. One category includes combined costs for nitrogen oxides, hydrocarbons, and carbon monoxide; the other includes costs for heavy metals, radioactive and toxic substances, and other pollutants.

For the purposes of this report, we wished to show costs for each year over the period 1972-1987 broken down by each of the seven pollutant categories provided by the Census data on manufacturing capital costs for years 1983-1986. In order to do this, we calculated the relative shares of total year 1983 manufacturing capital costs accounted for by each of the individual pollutants within each of the two categories that combine costs for more than one pollutant. These relative shares were then applied to total costs for each category of combined pollutant costs in previous years to calculate costs for individual pollutants in years prior to 1983. This method is summarized in Table B-2; the resulting capital cost estimates by pollutant for manufacturing industries (in current dollars) are presented in Table B-3.

A second manipulation of the data was required to derive costs by pollutant for non-manufacturing industries, which are not provided by the Census data. To do this, we assumed that the proportion of total non-manufacturing air capital costs (from the BEA data) accounted for by each of the seven pollutants corresponds to that given by the Census data for manufacturing industries over each of the years 1972-1987. The factors used in this derivation are presented in Table B-8. The resulting estimates of total private capital costs by pollutant are presented in Table B-4 (current dollars) and Table B-5 (constant 1986 dollars).

A final adjustment was required to show O&M costs by pollutant, which were not reported by either of the data sources. To do this, we assumed that the proportion of total O&M costs accounted for by each pollutant corresponds to that given by our calculations for total capital costs in each respective year. This enabled us to calculate O&M costs by pollutant for total private stationary source air costs for each year over the period 1972-1987. The resulting estimates of private O&M costs by pollutant are shown in Table B-6 (current dollars) and Table B-7 (constant 1986 dollars).

Due to the assumptions needed to produce a consistent set of private costs for different pollutants, the estimates of costs broken down by pollutant controlled should be viewed as highly speculative.

B.3. STATE AND LOCAL COSTS

State and local stationary source air pollution control costs are presented in Table B-9 (constant dollars) and Table B-10 (current dollars). These were derived from the BEA data. The data sources did not include any information on state and local costs broken down by pollutant, so no such estimates are presented in this report.

Table B-1: PRIVATE EXPENDITURES FOR AIR POLLUTION CONTROL

(millions of current dollars)

Line	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	CAPITAL EXPENDITURES																
2	Plant & Equip Expend	2,172	2,968	3,328	3,914	3,798	3,811	3,977	4,613	5,051	5,135	5,086	4,155	4,282	4,141	4,090	4,179
3	OPERATING EXPENDITURES																
4	Pollution Abatement																
5	Manufacturing Estabs	772	812	960	1,200	1,508	1,804	2,038	2,337	2,709	3,068	2,832					
6	Priv Owned Elec Utils	279	361	593	633	633	779	944	1,382	1,780	1,851	1,838					
7	Other Nonmanufacturing	213	234	286	362	466	580	670	780	931	1,069	1,004					
8	Total Pollution Abatement	1,264	1,407	1,839	2,195	2,607	3,163	3,652	4,499	5,420	5,988	5,674	6,149	6,690	6,997	7,072	7,763
9	Research and Development	411	451	492	466	543	654	789	924	869	852	912	1,315	1,359	1,427	1,499	1,574
10	Total Private Operating	1,675	1,858	2,331	2,661	3,150	3,817	4,441	5,423	6,289	6,840	6,586	7,464	8,049	8,424	8,571	9,337

Footnotes for Table B-1 by Line

1972-1982 Figures from *Survey of Current Business*, July 1986
2 Business, on capital account, plant and equipment expenditures, Table 10, line 4
5 Business, on current account, private, manufacturing establishments, Table 10, line 10
6 Business, on current account, private, privately owned electric utility establishments, Table 10, line 11
7 Business, on current account, private, other nonmanufacturing establishments, Table 10, line 12
8 Sum of lines 5, 6, and 7
9 Pollution abatement and control, research and development, private, Table 9, line 20
10 Sum of lines 8 and 9

1983-1987 Figures from *Survey of Current Business*, June 1989
2 Business, on capital account, pant and equipment expenditures, Table 7, no line number
5 Line 8 consists of manufacturing companies, privately and cooperatively owned electric utilities, and other nonmanufacturing companies
6 Line 8 consists of manufacturing companies, privately and cooperatively owned electric utilities, and other nonmanufacturing companies
7 Line 8 consists of manufacturing companies, privately and cooperatively owned electric utilities, and other nonmanufacturing companies
8 Business, on current account, private, operation of plant and equipment, Table 7, no line number
9 Pollution abatement and control, research and development, private, Table 6, line 20
10 Sum of lines 8 and 9

Table B-2: PRIVATE MANUFACTURING CAPITAL EXPENDITURES BY POLLUTANT

(millions of current dollars)

Line	Pollutant	Factors	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987[a]
1	Particulates		N/A	836	1,074	1,299	1,044	983	1,056	1,191	1,114	1,181	851	453	497	579	541	N/A
2	Sulfur Oxides		N/A	312	438	503	370	290	288	311	329	338	456	247	176	122	177	N/A
3	NOx and CO	0.248	N/A	163	234	272	237	236	339	383	496	496	348	53	34	49	64	N/A
4	Hydrocarbons/VOCs	0.752	N/A	*	*	*	*	*	*	*	*	*	*	161	195	355	493	N/A
5	Lead	0.073	N/A	*	*	*	*	*	*	*	*	*	*	8	10	48	50	N/A
6	Hazardous	0.252	N/A	*	*	*	*	*	*	*	*	*	*	29	46	38	50	N/A
7	Other	0.675	N/A	107	202	162	148	142	170	187	167	175	173	76	80	100	88	N/A
8	Total Private Mfg		1,418	1,948	2,236	1,798	1,652	1,854	2,072	2,105	2,190	1,828	1,027	1,037	1,292	1,463	N/A	

Footnotes for Table B-2

Private capital expenditures for air pollution control taken from census data, U.S. Department of Commerce, Bureau of the Census, *Pollution Abatement Costs and Expenditures* (PACE) for the years 1973-1986. Census data were not published prior to 1973. Survey for 1987 was not taken.

1973-1982 figures were taken from Table 2A, column “Capital expenditures, by air pollutants abated” (1979 figures are from Table 3A):
- Line 1: sub-column “Particulates”
- Line 2: sub-column “Sulfur oxides”
- Line 3: sub-column “Nitrogen oxides, hydrocarbons, carbon monoxide”
- Line 4: Not included in census data
- Line 5: Not included in census data
- Line 6: Not included in census data
- Line 7: sub-column “Heavy metals, radioactive and toxic substances, and other”

1983-1986 figures were taken from Table 3A, column “Air,” sub-column “By type of pollutant abated”:
- Line 1: sub-column “Particulates”
- Line 2: sub-column “Sulfur oxides”
- Line 3: sub-column “Nitrogen oxides and carbon monoxide”
- Line 4: sub-column “Hydrocarbon volatile organic compounds”
- Line 5: sub-column “Lead”
- Line 6: sub-column “Hazardous air pollutants”
- Line 7: sub-column “Other”

Factors were obtained in the following manner:

Line 3: Line 3 (1983) divided by the sum of Lines 3 and 4 (1983)
Line 4: Line 4 (1983) divided by the sum of Lines 3 and 4 (1983)
Line 5: Line 5 (1983) divided by the sum of Lines 5 - 7 (1983)
Line 6: Line 6 (1983) divided by the sum of Lines 5 - 7 (1983)
Line 7: Line 7 (1983) divided by the sum of Lines 5 - 7 (1983)

[a] Census data were not collected for 1987.

Table B-3: PRIVATE MANUFACTURING CAPITAL EXPENDITURES BY POLLUTANT

(millions of current dollars)

Line	Pollutant	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	Particulates	N/A	836	1,074	1,299	1,044	983	1,056	1,191	1,114	1,181	851	453	497	579	541	N/A
2	Sulfur Oxides	N/A	312	438	503	370	290	288	311	329	338	456	247	176	122	177	N/A
3	NOx and CO	N/A	40	58	68	59	59	84	95	123	123	87	53	34	49	64	N/A
4	Hydrocarbons/VOCs	N/A	122	175	204	178	177	255	288	373	373	262	161	195	355	493	N/A
5	Lead	N/A	8	15	12	11	10	13	14	12	13	13	8	10	48	50	N/A
6	Hazardous	N/A	27	51	41	37	36	43	47	42	44	44	29	46	38	50	N/A
7	Other	N/A	72	136	109	100	96	115	126	113	118	117	76	80	100	88	N/A
8	Total Private Mfg	N/A	1,418	1,948	2,236	1,798	1,652	1,854	2,072	2,105	2,190	1,828	1,027	1,037	1,292	1,463	N/A

Footnotes for Table B-3

Table B-3 is a recapitulation of Table B-2 with the following exceptions:

Figures for 1973-1982 from Line 3, Table B-2, were distributed between Lines 3 and 4, Table B-3
Line 3, Table B-3, was obtained by multiplying Line 3, Table B-2, by .248 (the factor in Line 3, Table B-2, column “Factors”)
Line 4, Table B-3, was obtained by multiplying Line 3, Table B-2, by .752 (the factor in Line 4, Table B-2, column “Factors”)

Figures for 1973-1982 from Line 7, Table B-2, were distributed among Lines 5, 6 and 7, Table B-3
Line 5, Table B-3, was obtained by multiplying Line 7, Table B-2, by .073 (the factor in Line 5, Table B-2, column “Factors”)
Line 6, Table B-3, was obtained by multiplying Line 7, Table B-2, by .252 (the factor in Line 6, Table B-2, column “Factors”)
Line 7, Table B-3, was obtained by multiplying Line 7, Table B-2, by .675 (the factor in Line 7, Table B-2, column “Factors”)

Table B-4: TOTAL PRIVATE CAPITAL EXPENDITURES BY POLLUTANT

(millions of current dollars)

Pollutant	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1 Particulates	N/A	1,751	1,835	2,274	2,205	2,269	2,265	2,652	2,672	2,770	2,367	1,834	2,053	1,858	1,513	1,546
2 Sulfur Oxides	N/A	653	749	880	781	670	619	693	789	792	1,268	1,000	727	391	496	506
3 NOx and CO	N/A	85	99	118	124	135	181	212	296	289	241	215	138	156	178	182
4 Hydrocarbons/VOCs	N/A	256	300	358	375	409	547	641	894	874	728	650	803	1,139	1,378	1,407
5 Lead	N/A	16	25	21	23	24	27	30	29	30	35	34	41	154	141	144
6 Hazardous	N/A	56	87	71	79	83	92	105	101	103	121	115	188	122	139	142
7 Other	N/A	151	233	191	211	222	247	280	270	276	325	309	332	322	246	251
8 Total Private Capital	2,172	2,968	3,328	3,914	3,798	3,811	3,977	4,613	5,051	5,135	5,086	4,155	4,282	4,141	4,090	4,179
9 Total Priv Cap (Checksum)	N/A	2,968	3,328	3,914	3,798	3,811	3,977	4,613	5,051	5,135	5,086	4,155	4,282	4,141	4,090	4,179

Footnotes for Table B-4

Total Private Capital expenditures (Line 8, Table B-4) were multiplied by factors in Table B-8 to distribute expenditures among pollutants in direct ratio to the percentage of expenditure per pollutant from census data.

Table B-5: TOTAL PRIVATE CAPITAL EXPENDITURES BY POLLUTANT

(millions of 1986 dollars)

Pollutant	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1 Particulates	N/A	3,911	3,640	4,058	3,708	3,608	3,364	3,608	3,327	3,161	2,563	1,953	2,126	1,887	1,513	1,525
2 Sulfur Oxides	N/A	1,458	1,485	1,571	1,314	1,065	919	943	982	904	1,374	1,064	752	397	496	499
3 NOx and CO	N/A	189	197	211	209	215	269	288	368	330	261	229	143	158	178	179
4 Hydrocarbons/VOCs	N/A	571	595	638	631	651	813	872	1,113	997	789	692	832	1,157	1,378	1,388
5 Lead	N/A	37	50	37	39	38	40	41	37	34	38	36	42	156	141	142
6 Hazardous	N/A	126	173	127	132	132	137	142	126	118	131	123	195	123	139	140
7 Other	N/A	336	462	341	354	352	366	381	336	315	352	329	343	327	246	248
8 Total Private Capital	4,994	6,628	6,601	6,983	6,387	6,061	5,908	6,276	6,288	5,860	5,508	4,425	4,433	4,207	4,090	4,122
9 Fixed-weighted indexes	0.435	0.448	0.504	0.560	0.595	0.629	0.673	0.735	0.803	0.876	0.923	0.939	0.966	0.984	1.000	1.014

Footnotes for Table B-5

Figures in Table B-5 were indexed to 1986 dollars by dividing each figure in Table B-4 by the fixed-weighted price index for the given year (Line 9, Table B-5).

Table B-6: TOTAL PRIVATE OPERATING EXPENDITURES BY POLLUTANT

(millions of current dollars)

Pollutant	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1 Particulates	N/A	1,096	1,285	1,546	1,829	2,272	2,529	3,117	3,327	3,690	3,065	3,294	3,859	3,779	3,171	3,454
2 Sulfur Oxides	N/A	409	524	599	648	671	691	815	982	1,056	1,642	1,796	1,366	796	1,038	1,131
3 NOx and CO	N/A	53	69	80	103	136	202	249	368	385	312	386	260	316	373	406
4 Hydrocarbons/VOCs	N/A	160	210	243	311	410	611	754	1,113	1,164	943	1,167	1,510	2,317	2,887	3,145
5 Lead	N/A	10	18	14	19	24	30	36	37	40	46	60	77	313	295	322
6 Hazardous	N/A	35	61	48	65	83	103	123	126	137	157	207	353	247	292	318
7 Other	N/A	94	163	130	175	222	275	329	336	368	421	554	624	655	515	561
8 Total Private Operating	1,675	1,858	2,331	2,661	3,150	3,817	4,441	5,423	6,289	6,840	6,586	7,464	8,049	8,424	8,571	9,337
9 Total Priv Oper (Checksum)	N/A	1,858	2,331	2,661	3,150	3,817	4,441	5,423	6,289	6,840	6,586	7,464	8,049	8,424	8,571	9,337

Footnotes for Table B-6

Factors in Table B-8 were applied to Total Private Operating Expenditures (BEA data, Line 8, Table B-6), to distribute expenditures among pollutants in direct ratio to the percentage of expenditure per pollutant from census data. This was accomplished by multiplying annual Total Private Operating (Line 8, Table B-6) times factors per pollutant in Table B-8.

Table B-7: TOTAL PRIVATE OPERATING EXPENDITURES BY POLLUTANT

(millions of 1986 dollars)

Pollutant	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1 Particulates	N/A	3,240	2,768	3,047	3,446	3,944	4,096	4,240	3,742	3,743	3,043	3,235	3,699	3,550	3,171	3,400
2 Sulfur Oxides	N/A	1,208	1,129	1,179	1,221	1,164	1,119	1,108	1,105	1,071	1,631	1,764	1,309	748	1,038	1,113
3 NOx and CO	N/A	157	150	158	194	235	327	339	414	390	310	379	249	297	373	400
4 Hydrocarbons/VOCs	N/A	473	452	479	587	712	990	1,025	1,252	1,181	937	1,146	1,448	2,177	2,887	3,095
5 Lead	N/A	30	38	28	36	42	49	49	41	41	45	59	74	294	295	317
6 Hazardous	N/A	104	131	95	123	144	167	167	141	139	156	203	339	232	292	313
7 Other	N/A	279	352	256	329	385	446	448	378	373	418	545	598	615	515	552
8 Total Private Operating	5,400	5,491	5,021	5,243	5,935	6,626	7,194	7,377	7,072	6,938	6,540	7,331	7,715	7,914	8,571	9,189
9 Fixed-weighted indexes	0.310	0.338	0.464	0.508	0.531	0.576	0.617	0.735	0.889	0.986	1.007	1.018	1.043	1.064	1.000	1.016

Footnotes for Table B-7

Figures in Table B-7 were indexed to 1986 dollars by dividing each figure in Table B-6 by the fixed-weighted price index for the given year (Line 9, Table B-7).

Table B-8: FACTORS USED TO DISTRIBUTE TOTALS ACROSS POLLUTANTS

Pollutant	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1 Particulates	N/A	0.590	0.551	0.581	0.581	0.595	0.569	0.575	0.529	0.539	0.465	0.441	0.479	0.449	0.370	0.370
2 Sulfur Oxides	N/A	0.220	0.225	0.225	0.206	0.176	0.156	0.150	0.156	0.154	0.249	0.241	0.170	0.094	0.121	0.121
3 NOx and CO	N/A	0.029	0.030	0.030	0.033	0.036	0.045	0.046	0.059	0.056	0.047	0.052	0.032	0.038	0.043	0.043
4 Hydrocarbons/VOCs	N/A	0.086	0.090	0.091	0.099	0.107	0.138	0.139	0.177	0.170	0.143	0.156	0.188	0.275	0.337	0.337
5 Lead	N/A	0.006	0.008	0.005	0.006	0.006	0.007	0.007	0.006	0.006	0.007	0.008	0.010	0.037	0.034	0.034
6 Hazardous	N/A	0.019	0.026	0.018	0.021	0.022	0.023	0.023	0.020	0.020	0.024	0.028	0.044	0.029	0.034	0.034
7 Other	N/A	0.051	0.070	0.049	0.055	0.058	0.062	0.061	0.053	0.054	0.064	0.074	0.077	0.078	0.060	0.060
8 Total	N/A	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Footnotes for Table B-8

1 Particulates (Line 1, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)
2 Sulfur Oxides (Line 2, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)
3 NOx and CO (Line 3, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)
3 Hydrocarbons/VOCs (Line 4, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)
4 Lead (Line 5, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)
1 Hazardous figures (Line 6, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)
1 Other (Line 7, Table B-3) divided by Total Private Mfg (Line 8, Table B-3)

Figures for 1987 were calculated in the same proportions as 1986 since a 1987 survey was not conducted.

Table B-9: STATE AND LOCAL AIR POLLUTION CONTROL COSTS

(millions of current dollars)

Line	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	State & Local Capital																
1	Publ-owned elec utilities	63	82	104	102	156	197	205	285	398	451	508	422	416	328	312	277
	State & Local Operating																
2	Pollution abatement	0	0	0	1	1	1	0	0	0	0	0	4	14	12	14	15
3	Regulation & monitoring	95	115	131	139	135	161	183	200	207	226	230	239	250	250	307	300
4	Research & development	17	6	7	8	6	7	8	7	5	0	2	6	4	3	4	2
5	Publ-owned elec utilities	23	29	56	45	58	60	72	106	148	135	141	143	147	189	182	192
6	Total St & Local O&M	135	150	194	193	200	229	263	313	360	361	373	392	415	454	507	509
7	Fixed-weighted indexes	0.393	0.418	0.493	0.555	0.591	0.631	0.674	0.740	0.817	0.890	0.943	0.956	0.989	0.998	1.000	1.004

Footnotes for Table B-9

1972-1982 Figures from *Survey of Current Business*, July 1986

1 Government, government enterprise fixed capital, publicly owned electric utilities, Table 10, line 27
2 Pollution abatement and control, pollution abatement, government, state and local, Table 9, line 14
3 Pollution abatement and control, regulation and monitoring, state and local, Table 9, line 18
4 Pollution abatement and control, research and development, state and local, Table 9, line 22
5 Business, on current account, government enterprise, publicly owned electric utilities, Table 10, line 16
6 Sum of lines 2 - 5

1983-1987 Figures from *Survey of Current Business*, June 1989

1 Government, government enterprise fixed capital, publicly owned electric utilities, Table 7, no line number
2 Pollution abatement and control, pollution abatement, government, state and local, Table 7, no line number
3 Pollution abatement and control, regulation and monitoring, state and local, Table 7, no line number
4 Pollution abatement and control, research and development, state and local, Table 7, no line number
5 Business, on current account, government enterprise, publicly owned electric utilities, Table 7, no line number
6 Sum of lines 2 - 5

Table B-10: STATE AND LOCAL AIR POLLUTION CONTROL COSTS

(millions of 1986 dollars)

Line	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	State & Local Capital																
1	Publ-owned elec utilities	160	196	211	184	264	312	304	385	487	507	539	442	421	329	312	276
	State & Local Operating																
2	Pollution abatement	0	0	0	2	2	2	0	0	0	0	0	4	14	12	14	15
3	Regulation & monitoring	242	275	266	250	228	255	272	270	253	254	244	250	253	250	307	299
4	Research & development	43	14	14	14	10	11	12	9	6	0	2	6	4	3	4	2
5	Publ-owned elec utilities	59	69	114	81	98	95	107	143	181	152	150	150	149	189	182	191
6	Total St & Local O&M	343	359	394	348	338	363	390	423	441	406	396	410	420	455	507	507

Footnotes for Table B-10

Figures in Table B-10 were indexed to 1986 dollars by dividing each figure in Table B-9 by the fixed-weighted price index for the given year (Line 7, Table B-9).

APPENDIX C
ESTIMATION OF MOBILE SOURCE EMISSIONS CONTROL COSTS

This appendix provides background documentation and component costs for the mobile source air pollution control cost estimates listed and discussed in Chapter 3. The derivation of the cost estimates is discussed below; this is followed by a set of data tables C-1 through C-17 that show the various components of mobile source costs.

The mobile source costs were derived using a special EPA analysis instead of the Commerce Department "Pollution Abatement and Control Expenditure" (PACE) reports. The data sources used in the cost derivations include EPA Regulatory Impact Analyses (RIAs) and other EPA reports. These are listed at the end of the discussion that follows. The estimated mobile source costs represent the direct pollution control compliance costs—both capital and operation and maintenance costs—borne by purchasers and users of mobile sources equipped with such controls. Total capital and costs for all mobile sources are shown in Table C-1.

C.1. GENERAL METHODOLOGY

The basic approach used to estimate the costs of controlling pollution emissions from motor vehicles was to calculate the purchase price and operation and maintenance (O&M) cost premiums associated with vehicles equipped with pollution abatement controls over the costs for vehicles not equipped with such controls. Calculations of both capital expenditures and O&M costs were made for each of several vehicle classes. Capital expenditures were annualized using three different capital amortization rates—three, seven, and ten percent, and an assumed capital life of 10 years. Annualized capital costs were added to annual O&M costs to calculated total annualized costs. Only the seven percent annualization is shown in this appendix. Other annualized costs are shown in Tables 3-3C through 3-3H.

The methodology used to project future costs for existing mobile source regulations differed from the projection methodology used for most other programs included in this report. Rather than using regression models to extrapolate historical cost data, future mobile source costs were calculated by multiplying unit vehicle pollution control hardware cost and O&M cost estimates by estimates of projected vehicle production and use levels, respectively, in future years for each vehicle class.

C.1.1. *New Regulation Costs*

The cost for new regulations that were not fully implemented by the end of 1988 were added to the projected future costs associated with established mobile source regulations. These include: oxides of nitrogen and particulate emissions tailpipe standards on light-duty trucks and heavy-duty engines; the diesel fuel sulfur content standard; and the fuel volatility rule, which is intended to limit the evaporation of volatile organics from gasoline. The costs associated with these regulations are broken out in Table C-15. These regulation costs are also broken down by the pollutants they are

intended to control, which are shown in Table C-16. For regulations aimed at more than one pollutant, costs were apportioned equally between the two pollutants. The data show that the main focus of new regulatory initiatives is on the control of precursors to ozone formation and emissions of particulate matter.

C.1.2. *Full Implementation Costs*

Costs associated with fully implementing certain existing regulations and programs are also included. These costs are associated with the additional efforts required to meet the national ambient air quality standard (NAAQS) for ozone. Table C-17 lists the mobile source measures that are included in the Administration's proposed strategy for achieving the ozone NAAQS, and the best available data on their costs. (These were obtained from Data Sources 18, 19, and 20 listed at the end of the narrative.) Since these measures are currently being debated as part of Clean Air Act amendments, they are subject to change pending final legislation.

C.2. COSTS BY VEHICLE CLASS

The mobile source analysis is organized according to the following vehicle classes in the sections listed:

C.2.1. Light-duty vehicles,
C.2.2. Trucks, and
C.2.3. Motorcycles and aircraft.

C.2.1. *Light-Duty Vehicles*

Costs for light-duty vehicles (passenger cars) are summarized in Table C-2; supporting detail is given in Table C-10. Total historical and projected future capital expenditures for all mobile source emission control are associated primarily with pollution abatement equipment on passenger cars, which comprise the bulk of all mobile sources of pollution. These capital costs reflect increasingly stringent regulatory requirements and improvements in pollution control technologies over time. Each of the following devices have been used at one time or another dating back to the Clean Air Act Amendments of 1965: air pumps, exhaust-gas recirculation valves, high altitude controls, evaporative emissions controls, and catalysts. The cost estimates for each component were computed on a per-vehicle basis by engineering cost analyses commissioned by EPA or completed in-house. The resulting per-vehicle capital costs were multiplied by vehicle production estimates to determine annual capital costs for each year.

Costs for operation and maintenance (O&M) of emission abatement devices include maintenance costs, fuel price penalty costs, and fuel consumption penalty costs. Operating costs per vehicle were multiplied by total vehicles in use to determine annual cost. Each of the three types of O&M costs are shown in Table C-2 and discussed below.

Total mobile source maintenance costs include the costs of maintaining pollution control equipment plus the cost of vehicle inspection/maintenance programs. Table C-2 shows that pollution controls have resulted in a net maintenance cost savings since 1975, the year that catalytic devices were first required on passenger vehicles. Catalysts require the use of unleaded fuel which is more beneficial for a vehicle than leaded gasoline. The use of unleaded fuels increases the longevity of exhaust systems and spark plugs, thus reducing maintenance costs. This cost savings was added to the cost of inspection/maintenance activities which includes the fee applied to every vehicle tested plus a weighted average cost of repair for those vehicles failing inspection.

The second O&M component—the fuel price penalty—reflects the price differential between unleaded and leaded gasoline. Historically, the price of unleaded fuel has been two to 3.5 cents per gallon higher than the price of leaded fuel. However, EPA estimates that by 1990 no significant price differential will exist between unleaded and leaded fuels; thus, no operating costs will be associated with fuel price penalty in years 1990-2000. The third component of mobile source O&M costs—fuel economy penalty—exists because vehicles with pollution control equipment get lower gas mileage than comparable vehicles without such controls. As shown in Tables C-2, this fuel economy penalty comprised the largest component of total operating costs until the late 1970s, although it declined over the period 1975-1980 as cars became more fuel efficient. EPA estimates that in 1982, the penalty became a net benefit as the change to a three-way catalyst in 1980 eventually made vehicles with pollution controls more fuel efficient than vehicles not equipped with controls.

As shown in Table C-2, the estimated switch in the maintenance and fuel economy O&M components from positive to negative costs leads to an overall net mobile source O&M cost savings in the year 1989. Savings from these two components coupled with the elimination of the fuel price penalty in 1990, are estimated to increase overall O&M savings significantly over the period 1990-2000. This greatly lowers the estimates of total annualized costs for mobile sources. It should be noted that other sources of mobile source cost estimates—such as the Commerce Department PACE reports—do not recognize any beneficial effects of pollution control devices on O&M costs, and thus report significantly higher overall costs for mobile source pollution control.

The only new regulation expected to affect passenger car costs is the fuel volatility rule. The cost for this rule was subtracted from projected future O&M cost savings for light-duty vehicles.

C.2.2. *Trucks*

The discussion of trucks is divided into five classes based on gross vehicle weight. They are discussed in the sections listed:

C.2.2.1. Light-duty trucks weighing 0-6,000 pounds (LDT1) and light-duty trucks weighing 6,000-8,500 pounds (LDT2),

C.2.2.2. Heavy-duty gasoline engine vehicles weighing 8,500-10,000 pounds (HDGE1),

C.2.2.3. Heavy-duty gasoline engine vehicles weighing more than 10,000 pounds (HDGE2), and

C.2.2.4. Heavy-duty diesel engine vehicles weighing more than 10,000 pounds (HDDE).

Capital and O&M cost calculations for trucks parallel those for light-duty vehicles, with the primary differences being: 1) the schedule for implementation of regulatory requirements; and 2) the unit costs for pollution abatement devices. Differences specific to particular classes of trucks are discussed below.

C.2.2.1. LDT1 and LDT2

The control costs for LDT1 and LDT2 are summarized in Tables C-3 and C-4; supporting detail is given in Tables C-11 and C-12. These classes of trucks are subject to two new regulations: the fuel volatility rule and the NOx truck standard. The NOx standard will result in additional capital costs beginning with the 1988 model year.

C.2.2.2. HDGE1

The control costs for HDGE1 are presented in Table C-5; supporting detail is given in Table C-13. While evaporative emission controls existed for HDGE1 as far back as 1972, the first large cost increase occurred with the 1979 model year as emission control requirements were strengthened for the first time. Initiatives to control hydrocarbons and carbon monoxide were enhanced again in 1985 and 1986, resulting in sharp increases in control costs. New regulations affecting HDGE1 include the fuel volatility rule and the NOx truck standard.

C.2.2.3. HDGE2

The control costs for HDGE2 are presented in Table C-6; supporting detail is given in Table C-14. Calculations for HDGE2 parallel those for HDGE1 except that no fuel price penalty was quantifiable for HDGE2. The fuel volatility rule and the NOx truck standard are the two new regulations affecting this vehicle class.

C.2.2.4. HDDE

The control costs for HDDE are presented in Table C-17. Capital costs resulting from emission control standards for HDDE began with the 1979 model year and increased with the 1985 model year, due to more stringent standards for hydrocarbons and carbon monoxide. No incremental maintenance costs are attributed to pollution control requirements for diesel engines.

Many of the new regulations scheduled for motor vehicles apply to HDDE vehicles. The diesel fuel rule restricts the sulfur content in diesel fuel to .05 percent beginning in 1994. EPA has estimated the cost to de-sulfur fuel is approximately 1.8 cents per gallon. This unit cost was multiplied by fleet fuel consumption estimates to derive annual cost estimates for HDDE. (See Data Source 16.)

The NOx and particulate matter (PM) standards affecting HDDE will result in five hardware cost additions between 1988 and 1994. Increased costs for fuel economy penalty and maintenance are also associated with the PM portion of the standards. Fuel economy penalties were derived from engineering studies that factored in annual diesel fuel consumption rates and an assumed diesel fuel price of $1.00 per gallon.

C.2.3. *Motorcycles and Aircraft*

The control costs for motorcycles are summarized in Table C-8; aircraft costs are presented in Table C-9. For motorcycles, the control of hydrocarbons and carbon monoxide emissions began with the 1978 model year. Maintenance costs have not been quantified and a fuel price penalty does not apply. For aircraft, emission controls began in 1975, and incremental maintenance costs were quantifiable. However, these maintenance costs are offset by fuel economy savings that accrue from improved combustion efficiency at idle.

C.3. DATA SOURCES

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3. Motorcycle Industry Council, Inc. *1987 Motorcycle Statistical Annual, and 1978 Motorcycle Statistical Annual*.

4. Gray, Charles L., "Updated Cost Estimates of Controlling HC Emissions From Mobile Sources", U.S. EPA Emissions Control Technology Division, Memorandum. November 28, 1983.

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16. U.S. EPA, *Draft Regulatory Impact Analysis - Control of Sulfur and Aromatics Contents of On-Highway Diesel Fuel*, Office of Air and Radiation, Office of Mobile Sources, July 1989.

17. Federal Register, Notice of Final Rulemaking, "Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Year 1989 and Beyond", March 22, 1989.

18. U.S. EPA, *Ozone Nonattainment Analysis: A Comparison of Bills An Interim Report*, Prepared for the Office of Air and Radiation, by E.H. Pechan and Associates, January 1990.

19. Title II-Provisions Relating to Mobile Sources, H.R. 3030, 101st Congress, 1st Session, July 27, 1989.

20. U.S. EPA, *Analysis of Costs of Hazardous Air Pollutant Controls Under Administration Bill, H.R. 2585, and S. 816.*, Prepared by Energy and Environmental Analysis, Inc. for the Office of Policy Analysis and Review, the Office of Air and Radiation, and the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, October 27, 1989.

Table C-1: TOTAL CONTROL COSTS FOR ALL VEHICLE CLASSES

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Capital Expenditure	268	564	472	2,775	3,256	3,548	3,685	4,010	3,716	4,189	4,049	4,812	6,125	6,664	6,885
2 Operating Cost	1,307	2,118	2,082	1,828	1,597	1,494	1,293	1,027	836	443	192	269	114	(3)	236

Footnotes to Table C-1 by Line

1. Represents the sum of each line 2 entry in Tables C-2 through C-9. For each vehicle class, capital expenditure is calculated on a per vehicle basis according to the vehicle hardware necessary to comply with emissions regulations. This figure is then multiplied by each year's production estimate to derive a total capital expenditure per year.

2. Represents the sum of each line 3 entry in Tables C-2 through C-9. For each vehicle class, operating cost is the sum of the following component costs: maintenance, fuel price penalty, and fuel economy penalty. Each of these components costs will be described in more detail in the footnotes to Table C-2. This sum is calculated on a per vehicle basis and is then multiplied by the total vehicles in use per year to derive total operating cost. Total vehicles in use per year accounts for 1) each year's production and 2) vehicles surviving from previous model years. See Tables C-10 through C-14 for supporting details and footnotes.

Table C-1A: TOTAL CONTROL COSTS FOR ALL VEHICLE CLASSES

(millions of 1986 dollars)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
3 Capital Expenditure	6,885	6,653	6,883	6,573	6,663	6,876	7,022	7,222	7,403	7,559	7,665	7,827	7,941	8,061	8,179
4 Existing Regs.	6,885	6,653	6,788	6,476	6,566	6,729	6,871	7,066	7,217	7,367	7,468	7,623	7,732	7,844	7,956
5 New Regs.	0	0	96	97	97	147	151	156	186	191	197	203	210	216	223
6 Operating Cost	236	238	213	(1)	(1,630)	(1,317)	(1,138)	214	274	1,168	1,919	2,692	3,444	3,481	3,355
7 Existing Regs.	236	238	213	(136)	(1,766)	(1,694)	(1,623)	(1,549)	(1,459)	(1,372)	(1,320)	(1,246)	(1,191)	(1,153)	(1,135)
8 New Regs.	0	0	0	135	135	377	484	437	388	335	318	301	282	266	249
9 Full Implementation	NA	NA	NA	NA	NA	NA	NA	1326	1345	2205	2922	3637	4353	4368	4240

Footnotes to Table C-1A by Line

3. Sum of lines 4 and 5.
4. Cost is determined using the same methodology described in line 1 of footnotes to Table C-1. Existing regulations only.
5. From Table C-15. New regulations only.
6. The sum of lines 7, 8 and 9.
7. Same methodology used in line 2 of Table C-1. Existing regulations only.
8. From Table C-15A. New regulations only.
9. From Table C-17.

Table C-2: CONTROL COSTS FOR LIGHT-DUTY VEHICLES (LDV)

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost at 7%	999	1,603	1,637	1,715	1,879	2,253	2,513	2,720	2,960	3,083	3,269	3,856	4,269	4,530	5,050
2 Capital Expend.	208	442	343	2,446	2,861	3,142	3,202	3,020	2,973	3,485	3,277	3,965	4,908	5,258	5,416
3 Operating Cost	962	1,504	1,489	1,220	979	908	714	493	315	(52)	(301)	(213)	(447)	(584)	(427)
4 Maint. Exp.	140	193	232	(104)	(238)	(354)	(502)	(638)	(747)	(829)	(823)	(868)	(590)	(598)	(394)
5 Fuel Price Penalty	0	0	0	125	239	384	453	495	557	590	622	692	770	880	993
6 Fuel Economy Penalty	822	1,311	1,257	1,200	979	878	763	636	505	187	(101)	(37)	(627)	(867)	(1,026)

Footnotes to Table C-2 by Line

1. Costs were annualized at 7 percent using the same methodology applied throughout this report (see sec. 1.3.1.) except that the depreciation schedule for mobile sources is 10 years.

2. Capital expenditure is calculated on a per vehicle basis and is the sum of the costs of the various hardware devices required to comply with emissions regulations. For a more detailed listing of these components see Table C-10, line 1. The sum of these costs are then multiplied by yearly production estimates to derive total expenditure. Only costs due to regulations implemented between 1972 and 1988 are considered.

3. Sum of lines 4 through 6.

4. Maintenance expenditure per vehicle (Table C-10) times total vehicles in use (Table C-10).

5. Derived by multiplying the unleaded miles driven per year (Table C-10) by the quotient of the premium in price for unleaded gasoline (Ref. 5,4) and the fuel efficiency (mpg) for a vehicle equipped with emissions controls (Ref. 5).

6. This factor is based on the fuel economy penalty per vehicle mile (Table C-10). The per mile figure is then multiplied by total miles travelled per year for all vehicles in use. This is based on each year's production (Table C-10), annual miles driven per vehicle (Ref. 8, p.H-11), and the survival rate for each model year (Ref. 2, p.26) to account for previous years' production.

Table C-2A: CONTROL COSTS FOR LIGHT-DUTY VEHICLES (LDV)

(millions of 1986 dollars)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total annualized cost	5,050	5,304	5,546	5,550	4,806	5,165	5,466	5,790	5,993	6,152	6,283	6,453	6,597	6,775	6,926
8 Existing Regs.	5,050	5,304	5,546	5,550	4,704	5,063	5,466	5,790	5,993	6,152	6,283	6,453	6,597	6,775	6,926
9 New Regs.	NA	NA	NA	NA	102	102	0	0	0	0	0	0	0	0	0
10 Capital Expend.	5,416	5,105	5,199	4,865	4,957	5,049	5,141	5,280	5,372	5,463	5,504	5,595	5,639	5,683	5,727
11 Existing Regs.	5,416	5,105	5,199	4,865	4,957	5,049	5,141	5,280	5,372	5,463	5,504	5,595	5,639	5,683	5,727
12 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13 Operating Cost	(427)	(450)	(492)	(648)	(1,774)	(1,637)	(1,600)	(1,462)	(1,325)	(1,196)	(1,077)	(976)	(894)	(833)	(790)
14 Existing Regs.	(427)	(450)	(492)	(750)	(1,876)	(1,739)	(1,600)	(1,462)	(1,325)	(1,196)	(1,077)	(976)	(894)	(833)	(790)
15 Maint. Exp.	(394)	(390)	(425)	(447)	(469)	(490)	(509)	(528)	(546)	(562)	(578)	(594)	(611)	(629)	(646)
16 Fuel Price Penalty	993	1,093	1,195	1,040	0	0	0	0	0	0	0	0	0	0	0
17 Fuel Economy Penalty	(1,026)	(1,154)	(1,261)	(1,343)	(1,407)	(1,250)	(1,091)	(934)	(779)	(633)	(499)	(382)	(283)	(204)	(144)
18 New Regs.	NA	NA	NA	102	102	102	**	**	**	**	**	**	**	**	**

Footnotes to Table C-2A by Line

7. Sum of lines 8 and 9.

8. See footnote 1, Table C-2. Existing regulations only.

9. See footnote 1, Table C-2. New regulations only.

10. Sum of lines 11 and 12.

11. See footnote 2, Table C-2. Existing regulations only.

12. See footnote 2, Table C-2. New regulations only.

13. Sum of lines 14 and 18.

14. Sum of lines 15 through 17.

15. See footnote 4, Table C-2. Existing regulations only.

16. See footnote 5, Table C-2. Existing regulations only.

17. See footnote 6, Table C-2. Existing regulations only.

18. The only regulation that qualifies as a new regulation and applies to light-duty vehicles is fuel volatility (Phase I RVP).

    The ** beginning in 1992 are used to indicate that, although phase II RVP is expected to begin in 1992, current cost estimates are included with the proposed Clean Air Act ammendment section (see Table C-17).

Table C-3: CONTROL COSTS FOR LIGHT-DUTY TRUCKS (LDT1)

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	148	257	246	306	318	338	382	421	453	484	528	568	692	759	856
2 Capital Expend.	29	73	61	276	331	327	326	330	244	262	291	348	566	628	666
3 Operating Cost	143	242	222	243	208	182	180	172	170	164	170	171	224	241	291
4 Maint. Exp.	7	8	7	(3)	(9)	(10)	(16)	(21)	(25)	(28)	(21)	(23)	21	22	53
5 Fuel Price Penalty	0	0	0	22	42	60	81	95	110	119	129	140	156	180	204
6 Fuel Economy Penalty	136	234	215	224	175	132	114	98	85	73	63	54	46	40	33

All footnotes correspond to the footnotes for Table C-2. Refer to Table C-11 for supporting details.

Table C-3A: CONTROL COSTS FOR LIGHT-DUTY TRUCKS (LDT1)

(millions of 1986 dollars)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	856	928	1,004	1,042	880	948	998	1,059	1,099	1,133	1,169	1,203	1,230	1,262	1,297
8 Existing Regs.	856	928	996	1,011	842	903	960	1,014	1,045	1,070	1,097	1,122	1,147	1,176	1,209
9 New Regs.	NA	NA	7	31	38	46	37	46	54	63	71	81	83	85	88
10 Capital Expend.	666	706	779	780	786	811	837	864	892	920	949	980	1,011	1,044	1,077
11 Existing Regs.	666	706	727	728	734	758	782	807	833	859	887	915	944	975	1,006
12 New Regs.	NA	NA	51	51	52	53	55	57	59	61	63	65	67	69	71
13 Operating Cost	291	309	320	295	56	46	18	7	0	(7)	(11)	(16)	(22)	(27)	(34)
14 Existing Regs.	291	309	320	278	40	30	18	7	0	(7)	(11)	(16)	(22)	(27)	(34)
15 Maint. Exp.	53	51	43	35	28	21	15	8	1	(5)	(10)	(16)	(22)	(27)	(34)
16 Fuel Price Penalty	204	230	255	225	0	0	0	0	0	0	0	0	0	0	0
17 Fuel Economy Penalty	33	28	23	18	12	9	4	(1)	(1)	(2)	(1)	0	0	0	0
18 New Regs.	NA	NA	NA	16	16	16	**	**	**	**	**	**	**	**	**

LDT1 are trucks with a gross vehicle weight between 0 and 6,000 pounds.

All footnotes correspond to the footnotes for Table C-2. Refer to Table C-11 for supporting details.

Table C-4: CONTROL COSTS FOR LIGHT-DUTY TRUCKS (LDT2)

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	204	378	357	335	357	330	305	321	347	358	396	428	522	610	727
2 Capital Expend.	13	30	27	13	17	22	26	473	291	249	290	312	507	562	596
3 Operating Cost	203	372	347	323	343	313	284	233	218	194	193	185	211	220	256
4 Maint. Exp.	11	16	20	25	30	40	47	(11)	(21)	(29)	(27)	(34)	(13)	(17)	2
5 Fuel Price Penalty	0	0	0	0	0	0	0	39	62	71	89	106	128	155	184
6 Fuel Economy Penalty	192	356	327	298	313	273	237	205	177	152	131	113	96	82	69

All footnotes correspond to the footnotes for Table C-2. Refer to Table C-12 for supporting details.

Table C-4A: CONTROL COSTS FOR LIGHT-DUTY TRUCKS (LDT2)

(millions of 1986 dollars)

Line Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	727	822	918	916	734	780	809	851	878	901	922	946	968	996	1,027
8 Existing Regs.	727	822	913	893	706	748	787	825	847	865	880	899	920	946	975
9 New Regs.	NA	NA	4	23	27	32	22	27	31	37	42	47	49	50	52
10 Capital Expend.	596	614	655	669	662	705	728	751	775	800	826	852	879	907	936
11 Existing Regs.	596	614	626	639	632	673	695	718	741	764	789	814	840	867	894
12 New Regs.	NA	NA	29	30	30	32	33	34	35	36	37	38	39	41	42
13 Operating Cost	256	267	273	244	9	(10)	(43)	(63)	(74)	(85)	(97)	(106)	(115)	(121)	(129)
14 Existing Regs.	256	267	273	229	(6)	(24)	(43)	(63)	(74)	(85)	(97)	(106)	(115)	(121)	(129)
15 Maint. Exp.	2	(5)	(16)	(27)	(37)	(47)	(57)	(67)	(77)	(87)	(97)	(106)	(115)	(121)	(129)
16 Fuel Price Penalty	184	213	240	216	0	0	0	0	0	0	0	0	0	0	0
17 Fuel Economy Penalty	69	59	49	40	31	23	15	5	4	2	0	0	0	0	0
18 New Regs.	NA	NA	NA	15	15	15	**	**	**	**	**	**	**	**	**

LDT2 consists of trucks with a gross vehicle weight between 6,000 and 8,500 pounds.

All footnotes correspond to the footnotes for Table C-2A. Refer to Table C-12A for supporting details.

Table C-5: CONTROL COSTS FOR HEAVY-DUTY GASOLINE ENGINES (HDGE1)

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	2	3	9	13	22	33	47	63	70	73	72	73	76	78	83
2 Capital Expend.	5	6	12	10	14	16	18	26	16	14	12	13	17	35	39
3 Operating Cost	1	2	6	8	16	24	36	48	52	53	52	52	53	53	54
4 Maint. Exp.	1	2	2	2	3	3	4	4	4	4	4	4	4	0	1
5 Fuel Price Penalty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Fuel Economy Penalty	0	0	3	6	13	21	32	44	48	50	48	48	50	52	53

All footnotes correspond to the footnotes for Table C-2. Refer to Table C-13 for supporting details.

Table C-5A: CONTROL COSTS FOR HEAVY-DUTY GASOLINE ENGINES (HDGE1)

(millions of 1986 dollars)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	83	93	104	112	99	92	87	84	83	81	80	77	75	73	72
8 Existing Regs.	83	93	104	110	97	91	86	83	82	80	79	75	73	72	71
9 New Regs.	NA	NA	0	2	2	2	1	1	1	1	1	1	1	1	1
10 Capital Expend.	39	61	63	65	65	68	69	71	74	76	78	81	83	86	88
11 Existing Regs.	39	61	62	65	65	67	68	71	73	75	77	80	82	84	87
12 New Regs.	NA	NA	1	1	1	1	1	1	1	1	1	1	1	1	1
13 Operating Cost	54	58	62	64	44	30	16	6	(4)	(12)	(18)	(24)	(29)	(33)	(37)
14 Existing Regs.	54	58	62	63	43	29	16	6	(4)	(12)	(18)	(24)	(29)	(33)	(37)
15 Maint. Exp.	1	(3)	(8)	(12)	(16)	(19)	(22)	(25)	(28)	(31)	(33)	(36)	(38)	(40)	(42)
16 Fuel Price Penalty	0	7	15	18	0	0	0	0	0	0	0	0	0	0	0
17 Fuel Economy Penalty	53	54	55	57	59	48	39	31	24	19	15	12	9	7	5
18 New Regs.	NA	NA	NA	1	1	1	**	**	**	**	**	**	**	**	**

HDGE1 consists of trucks with a gross vehicle weight between 8,500 and 10,000 pounds.

All footnotes correspond to the footnotes for Table C-2A. Refer to Table C-13A for supporting details.

Table C-6: CONTROL COSTS FOR HEAVY-DUTY GASOLINE ENGINES (HDGE2)

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	6	9	37	57	81	102	128	149	160	159	151	146	144	141	142
2 Capital Expend.	14	14	30	24	20	20	24	31	20	12	10	11	14	30	33
3 Operating Cost	4	5	29	46	66	85	107	124	133	130	122	117	117	114	114
4 Maint. Exp.	4	5	6	6	7	7	7	7	7	7	6	6	5	0	1
5 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 Fuel Economy Penalty	0	0	23	39	60	78	100	116	126	123	116	112	112	114	113

Footnotes correspond to the footnotes for Table C-2, with the following exceptions:

5. Data not available to compute a fuel price penalty for this vehicle class.

Refer to Table C-14 for supporting details.

Table C-6A: CONTROL COSTS FOR HEAVY-DUTY GASOLINE ENGINES (HDGE2)

(millions of 1986 dollars)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	142	143	144	147	151	132	115	103	93	85	49	49	49	50	50
8 Existing Regs.	142	143	144	145	149	130	114	102	92	84	48	48	48	48	49
9 New Regs.	NA	NA	0	2	2	2	1	1	1	1	1	1	1	1	1
10 Capital Expend.	33	48	50	52	52	53	55	56	58	60	62	63	65	67	69
11 Existing Regs.	33	48	49	51	51	52	54	55	57	59	61	62	64	66	68
12 New Regs.	NA	NA	1	1	1	1	1	1	1	1	1	1	1	1	1
13 Operating Cost	114	110	107	108	107	82	59	40	24	12	(28)	(30)	(32)	(34)	(36)
14 Existing Regs.	114	110	107	106	106	81	59	40	24	12	(28)	(30)	(32)	(34)	(36)
15 Maint. Exp.	1	(3)	(7)	(10)	(13)	(16)	(19)	(21)	(24)	(26)	(28)	(30)	(32)	(34)	(36)
16 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17 Fuel Economy Penalty	113	113	114	116	119	97	78	61	48	38	0	0	0	0	0
18 New Regs.	NA	NA	NA	1	1	1	**	**	**	**	**	**	**	**	**

HDGE2 consists of gasoline powered trucks with a gross vehicle weight greater than 10,000 pounds.

Footnotes correspond to the footnotes for Table C-2A, with the following exceptions:

16. Data not available to compute a fuel price penalty for this vehicle class.

Refer to Table C-14A for supporting details.

Table C-7: CONTROL COSTS FOR HEAVY-DUTY DIESEL ENGINES (HDDE)

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	0	0	0	0	0	0	0	7	12	17	21	26	32	40	48
2 Capital Expend.	0	0	0	0	0	0	0	49	36	35	29	34	43	52	58
3 Operating Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Maint. Exp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 Fuel Economy Penalty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Footnotes correspond to the footnotes for Table C-2, with the following exceptions:

5. Not applicable for diesel engines.

Table C-7A: CONTROL COSTS FOR HEAVY-DUTY DIESEL ENGINES (HDDE)

(millions of 1986 dollars)

Line Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	48	56	67	72	78	332	589	557	525	488	487	487	483	483	483
8 Existing Regs.	48	56	65	68	72	76	82	87	91	94	97	100	102	105	108
9 New Regs.	NA	NA	2	4	6	256	508	470	434	394	390	387	381	378	374
10 Capital Expend.	58	61	77	79	79	127	131	135	163	168	173	179	184	189	195
11 Existing Regs.	58	61	63	65	65	67	69	71	73	75	77	80	82	84	87
12 New Regs.	NA	NA	14	14	14	60	62	64	90	93	96	99	102	105	108
13 Operating Cost	0	0	0	0	0	241	484	437	388	335	318	301	282	266	249
14 Existing Regs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Maint. Exp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17 Fuel Economy Penalty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 New Regs.	NA	NA	NA	NA	0	241	484	437	388	335	318	301	282	266	249

HDDE consists of diesel powered trucks with a gross vehicle weight greater than 10,000 pounds.

Footnotes correspond to the footnotes for Table C-2A, with the following exceptions:

16. Not applicable for diesel engines.

18. HDDE operating costs are affected by two new regulations (see Table C-15A).

Table C-8: CONTROL COSTS FOR MOTORCYCLES

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	(5)	(7)	(10)	(12)	(14)	(18)	(17)	(21)	(12)	10	29	42	50	62	70
2 Capital Expend.	0	0	0	0	0	0	75	75	129	122	105	66	62	89	68
3 Operating Cost	(5)	(7)	(10)	(12)	(14)	(18)	(28)	(42)	(52)	(47)	(42)	(39)	(39)	(41)	(42)
4 Maint. Exp.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 Fuel Economy Penalty	(5)	(7)	(10)	(12)	(14)	(18)	(28)	(42)	(52)	(47)	(42)	(39)	(39)	(41)	(42)

Footnotes correspond to the footnotes for Table C-2, with the following exceptions:

4,5. Not applicable for motorcycles.

Table C-8A: CONTROL COSTS FOR MOTORCYCLES

(millions of 1986 dollars)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	70	75	69	63	45	39	29	26	23	17	14	14	14	14	15
8 Existing Regs.	70	75	69	63	45	39	29	26	23	17	14	14	14	14	15
9 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10 Capital Expend.	68	46	47	49	51	53	55	56	59	61	63	65	67	70	72
11 Existing Regs.	68	46	47	49	51	53	55	56	59	61	63	65	67	70	72
12 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13 Operating Cost	(42)	(44)	(46)	(48)	(55)	(51)	(53)	(56)	(58)	(60)	(63)	(65)	(68)	(70)	(73)
14 Existing Regs.	(42)	(44)	(46)	(48)	(55)	(51)	(53)	(56)	(58)	(60)	(63)	(65)	(68)	(70)	(73)
15 Maint. Exp.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17 Fuel Economy Penalty	(42)	(44)	(46)	(48)	(55)	(51)	(53)	(56)	(58)	(60)	(63)	(65)	(68)	(70)	(73)
18 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Footnotes correspond to the footnotes for Table C-2A, with the following exceptions:

9,12,15,16,18. Not applicable for motorcycles.

Table C-9: CONTROL COSTS FOR AIRCRAFT

(millions of 1986 dollars)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Annualized Cost	0	0	0	1	3	6	8	9	10	11	14	22	21	19	17
2 Capital Expend.	0	0	0	6	13	21	15	6	7	9	35	62	9	8	10
3 Operating Cost	0	0	0	0	0	0	0	0	0	(0)	(2)	(3)	(5)	(7)	(9)
4 Maint. Exp.	0	0	0	0	0	0	0	0	0	0	1	2	2	3	4
5 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 Fuel Economy Penalty	0	0	0	0	0	0	0	0	0	(1)	(3)	(5)	(7)	(10)	(13)

Footnotes correspond to the footnotes for Table C-2, with the following exceptions:

5. Not applicable for aircraft.

Table C-9A: CONTROL COSTS FOR AIRCRAFT

(millions of 1986 dollars)

Line Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
7 Total Annualized Cost	17	14	11	10	9	7	2	(7)	(8)	(10)	(11)	(13)	(15)	(18)	(20)
8 Existing Regs.	17	14	11	10	9	7	2	(7)	(8)	(10)	(11)	(13)	(15)	(18)	(20)
9 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10 Capital Expend.	10	12	13	15	11	11	7	8	11	12	11	13	13	15	13
11 Existing Regs.	10	12	13	15	11	11	7	8	11	12	11	13	13	15	13
12 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13 Operating Cost	(9)	(11)	(13)	(16)	(17)	(19)	(20)	(21)	(23)	(25)	(27)	(29)	(31)	(34)	(36)
14 Existing Regs.	(9)	(11)	(13)	(16)	(17)	(19)	(20)	(21)	(23)	(25)	(27)	(29)	(31)	(34)	(36)
15 Maint. Exp.	4	5	6	8	8	9	10	10	11	12	13	14	15	16	17
16 Fuel Price Penalty	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17 Fuel Economy Penalty	(13)	(16)	(20)	(23)	(26)	(28)	(30)	(32)	(34)	(37)	(40)	(43)	(46)	(50)	(53)
18 New Regs.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Footnotes correspond to the footnotes for Table C-2A, with the following exceptions:

9,12,16,18. Not applicable for aircraft.

Table C-10: LIGHT-DUTY VEHICLE CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Capital Expend. per Veh.	19.1	38.6	38.6	283.0	283.0	283.0	283.0	283.0	331.1	408.3	410.7	440.1	474.6	474.6	474.6
2 Maint. Cost per Vehicle	4.7	4.7	4.7	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3
3 Fuel Econ. Penalty/Veh. Mile	0.003	0.004	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001
4 Inspection/Maint. Programs	0	0	0	11	11	42	42	42	42	54	135	162	513	571	834
5 Existing	0	0	0	11	11	42	42	42	42	54	135	162	513	571	834
6 New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Production(10E6)	11	11	9	9	10	11	11	11	9	9	8	9	10	11	11
8 Total Vehicles in Use(10E6)	30	41	50	58	66	75	83	88	91	93	93	93	95	97	99
9 Unl. Miles Driven/Flt(10E6)	0	0	0	90844	196874	308713	415492	507265	581026	642566	687872	735275	787928	838928	884782

Table C-10A: LIGHT-DUTY VEHICLE CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1 Capital Expend. per Veh.	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475
2 Maint. Cost per Vehicle	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3
3 Fuel Econ. Penalty/Veh. Mile	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4 Inspection/Maint. Programs	834	877	877	877	877	877	877	877	877	877	877	877	877	877	877
5 Existing	834	877	877	877	877	877	877	877	877	877	877	877	877	877	877
6 New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Production(10E6)	11	11	11	10	10	11	11	11	11	12	12	12	12	12	12
8 Total Vehicles in Use(10E6)	99	100	101	102	103	104	105	106	107	108	109	110	112	113	114
9 Unl. Miles Driven/Flt(10E6)	884782	915164	943105	958231	972766	989285	1004818	1020747	1036167	1051124	1065277	1080328	1095048	1109349	1123098

Footnotes to Tables C-10 and C-10A by Line

1. Sum of the costs for vehicle pollution control devices such as: catalysts (Ref. 4), air pumps (Ref. 6), exhaust-gas recirculation units (Ref. 10), high altitude controls (Ref. 4), and evaporative emissions canisters (Ref. 4). These control devices were phased in at various points in time. The timing was due to 1) new regulatory requirements and/or 2) technological advancements in control devices.

2. We assumed a pre-1975 baseline maintenance expense of $5.00 per vehicle per year to cover maintenance expenses prior to the existence of inspection/maintenance programs and also to cover those vehicle maintenance expenditures for vehicles which are not in areas with established inspection/maintenance programs. Beginning in 1975, the maintenance benefits from the use of catalytic converters (Ref. 4)was added to the baseline cost.

3. Calculated as the difference in fuel efficiency (in terms of miles per gallon) between a vehicle equipped with emissions controls and one that is not (Ref. 5), multiplied by the price of gasoline (Ref. 5,9, Table 9.4).

4. Sum of lines 5 and 6. Millions of 1986 dollars.

5. These costs are due to inspection/maintenance programs implemented prior to 1988. The cost includes a component for the inspection program fee plus a weighted average cost of repair for those vehicles requiring repair. This was computed by dividing population (Ref. 14) for areas with programs by the population per vehicle (Ref. 2). This equals the number of vehicles affected by the programs, which was then multiplied by a per vehicle cost (Ref.15) to derive total cost. Millions of 1986 dollars.

6. Same process as footnote 5 with an incremental cost per vehicle (Ref.15) to account for program enhancement expected after 1988. Millions of 1986 dollars.

7. Ref. 5,7 App. B (pp.B5-B18).

8. Calculated as vehicle production (line 7) times the vehicle survival rate per age class (Ref.2, p.26) corresponding to that year and age. Each year accumulates figures from up to the previous twenty years.

9. Calculated as production (line 12) times the percentage of each model year using unleaded gasoline (Ref.5) times the vehicle survival rate (Ref.2, p.26). Each year's figure includes a running total for previous years' surviving vehicles.

Table C-11: LDT1 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Capital Expend. per Veh.	20	44	44	268	268	268	268	284	284	332	332	354	480	480	480
2 Maint. Cost per Vehicle	5	5	5	-5	-5	-5	-5	-6	-6	-8	-8	-8	-8	-8	-8
3 Fuel Econ. Penalty/Veh. Mi.	0.003	0.004	0.000	0.002	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 Inspection/Maint. Programs	0	0	0	2	2	6	6	6	6	8	20	24	76	84	123
5 Existing	0	0	0	2	2	6	6	6	6	8	20	24	76	84	123
6 New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Production(10E6)	1.5	1.8	1.5	1.1	1.3	1.3	1.3	1.2	0.9	0.8	0.9	1.0	1.3	1.4	1.5
8 Total Vehicles in Use(10E6)	3.6	5.2	6.5	7.3	8.2	9.1	9.9	10.6	10.9	11.1	11.4	11.7	12.3	12.9	13.5
9 Unleaded Miles Driven/Fleet	0	0	0	15512	34794	52862	68868	81398	87016	90109	93837	98339	105286	112771	120059

All footnotes correspond to the footnotes for Table C-10.

Table C-11A: LDT1 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1 Capital Expend. per Veh.	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480
2 Maint. Cost per Vehicle	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
3 Fuel Econ. Penalty/Veh. Mi.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 Inspection/Maint. Programs	123	129	129	129	129	129	129	129	129	129	129	129	129	129	129
5 Existing	123	129	129	129	129	129	129	129	129	129	129	129	129	129	129
6 New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Production(10E6)	1.5	1.6	1.6	1.6	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.2
8 Tot. Vehicles in Use/Yr(10E	13.5	14.2	14.9	15.5	15.8	16.2	16.6	17.0	17.4	18.0	18.5	19.1	19.8	20.4	21.2
9 Unleaded Mi. Driven/Fleet	120059	126874	132594	136730	139705	0	0	0	0	0	0	0	0	0	0
Other: Future Regulations:															
10 NOx (per Veh.)	NA	NA	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74

All footnotes correspond to the footnotes for Table C-10, wth the following exceptions:

10. Reference 12. See footnotes Table C-15A.

Table C-12: LDT2 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Capital Expend. per Veh.	14	25	25	14	14	14	14	330	330	330	330	332	450	450	450
2 Maint. Cost per Vehicle	5	5	5	5	5	5	5	-12	-12	-12	-12	-12	-12	-12	-12
3 Fuel Econ. Penalty/Veh. Mi.	0.006	0.009	0.001	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 Inspection/Maint. Programs	0	0	0	2	2	6	6	6	6	6	17	18	50	58	89
5 Existing	0	0	0	2	2	6	6	6	6	6	17	18	50	58	89
6 New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Production(10E6)	1.0	1.2	1.1	0.9	1.3	1.6	1.9	1.4	0.9	0.8	0.9	0.9	1.1	1.2	1.3
8 Total Vehicles in Use(10E6)	2.3	3.4	4.3	5.1	6.1	7.3	8.8	9.8	10.2	10.3	10.6	10.9	11.4	11.9	12.5
9 Unleaded Miles Driven/Fleet	0	0	0	0	0	0	0	25544	38516	47285	56587	65346	75444	85519	94943

All footnotes correspond to the footnotes for Table C-10.

Table C-12A: LDT2 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1 Capital Expend. per Veh.	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
2 Maint. Cost per Vehicle	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12
3 Fuel Econ. Penalty/Veh. Mi.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 Inspection/Maint. Programs	89	93	93	93	93	93	93	93	93	93	93	93	93	93	93
5 Existing	89	93	93	93	93	93	93	93	93	93	93	93	93	93	93
6 New	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Production(10E6)	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	1.9	2.0
8 Total Vehicles in Use/Yr(10E	12.5	13.1	13.6	14.1	14.5	14.9	15.2	15.6	16.0	16.4	16.9	17.2	17.6	18.2	18.8
9 Unleaded Mi. Driven/Fleet	94943	102942	109553	114856	118570	0	0	0	0	0	0	0	0	0	0
Other: Future Regulations:															
10 NOx (per Veh.)	NA	NA	21.06	21.06	21.06	21.06	21.06	21.06	21.06	21.06	21.06	21.06	21.06	21.06	21.06

All footnotes correspond to the footnotes for Table C-10, with the following exceptions:

10. Reference 12. See footnotes Table C-15A.

Table C-13: HDGE1 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Capital Expend. per Veh.	46	46	103	103	103	103	103	186	186	186	186	186	186	360	360
2 Maint. Cost per Vehicle	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3 Fuel Econ. Penalty/Veh. Mi.	0.000	0.000	0.002	0.002	0.003	0.003	0.004	0.006	0.007	0.006	0.006	0.006	0.006	0.006	0.005
4 Inspection/Maint. Programs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5 Existing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 New	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7 Production(10E6)	0.10	0.13	0.11	0.10	0.13	0.15	0.17	0.14	0.09	0.08	0.06	0.07	0.09	0.10	0.11
8 Total Vehicles in Use(10E6)	0.24	0.35	0.43	0.49	0.58	0.68	0.79	0.86	0.86	0.85	0.82	0.80	0.81	0.82	0.83
9 Unleaded Miles Driven/Fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

All footnotes correspond to the footnotes for Table C-10.

Table C-13A: HDGE1 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1 Capital Expend. per Veh.	360	534	534	534	534	534	534	534	534	534	534	534	534	534	534
2 Maint. Cost per Vehicle	5	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38
3 Fuel Econ. Penalty/Veh. Mi.	0.005	0.005	0.005	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 Inspection/Maint. Programs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5 Existing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 New	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7 Production(10E6)	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.16	0.16
8 Total Vehicles in Use/Yr(10E	0.83	0.86	0.88	0.90	0.91	0.93	0.95	0.97	0.99	1.02	1.04	1.07	1.10	1.13	1.17
9 Unleaded Miles Driven/Fleet	0	2276	4294	6067	7513	0	0	0	0	0	0	0	0	0	0
Other: Future Regulations:															
10 NOx (per Veh.)	NA	NA	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20

All footnotes correspond to the footnotes for Table C-10, with the following exceptions:

10. Reference 12. See footnotes Table C-15A.

Table C-14: HDGE2 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 Capital Expend. per Veh.	46	46	103	103	103	103	103	186	186	186	186	186	186	360	360
2 Maint. Cost per Vehicle	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3 Fuel Econ. Penalty/Veh. Mi.	0.000	0.000	0.004	0.004	0.007	0.007	0.007	0.010	0.014	0.015	0.015	0.014	0.014	0.014	0.011
4 Inspection/Maint. Programs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5 Existing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 New	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7 Production(10E6)	0.31	0.31	0.29	0.23	0.20	0.20	0.23	0.17	0.11	0.06	0.05	0.06	0.08	0.08	0.09
8 Total Vehicles in Use(10E6)	0.76	1.01	1.22	1.34	1.41	1.47	1.55	1.56	1.51	1.41	1.31	1.22	1.15	1.09	1.05
9 Unleaded Miles Driven/Fleet	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

All footnotes correspond to the footnotes for Table C-10.

Table C-14A: HDGE2 CONTROL COSTS -- SUPPORTING DETAIL

(all dollars are millions of 1986)

Line	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1 Capital Expend. per Veh.	360	498	498	498	498	498	498	498	498	498	498	498	498	498	498
2 Maint. Cost per Vehicle	5	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38
3 Fuel Econ. Penalty/Veh. Mi.	0.011	0.011	0.011	0.011	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 Inspection/Maint. Programs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5 Existing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 New	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7 Production(10E6)	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.14
8 Total Vehicles in Use(10E6)	1.05	1.01	0.98	0.95	0.92	0.90	0.88	0.87	0.87	0.88	0.89	0.91	0.93	0.96	0.99
9 Unleaded Miles Driven/Fleet	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other: Future Regulations:															
10 NOx (per Veh.)	NA	NA	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20

All footnotes correspond to the footnotes for Table C-10, with the following exceptions:

10. Reference 12. See footnotes Table C-15A.

Table C-15: CAPITAL CONTROL COSTS DUE TO NEW REGULATIONS

(millions of 1986 dollars)

Reg. Veh. Class	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NOx + PM Standard													
LDT1	51	51	52	53	55	57	59	61	63	65	67	69	71
LDT2	29	30	30	32	33	34	35	36	37	38	39	41	42
HDGE1	1	1	1	1	1	1	1	1	1	1	1	1	1
HDGE2	1	1	1	1	1	1	1	1	1	1	1	1	1
HDDE	14	14	14	60	62	64	90	93	96	99	102	105	108
Total	96	97	97	147	151	156	186	191	197	203	210	216	223

All per vehicle costs were obtained from the appropriate RIA (Ref. 12) and multiplied by production estimates (Tables C-10A—C-14A).

Table C-15A: OPERATING CONTROL COSTS DUE TO NEW REGULATIONS

(millions of 1986 dollars)

Reg. Veh. Class	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Volatility		134	134	134									
Diesel Fuel Quality													
HDDE					225	173	117	56	31	6	-22	-49	-76
NOx + PM Standard													
HDDE				241	259	265	272	279	287	295	305	314	325
Total: All Regs.		134	134	375	484	438	389	335	318	301	283	265	249

Fuel Volatility: Notice of Final Rulemaking (Ref. 17)

Diesel Fuel Quality: Draft Regulatory Impact Analysis (Ref. 16)

NOx + PM Standard: Regulatory Impact Analysis (Ref.12).

Table C-16: CAPITAL CONTROL COSTS BY POLLUTANT

(millions of 1986 dollars)

Pollutant	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NOx	91	92	92	106	110	113	117	120	124	128	132	136	141
PM	5	5	5	40	41	43	69	71	73	75	77	80	82
Total	96	97	97	147	151	156	186	191	197	203	210	216	223

Costs attributable to controlling NOx and PM are associated with one regulation, the NOx and PM truck standard. See Table C-15.

Table C-16A: OPERATING CONTROL COSTS BY POLLUTANT

(millions of 1986 dollars)

Pollutant	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
HC		134	134	134									
PM	0	0	0	241	484	438	389	335	318	301	283	265	249
Total	0	134	134	375	484	438	389	335	318	301	283	265	249

All costs are taken directly from Table C-15A.

Below is a list of new regulations and the pollutants they are primarily designed to control:

Fuel Volatility -- hydrocarbons

Diesel Sulfur Content -- particulate matter

NOx + PM Truck Standards -- oxides of nitrogen and particulate matter

Table C-17: CONTROL COSTS DUE TO CAA AMENDMENTS

(millions of 1986 dollars)

Line	1993	1994	1995	1996	1997	1998	1999	2000
1 Reid Vapor Pressure II	222	228	232	236	240	243	247	251
2 Evaporative/Running Losses	57	58	58	59	59	60	60	61
3 Tailpipe/Useful Life	436	440	444	448	452	456	460	464
4 Refueling: Stage II	108	112	116	120	124	127	131	135
5 Alternative Fuels			145	145	145	145	145	0
6 Basic Inspect./Maintenance	65	66	67	68	69	70	71	72
7 Enhanced Inspect./Maint.	69	70	71	72	73	75	76	77
8 Oxides of Nitrogen (NOx)	369	371	372	374	375	377	378	380
9 Air Toxics			700	1400	2100	2800	2800	2800
10 Total	1326	1345	2205	2922	3637	4353	4368	4240

Footnotes to Table C-17 by Line

Except for line 9 (Ref. 20), all costs were derived from the 1995 and 2005 point estimates given in Reference 18. Interpolation was used to fill in intervening years. For simplicity, all costs were assumed to begin in 1993 and are treated as operating costs. These costs are *not* divided between the various vehicle classes and, therefore, they are only reflected in Table C-1A (Total Costs for All Vehicle Classes).

Following is a brief discussion of each of the nine line items. This discussion is only intended to highlight some of the more significant provisions related to each line entry. Reference 19 (Title II of H.R.3030) applies to each line entry (except where noted otherwise) and should be consulted for more detail.

1. Reid Vapor Pressure II - requires the Reid vapor pressure of gasoline not to exceed 9.0 pounds per square inch (Sec. 214).

2. Evaporative/Running losses - requires the greatest degree of emission reduction achievable with respect to evaporative emissions of hydrocarbons from all gasoline-fueled motor vehicles (1) during operation and (2) over two or more days of nonuse, during ozone prone summertime conditions (Sec. 205).

3. Tailpipe/Useful Life - consists of a number of regulatory provisions. Tightened tailpipe standards is a general term consisting of an array of more stringent standards for emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen for light-duty vehicles and light-duty trucks. For light-duty vehicles, emissions of hydrocarbons must be reduced incrementally so that by the 1995 model year emissions are not exceeding 0.25 grams per vehicle mile (gpm). Emissions of carbon monoxide from 1981 and later model years may not exceed 3.4 gpm. And emissions of oxides of nitrogen will be gradually reduced from 1.0 gpm to 0.7 gpm by the 1995 model year (Sec. 202). Light-duty trucks must meet hydrocarbon emissions limits of 0.41 gpm and 0.50 gpm (depending on the loaded vehicle weight) by the 1996 model year. Similarly, carbon monoxide standards of 4.20 gpm and 5.50 gpm (also depending on vehicle weight) must be met by the 1996 model year

(Sec. 203). Useful life refers to the initiative to require the manufacturer's of pollution control equipment to increase the useful life of such euipment from 50,000 to 100,000 miles.

4. Refueling: Stage II - requires the owners or operators of all gasoline dispensing systems in nonattainment areas designated as “moderate” to install a system for gasoline vapor recovery during the fueling of motor vehicles (Title I, Sec. 103). Usually a vapor trapping nozzle is attached to a fuel dispensor which returns the recovered vapors to the fueling stations gasoline storage tanks.

5. Alternative Fuels - is the general term for the program that includes the manufacturing of “clean-fuel” vehicles and the supplying of clean fuel for those vehicles. The costs figures in line 5 combine the costs for the fuel program and the vehicle program. While the term “clean alternative fuels” refers to any power source with low emissions comparable to gasoline, the costs shown here assume that methanol is the fuel of choice. Currently, the scope of the program is to include those nonattainment areas with a 1988 ozone design value at or above 0.18 parts per million and having a 1980 population of two hundred and fifty thousand or more. Additionally, the program calls for the production of clean fuel vehicles according to the following schedule: 500,000 in 1995, 750,000 in 1996 and 1,000,000 each year for the period between 1997 and 2003 (Sec. 201).
6. Basic Inspection/Maintenance - provides for the establishment of inspection/maintenance programs in marginal nonattainment areas (Title I, Sec. 103).

7. Enhanced Inspection/Maintenance - provides for a revision (i.e., enhancement) in the current inspection/maintenance program for serious nonattainment areas (Title I, Sec. 103).

8. Oxides of Nitrogen - the standards for this entry are explained under the tightened tailpipe entry (line 3). The costs are shown as a separate entry because they comprise a significantly large percentage of the total costs.

9. Air Toxics - requires a study to be completed evaluating air toxics emitted from mobile sources and their fuels and any necessary regulations to be implemented. It also requires the regulation of at least benzene and formaldehyde (Ref. 20). The numbers shown are the estimated costs of controlling benzene and formaldehyde. These costs were derived using the following assumptions and calculations. Reference 20 gives an estimated cost of control for the year 2003. Since 1998 is the first model year impacted by any air toxics regulation, it was assumed that 100 percent of the costs would be incurred in 1998 and beyond. Prior to 1998, costs were assumed to be incurred according to the following schedule (to account for lead-time, tooling-up, etc...,): 1995 - 25 percent, 1996 - 50 percent, 1997 - 75 percent.

It should be noted that the provisions listed above are not the only possible regulatory options under consideration for the administration's proposal. They represent the provisions under consideration *with available cost information* at the time of the writing of this appendix. The costs of the final ammendments are expected to be higher.

APPENDIX D
ESTIMATION OF PRIVATE RADON MITIGATION COSTS

This appendix provides documentation for the estimated costs of private radon mitigation efforts which are presented in Chapter 3. The costs, which are shown in Table D-1, are based on survey data on actual current expenditures and extrapolation from these estimates. The cost estimates represent what can reasonably be expected given observed responses to current programs.

The estimates provided in Table D-1 were generated by adapting a radon mitigation model developed by Small and Peters (1988).[1] They include costs for both roughing-in and activating new construction and for retrofitting existing homes. The lognormal exposure distribution parameters used for our analysis were obtained from Puskin and Nelson (1989).[2]

Small and Peters assume a fixed testing rate and a logistic mitigation gradient. Doyle, et al. (1990)[3] report that 2.6 percent of the households in the Washington, D.C. media market tested for radon exposure as part of a WJLA television radon awareness campaign. Desvousges, et al. (1989)[4] found that 4-5 percent of the households in Randallstown, Maryland had tested for radon exposure over a three-year period in the absence of any special outreach program. The EPA Radon Program reported that 1.5 million radon monitors had been sold by mid-1989. A two percent testing rate appears consistent with these data and was thus used to generate testing cost estimates. An average cost of $20 per test for monitoring was assumed for both new and existing homes.

An average of about 1.1 million new single-family homes have been built over the last fifteen years.[5] About one percent of new homes are currently being constructed with roughed-in passive radon mitigation at a cost of $300 per home. It costs an additional $200 to activate the system. To calculate these costs for future years, it is assumed that the rough-in rate will double in 1990 and

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[1] Small, Mitchell J. and Catherine A. Peters, "Public Policy Model for the Indoor Radon Problem," *Mathematical Computer Modeling* 10:5 (1988), 349-358.

[2] Puskin, Jerome S. and Christopher B. Nelson, "EPA's Perspective on Risks from Residential Radon Exposure," *Journal of the Air Pollution Control Association*, 39:7 (July 1989), 915-920.

[3] Doyle, James K., Gary H. McClelland, William D. Schulze, Paul A. Locke, Steven R. Elliott, Glenn W. Russell, and Andrew Moyad, *An Evaluation of Strategies for Promoting Effective Radon Mitigation*, U.S. Environmental Protection Agency report EPA/230/02-90-275, March, 1990.

[4] Desvousges, William H., V. Kerry Smith, and Hillery H. Rink III, *Communicating Radon Risk Effectively: Radon Testing in Maryland*, Research Triangle Institute final report to U.S. EPA Office of Planning and Evaluation, EPA-230-03-89-048, March 1989.

[5] U.S. Bureau of the Census, *Statistical Abstract of the United States*, 109th ed., Washington, D.C., 1989.

increase by two percent per year through the year 2000. In the absence of data on the behavior of owners of homes with roughed-in systems, they are assumed to be twice as likely to test and mitigate as owners of homes that are not roughed-in.

Figure D-1 shows the assumed logistic function for the probability of mitigating at various exposure levels. The points indicated in the figure show the proportion of respondents in an ongoing study of New York homeowners[6] who said they did something to lower their radon exposure and those who spent at least $100 on mitigation. These households participated in an extensive monitoring and risk communication study over a three-year period. Table D-2 shows the number of homeowners who mitigated at various exposure and cost levels. The New Jersey Department of Environmental Protection indicates that about 12,000 New Jersey homes had been mitigated as of 1989. The EPA Radon Program estimates the national mitigation level to be about four times this number. The rate derived from the logistic response gradient is consistent with this EPA's estimate.

The overall average mitigation cost in the New York study was about $1200. In a personal communication, William Schulze reported that eight of the 700 respondents in the WJLA survey employed a private mitigation contractor and reduced home radon exposures to 3-5 pCi/l. The average cost was $1346, but one homeowner paid $4500. Excluding the high observation, the average cost was $895. Respondents estimated that operating costs averaged $73 per year. An additional 43 homeowners reported average mitigation costs of $123, but did not retest; the effectiveness of these efforts is thus questionable.

Napolitano (1987)[7] estimated average costs weighted by home foundation type to be about $1800 in capital costs and $130 in annual operating and maintenance cost. Bruce Henschel of the EPA Office of Research and Development estimates that 95 percent of homes with basement readings between 4 and 10 pCi/l could be mitigated at a commercial cost of $800-$2500. The cost estimates reported here are based on the $1200 cost from the New York study as the best available estimate of what homeowners actually spent in 1988 on capital costs, and Napolitano's estimate of O&M costs.

There was very little homeowner radon testing and mitigation activity in 1986 and 1987. The cost estimates assume a rapid buildup to current levels of activity from nearly negligible levels in the first two years. The cost analysis in this report assumes that the public's response to EPA's outreach activities will remain the same through the year 2000. In each year after 1988, we assume

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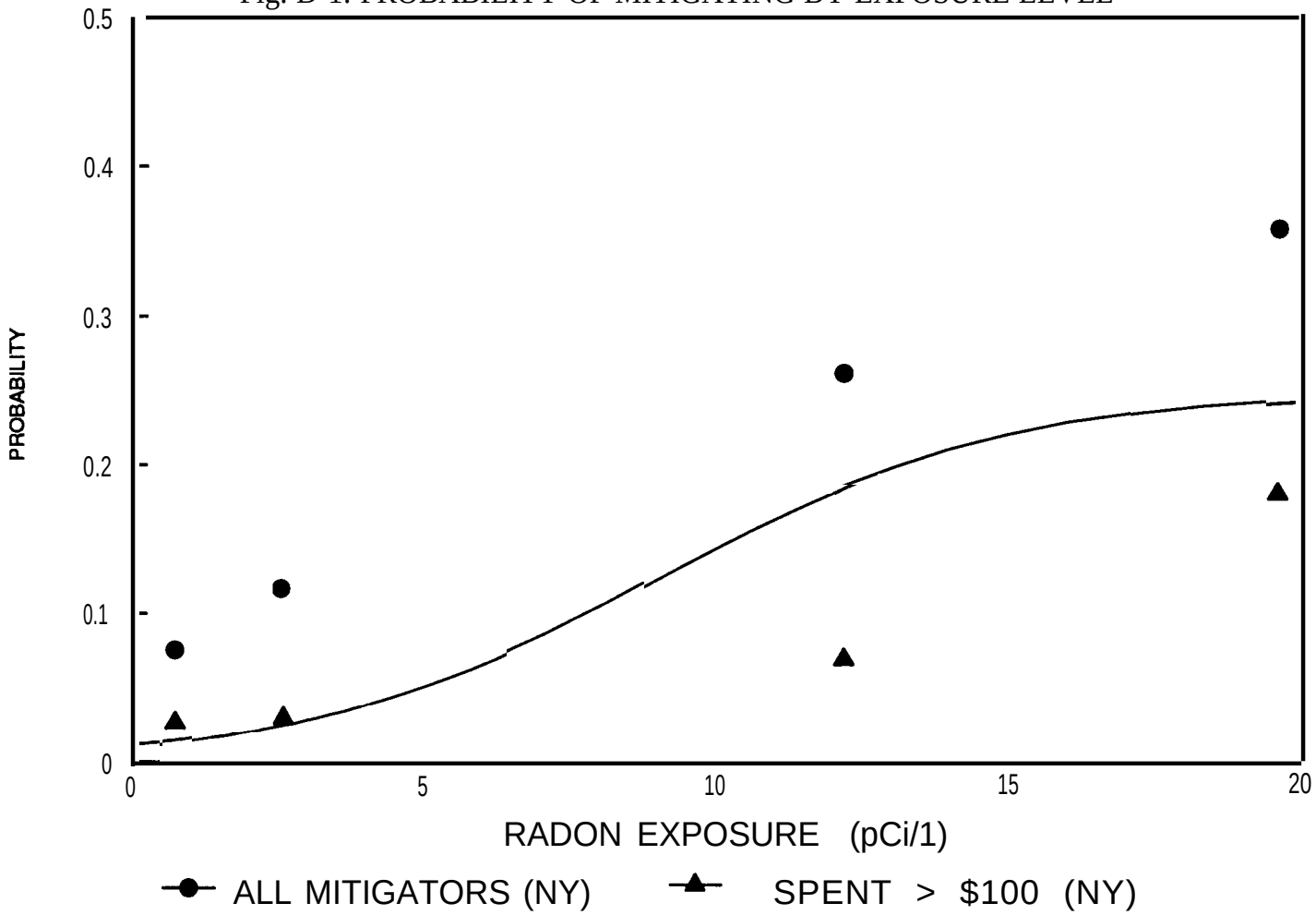
[6] Smith, V. Kerry, William H. Desvousges, Ann Fisher, and F. Reed Johnson, *Communicating Radon Risk Effectively: A Mid-Course Evaluation*, final report to U.S. EPA Office of Policy, Planning, and Evaluation, EPA-230-07-87-029, July 1987.

[7] Napolitano, Samuel, "An Analysis of Radon Risks and Strategies for their Reduction," EPA Office of Radiation Programs, October 2, 1987 draft.

that two percent of the untested population will monitor their homes for radon. Mitigation rates for existing homes with radon exposure above four pCi/l are assumed to continue to range between five percent and 25 percent.

Fig. D-1: PROBABILITY OF MITIGATING BY EXPOSURE LEVEL



Source: Based on proportion of respondents in V. Kerry Smith, William H. Desvousges, Ann Fisher, and F. Reed Johnson, *Communicating Radon Risk Effectively: A Mid-Course Evaluation*, final report to U.S. EPA Office of Policy, Planning, and Evaluation, EPA-230-07-87-029, July 1987, who said they did something to lower their radon exposure and those who spent at least $100 on mitigation.

Table D-1: PRIVATE RADON MITIGATION COSTS

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Monitoring Costs															
1. New Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
2. Existing Homes	0.5	1.5	10.0	23.6	22.9	22.4	22.0	21.5	21.1	20.7	20.3	19.9	19.5	19.1	18.7
3. Total Monitoring Costs	0.5	1.5	10.0	23.6	22.9	22.5	22.0	21.6	21.2	20.8	20.4	20.0	19.6	19.3	18.9
Capital Costs															
4. New Construction	0.0	0.7	1.7	3.5	6.9	13.9	20.8	27.7	34.6	41.6	48.5	55.4	62.4	69.3	76.2
5. Existing Homes	0.6	1.8	22.1	52.2	49.6	47.6	45.7	43.8	42.0	40.2	38.5	36.8	35.3	33.7	32.2
6. Total Capital Costs	0.6	2.5	23.8	55.7	56.5	61.5	66.5	71.5	76.6	81.8	87.0	92.3	97.6	103.0	108.4
7. Total Capital Costs	1.1	4.0	33.8	79.3	79.4	94.0	88.5	93.1	97.8	102.6	107.4	112.3	117.2	122.3	127.3
Operating Costs															
8. New Construction	0.0	0.0	0.0	0.1	0.3	0.8	1.4	2.3	3.3	4.6	6.1	7.8	9.8	11.9	14.3
9. Existing Homes	0.1	0.3	2.7	8.3	13.7	18.8	23.8	28.5	33.1	37.4	41.6	45.6	49.4	53.1	56.6
10. Total Operating Costs	0.1	0.3	2.7	8.4	14.0	19.6	25.2	30.8	36.4	42.1	47.7	53.4	59.2	65.0	70.8
11. Total Costs	1.2	4.2	36.5	87.7	93.4	103.6	113.7	123.9	134.3	144.6	155.2	165.7	176.5	187.3	198.1
New Construction															
12. % Roughed in	0.0	0.2	0.5	1.0	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0
13. % Activated	0.0	2.0	4.0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
14. No. Activated	0	50	220	800	1,600	3,300	4,900	6,600	8,200	9,900	11,500	13,200	14,800	16,500	18,100
Existing Homes															
15. % Tested	0.0	0.1	0.8	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.6	1.6
16. % Mitigated	2.0	2.0	3.7	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.2	3.1	3.0	3.0	2.9
17. No. Mitigated	500	1,500	18,400	43,500	41,300	39,700	38,100	36,500	35,000	33,500	32,100	30,700	29,400	28,100	26,800

Notes for Table D-1 by Line:

1-3. Based on average monitoring costs of $20. Assumed test rates are shown in line 15.

4-6. Based on average rough-in costs of $300 and activation costs of $200 for new construction. Average mitigation cost for existing homes is $1,200. The number of mitigations is based on a 0.03 probability of testing. The probability of mitigating is given by 0.25/[1 + exp(3 - 0.33*concentration)]. Radon concentrations are assumed to be lognormally distributed with geometric mean of 0.9 and geometric standard deviation of 3.2. (See text of Appendix D for further details.) Rates of testing and mitigation in roughed-in new construction are assumed to be twice those of existing homes. The rough-in and activation rates are shown in lines 12-14. The derived mitigation rates and associated number of mitigating households for each year are shown in lines 16 and 17.

7. Total of lines 3 and 6. Line 3 includes only initial monitoring, which is considered to be more a capital than an operating cost. Follow-up monitoring is included under line 10.

8-10. Based on average annual operating and maintenance cost of $130.

11. Total of lines 7 and 10.

Table D-2: MITIGATION BY EXPOSURE AND COST LEVELS

Annual Basement Reading (pCi/l)	Cost ($ per household) <100	101-500	501-1000	1001-2000	2501-5000	>5000	Number of House-holds	Total Cost ($)	Average Cost ($)
<1	32	10	3	4	0	0	49	10,755	219
1-3.9	65	16	2	3	2	1	89	86,005	966
4-19.9	45	4	4	2	2	4	61	112,930	1,851
>20	6	3	2	0	1	0	12	35,920	2,993
Total Number	148	33	11	9	5	5	211	245,610	1,164

Source: Smith, V. Kerry, William Desvousges, Ann Fisher, and F. Reed Johnson, *Communicating Radon Risk Effectively: A Mid-Course Evaluation*, Final Report to the U.S. EPA Office of Policy, Planning and Evaluation, EPA-230-07-87-289, July 1987.

APPENDIX E
ESTIMATION OF NON-POINT SOURCE POLLUTION CONTROL COSTS

This appendix contains background data and documentation for the non-point source control costs presented in Chapter 4. Historical costs were derived for three types of non-point source pollution control which are discussed in the sections indicated below.

E.1. Soil erosion control;
E.2. Highway erosion control; and
E.3. Agricultural feedlot runoff control.

E.1. SOIL EROSION CONTROL

Table E-1 contains estimates of soil erosion control costs for public and private sectors of the economy. The capital costs are based on estimates of erosion control program grants distributed by Federal agencies, primarily the Department of Agriculture (USDA), with matching funds provided by state, local or private farming operations. Not all erosion control efforts are aimed at preventing water quality damages; thus, only a portion of total expenditures for erosion control were attributed to non-point source water pollution control. The portion chosen was 10 percent, which is based on information provided in USDA publications that breakdown certain Federal expenditures for erosion control program by purpose. The 10 percent factor was applied to costs for all erosion control activities, both public and private.

For certain years, the relative contribution of Federal, state, local and private costs are not broken out separately from the expenditure data. For these years, the average proportion of total costs borne by each sector in years for which data were available were used to estimate costs by sector.

While data on total costs and total capital costs are available, data on capital and operation and maintenance (O&M) costs for individual sectors is not reported. Additional information allowed us to distinguish private capital costs from government expenditures. Armed with this information, it was assumed that costs were divided evenly between capital and O&M expenditures for Federal, state and local governments, while 75 percent of private expenditures were for capital improvements and 25 percent were used to operate and maintain these structures. These ratios maintained the observed balance between aggregate national capital and O&M costs, and public and private costs.

E.2. HIGHWAY EROSION CONTROL

The cost estimates for highway erosion control shown in Table E-1 were provided by the Department of Commerce “Pollution Abatement and Control Expenditures” (PACE) reports. The Commerce reports do not separate state and local expenditures in this area. Therefore, it was assumed that the division is approximately 50-50, which mirrors that for soil erosion costs. The distribution of total costs between capital and O&M costs, on the other hand, was assumed to be

more heavily weighted to O&M costs. Ninety percent of Federal costs were attributed to O&M costs, and the remaining 10 percent to capital costs. The ratio of O&M to capital costs for state and local governments was assumed to be 4:1, due to the relatively greater amounts of new highway construction undertaken by state and local governments.

All highway erosion control measures are assumed to contribute to the improvement or maintenance of water quality conditions. If this assumption is too strong, the cost estimates should be adjusted downward to reflect only projects having positive contribution to water quality conditions in nearby waterbodies.

E.3. AGRICULTURAL FEEDLOT RUNOFF CONTROL

The cost estimates for agricultural feedlots shown in Table E-1 are included in the non-point source category, although a strong case can be made to include them in the point source category. The estimates are based on data from the Department of Commerce PACE reports. The costs are clearly differentiated in the PACE reports between capital and O&M expenditures. All costs are attributed to private operations, and no feedlot costs have been estimated for public activities, which are not significant.

E.4. MISSING ESTIMATES

The costs of non-agricultural erosion controls have not been included in the current cost estimates; thus, the costs of controlling water pollution from silvicultural, rangeland, and mining have been omitted. These costs have been significant in selected areas of the United States, but national estimates have been relatively low compared to costs for controlling agricultural sources of pollution. The costs of controlling nutrients on agricultural lands have not been included, although it is expected that some part of these costs have been captured in the costs included for erosion control. Some agricultural soil erosion control projects also serve to reduce nutrient runoff into rivers, lakes and estuaries.

Greater attention is currently being directed to non-point sources of pollution, so future costs may eventually prove to much greater than those estimated in this report. Preliminary analysis suggests that soil erosion costs would increase dramatically if pollution control measures were applied widely on farmlands.

Table E-1: CONTROL COSTS FOR CONSERVATION, HIGHWAY EROSION, AND ANIMAL FEEDLOTS

(millions of 1986 dollars)

Category/Funding Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Soil Conservation															
Non-EPA Federal Capital	74	80	57	65	72	80	77	60	63	66	68	70	66	71	53
Non-EPA Federal Operating	74	80	57	65	72	80	77	60	63	66	68	70	66	71	53
State Government Capital	7	7	6	6	7	7	7	6	6	6	6	6	6	6	5
State Government Operating	7	7	6	6	7	7	7	6	6	6	6	6	6	6	5
Local Government Capital	7	7	6	6	7	7	7	6	6	6	6	6	6	6	5
Local Government Operating	7	7	6	6	7	7	7	6	6	6	6	6	6	6	5
Private Capital	70	74	59	65	70	76	72	60	64	64	66	68	63	68	51
Private Operating	23	25	20	22	23	25	24	20	21	21	22	23	21	23	17
Highway Erosion															
Non-EPA Federal Capital	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Non-EPA Federal Operating	7	6	5	5	6	6	5	6	5	7	6	7	7	5	5
State Government Capital	53	48	43	46	44	36	32	36	37	35	40	37	41	39	42
State Government Operating	213	193	170	184	177	146	127	143	146	142	159	150	165	156	168
Local Government Capital	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Local Government Operating	213	213	213	213	213	213	213	213	213	213	213	213	213	213	213
Agricultural Feedlots															
Private Capital	5	5	6	6	6	6	5	4	3	3	3	2	3	3	3
Private Operating	1	1	2	2	4	4	4	4	4	5	6	7	8	8	8

Sources for Table E-1

Soil conservation expenditures are derived from a diverse number of sources. The primary data sources include:

"Conservation and Erosion Control Costs in the United States," G. Pavelis, USDA, Economic Research Service, ERS Staff Report No. AGES850423, July 1985.

"Conservation capital in the United States, 1935-1980," *Journal of Soil and Water Conservation*, G. Pavelis, Nov-Dec, 1983.

"1980 Appraisal Part I: Soil, Water, and Related Resources in the United States: Status, Condition and Trends", USDA, Soil Conservation Service, March, 1981.

"Agricutural Statistics," US Department of Agriculture, various years.

Highway erosion expenditures are from the U.S. Department of Commerce, Bureau of Economic Analysis series on "Pollution Abatement and Control Expenditure." For example, the most recent data was published in June, 1989 in the *Survey of Current Business*. Cost estimates for federal expenditure can be found in Table 7, line 20, and costs for state and local governments can be found on line 23.

Costs in the *Survey of Current Business* do not differentiate between capital and operating expenditures. Therefore, federal expenditures were assumed to be 10 percent capital cost and 90 percent operating cost. State and local expenditures were assumed to be 20 percent capital costs and 80 percent operating costs. The difference is due to the degree of new construction occuring on state and local highways, versus that taking place on federal highways.

Feedlot expenditures are from the U.S. Department of Commerce, Bureau of Economic Analysis series on "Pollution Abatement and Control Expenditures." For example, the most recent data was published in June, 1989 in the *Survey of Current Business*. Cost estimates can be found in Table 7, line 6 for capital, and line 12 for operating expenditures.

APPENDIX F
ESTIMATION OF WATER POLLUTION CONTROL COSTS

This appendix provides component costs and background documentation for the derivation of the historical water quality and drinking water cost estimates presented in Chapter 4. These two categories of water costs are discussed separately below.

F.1. WATER QUALITY COSTS

Estimates of historical water quality costs were derived from three different sources. Estimates of private sector costs were derived from the "Pollution Abatement and Control Expenditures" (PACE) reports published annually in the *Survey of Current Business* by the U.S. Department of Commerce. These costs represent private expenditures to control industrial effluents in compliance with NPDES permits and for the pretreatment of discharges to municipal wastewater treatment facilities.

Estimates of state and local costs were derived from annual *Government Finances* reports published by the U.S. Census Bureau. The Census data show state and local water quality program implementation costs as well as wastewater treatment and sewerage costs. Adjustments were made to the Census data to remove all indirect expenditures associated with Federal and state grants to state and local governments. In addition, 20 percent of state and local costs reported as "natural resources" costs in the Census data were added to state and local wastewater treatment and sewerage costs. This adjustment was made to include that portion of natural resource costs which are believed to be related to water quality.

Finally, estimates of EPA water quality costs which, for the most part, represent Federal grants to state and local governments for NPDES program implementation and wastewater treatment, respectively, were derived from annual "Justification of Appropriation Estimates for Committee on Appropriations" documents.

Table F-1 presents cost data from the *Government Finances* series. Table F-2 presents data on Federal grants. Table F-3 contains local capital expenditures for sewerage and wastewater treatment adjusted to exclude Federal grants to local governments. Table F-4 presents estimates of total state and local water quality expenditures which include that portion of natural resource expenditures directed to water quality and exclude Federal grants for wastewater treatment. Table F-5 presents state, local, and private water quality costs in current dollars broken into capital and O&M cost components. Table F-6 shows these costs in constant 1986 dollars, and Table F-7 shows the conversion of cost estimates from fiscal years into calendar years.

F.2. DRINKING WATER TREATMENT COSTS

The Safe Drinking Water Act (SDWA) of 1974 initiated a regulatory program to develop and enforce uniform national quality standards to assure the safety of public drinking water supplies. The SDWA called for promulgation of National Interim Primary Drinking Water Regulations (NIPDWR) while final regulations were being developed. The Final EPA rule specifying the NIPDWR for inorganic and microbiological contaminants was published in the Federal Register in December of 1976. State enforcement was required to begin within 18 months. Another rule, the Total Trihalomethane (TTHM) regulation directed to controlling the most common forms of harmful by-products of chlorine disinfection, was finalized in November of 1979. Together, the TTHM rule and the interim regulations have accounted for the majority of SDWA-induced compliance expenditures to date.

Final National Primary Drinking Water Regulations for fluoride, volatile organic chemicals (VOCs), surface water treatment, and coliforms were promulgated only recently and thus have only just begun to impose costs. These and other forthcoming rules for the remainder of the 83 contaminants listed in the 1986 Amendments to the SDWA are expected to add significantly to compliance costs over the next several years.

Total drinking water treatment costs are shown in Tables F-8 through F-11. The data in the tables are broken down into three time periods corresponding to the appropriate regulatory phases:

The **Pre-Regulatory Period** covering years prior to 1978, during which there were no effective regulations under the SDWA;

The **Interim (NIPDWR/TTHM) Period** covering years 1978-1988, during which the interim primary regulations and the trihalomethane rule were the only effective SDWA regulations; and

The **1986 SDWA Amendments Period** covering years 1989-2000, during which compliance costs pursuant to the SDWA 1986 amendments have and will be incurred.

The focus of this section of Appendix F is costs associated with treating public drinking water supplies as opposed to costs directly related to providing public water (*e.g.* costs for water mains). The *Government Finances* series, from which data presented in columns B and C of Tables F-8 and F-9 (data from Table F-8 indexed to 1986 dollars) were obtained, reports not only the local government costs associated with drinking water treatment, but also costs for supplying water to the public. Since they are not directly related to costs incurred for assuring the safety of public drinking water, estimated water supply costs were removed from the *Government Finances* series data. The costs that remain (costs for water treatment) are shown in columns F and G of Tables F-8 and F-9. Figures 1 and 2 present costs for water treatment, while Figures 3 and 4 present total drinking water costs, including costs for water supply and treatment, disaggregated into baseline and SDWA expenditures.

F.2.1. *Expenditures During The Pre-Regulatory Period*

Even before Federal regulations regarding drinking water quality were promulgated, municipalities and private water suppliers incurred treatment costs to assure acceptable taste and odor and to avoid outbreaks of acute waterborne diseases. The U.S. Public Health Service published voluntary standards in 1962 which were followed widely.

A November, 1977 EPA report entitled, *The Cost of Water Supply And Water Utility Management*, summarizes the results of research conducted by the Municipal Environmental Research Laboratory that provides insights into the cost of treating water in the pre-regulatory period. Detailed case studies of 12 municipal water utilities of various sizes and geographic locations were prepared. A time series of cost data was developed for each utility covering the period 1965 through 1974. The results indicate that, on average, 12.4 percent of total drinking water supply O&M costs were devoted to water treatment. These data were used to calculate that portion of total drinking water O&M costs devoted to treatment during the pre-regulatory period.

Unfortunately this report analyzed capital costs in terms of annual interest and depreciation costs only, which is not compatible with capital outlays, the focus of our analysis. A 1977 Commerce Department study entitled, *The 1977 Market for Water And Wastewater Treatment Equipment*, provides a time series of data that permits a comparison of capital outlays for drinking water treatment to total capital outlays by the water industry. For the period 1965 through 1974, the data indicate that capital outlays for water treatment were 18.4 percent of total capital outlays by drinking water suppliers. These data were used to calculate that portion of total drinking water capital costs that were devoted to treatment during the pre-regulatory period.

F.2.2. *The Interim Period*

In August 1980, EPA published a report entitled, *Water Utility Financing Study: National Costs of The Interim Primary Drinking Water Regulations.* This report estimated that treatment processes to be installed pursuant to the NIPDWR would result in capital outlays of $1.49 billion and O&M costs of $231 million per year. The total national cost of associated monitoring requirements was not estimated.

The forecasts on which the Water Utility Financing Study was based did not, for the most part, materialize. Monitoring data revealed that inorganic chemical contamination of supplies was not as extensive as had been supposed. The inorganic chemical portions of the NIPDWR were modeled after the 1962 U.S. Public Health Service Standards, and many public water systems were already meeting these standards. It is believed that relatively little compliance activity has actually been required regarding inorganic chemicals, which accounted for the bulk of forecasted expenditures.

In contrast, monitoring for microbiological contamination has revealed a significant number of problems requiring resolution. The microbiological portion of the total and compliance expenditures forecast in the Water Utility Financing Study included capital outlays of $343 million

and O&M costs of $38 million. The declines measured in the number of violators of microbiological standards suggests that these compliance costs were realized.

In the September 1979 report, *Economic Impact Analysis of The Promulgated Trihalomethane Regulation For Drinking Water,* EPA estimated that total compliance costs for this rule would include capital outlays of $104 million and O&M costs of $14 million per year. Monitoring costs were not included in the analysis. In 1986, the American Water Works Association Research Foundation conducted a survey of a statistical sampling of water systems to assess trihalomethane compliance and to estimate compliance costs. By extrapolation, the study concludes that industry-wide capital outlays fell in a range from $31 million to $99 million while O&M expenditures range from $8 million to $29 million per year.[1]

In the report, *1984 Water Utility Operating Data*, based on a member survey conducted by the American Water Works Association, an estimate of the existing level of expenditure for monitoring of regulated contaminants is provided. Converted to 1986 dollars, the responding utilities, which serve 46 percent of the total population served by community water systems, reported expenditures totalling $53 million per year. If the utilities serving the other 54 percent of the total population served by community water systems expended proportionate amounts, the total monitoring expenditure for all community water systems would be $115 million per year.

By synthesizing the above analyses, it was possible to construct an overall estimate of SDWA compliance expenditures during the Interim period covering years 1978 through 1988. To estimate capital and O&M expenditures, it was assumed that the microbiological portion of expenditure forecasts for the NIPDWR and the trihalomethane regulation were fully realized. In addition, the estimate of monitoring costs based on the AWWA survey was used. Total O&M expenditures (including monitoring costs) over the period are estimated as $167 million per year. For capital outlays, the total estimated capital cost of $447 million for compliance with microbiological and TTHM regulations was used. This translates into an average annual capital outlay of $41 million per year over the eleven year period.

F.2.3. *The SDWA 1986 Amendments Period*

In compliance with Executive Order 12291, EPA is required to assess the total national cost of all proposed new regulations. This process has been completed for many new regulations forthcoming under the 1986 Amendments to the Safe Drinking Water Act, except for the disinfection by-products rules. It is estimated that, when fully realized, compliance with the new regulations will require additional capital outlays of roughly $1 to $2 billion per year and additional O&M expenditures (including monitoring costs) of about $1.25 billion per year throughout the mid to late 1990s.

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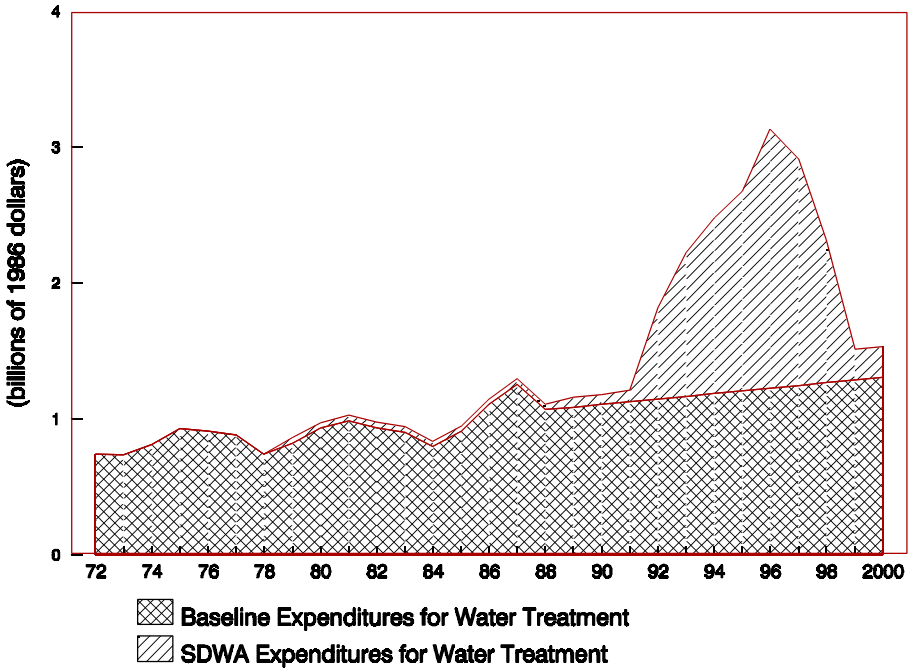
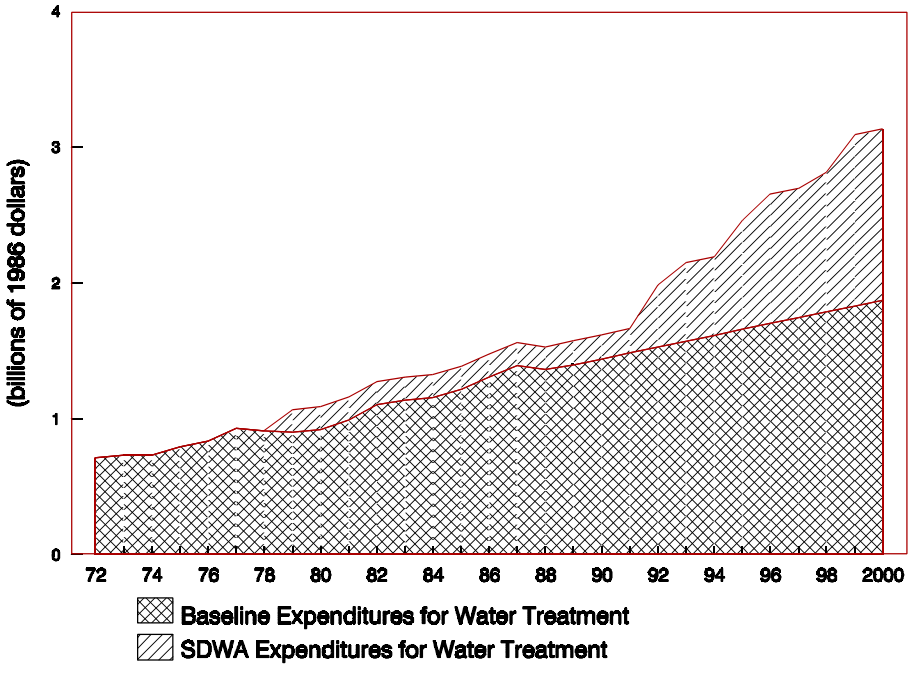
[1] McGuire, M.J. and Meadow, R.G., "AWWARF Trihalomethane Survey," *Journal of the American Water Works Association,* Vol. 80, No. 1, January 1988.

Fig. F-1: CAPITAL OUTLAYS FOR DRINKING WATER TREATMENT



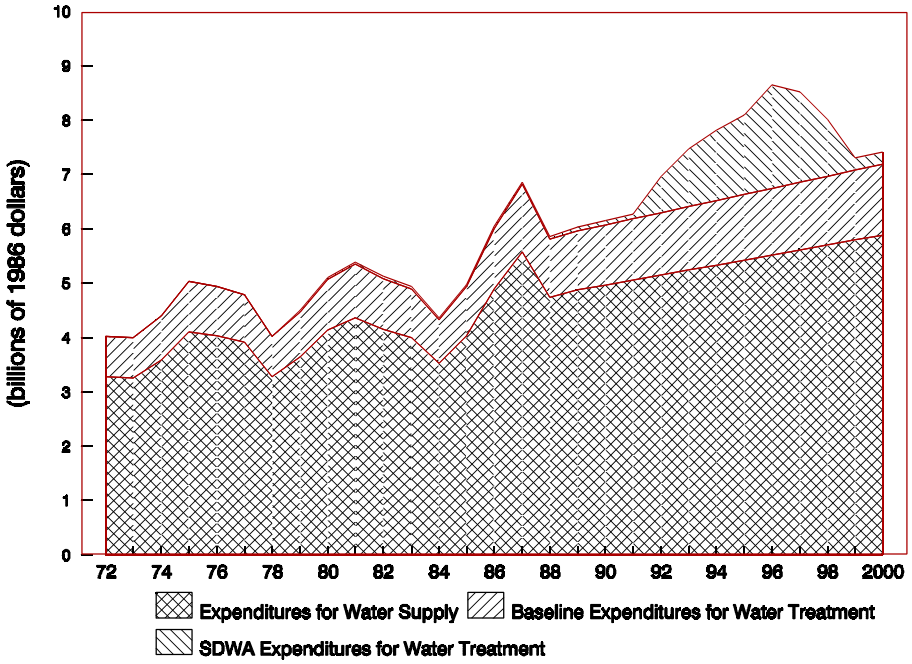
Source: Table F-9.

Fig. F-2: OPERATING EXPENDITURES FOR DRINKING WATER TREATMENT



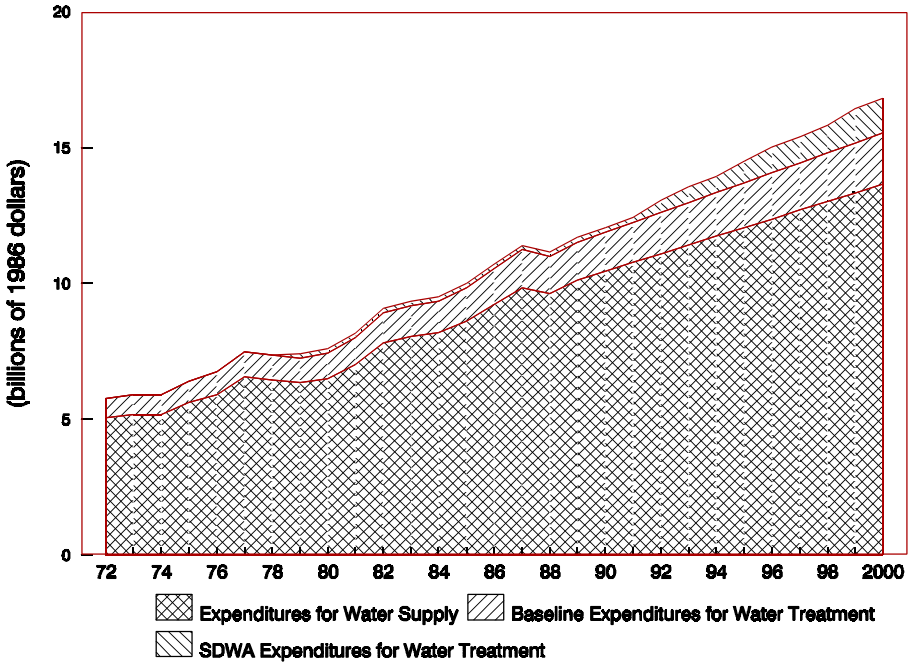
Source: Table F-9.

Fig. F-3: TOTAL CAPITAL OUTLAYS FOR DRINKING WATER SUPPLY



Source: Table F-9. Expenditures for Water Supply equals column D minus columns F and H in Table F-9.

Fig. F-4: TOTAL OPERATING EXPENDITURES FOR DRINKING WATER SUPPLY



Source: Table F-9. Expenditures for Water Supply equals column E minus columns G and I in Table F-9.

Table F-1: DATA FROM *GOVERNMENT FINANCES* SERIES

(millions of current dollars)

	EXPENDITURES FOR SEWERAGE						EXPENDITURES FOR NATURAL RESOURCES					
	Local			State			Local			State		
	Capital	O&M	Total	Capital	O&M	Total	Capital	O&M	Total	Capital	O&M	Total
	B	C	D	F	G	H	J	K	L	N	O	P
1972	2,091	1,073	3,164	0	0	0	233	407	640	542	1,928	2,470
1973	2,428	1,176	3,604	0	0	0	248	407	655	526	2,097	2,623
1974	2,640	1,440	4,080	0	0	0	290	454	744	631	2,286	2,917
1975	3,569	1,693	5,262	0	0	0	336	519	855	777	2,591	3,368
1976	3,955	1,982	5,937	0	0	0	336	685	1,021	736	2,905	3,641
1977	4,208	2,329	6,537	0	0	0	301	595	896	953	3,155	4,108
1978	4,180	2,662	6,842	185	115	300	296	688	984	348	2,893	3,241
1979	5,415	3,073	8,488	204	103	307	334	778	1,112	387	3,207	3,594
1980	6,028	3,530	9,558	243	91	334	526	859	1,385	527	3,597	4,124
1981	6,692	4,084	10,776	220	125	345	448	1,003	1,451	570	4,155	4,725
1982	5,660	4,778	10,438	235	124	359	368	980	1,348	696	4,469	5,165
1983	5,726	5,310	11,036	80	123	203	480	1,057	1,537	831	4,714	5,545
1984	5,550	5,720	11,270	113	133	246	584	1,175	1,759	829	4,833	5,662
1985	5,738	6,119	11,858	187	141	328	660	1,302	1,962	1,076	5,319	6,395
1986	6,296	6,670	12,966	165	177	341	727	1,449	2,176	1,076	5,822	6,897
1987	7,114	7,342	14,456	192	213	406	745	1,639	2,384	1,261	6,093	7,354

Footnotes for Table F-1 by Column

EXPENDITURES FOR SEWERAGE:

B **Local Capital Expenditures for Sewerage** from *Government Finance* series. Used "Total Capital Outlay" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 14; for 1978-1980 see Table 13; and for 1972-1976 see Table 9.

C **Local O&M Expenditures for Sewerage** from *Government Finance* series. Used "Current Operation" under Direct Expenditures. For 1985-1987, see Table 8. For 1984 and earlier, Local O&M was calculated in the spreadsheet by subtracting local capital expenditures (column B) from total local expenditures (column D).

D **Total Local Expenditures for Sewerage** from *Government Finance* series. Used "Total" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 11; for 1978-1980 see Table 10; and for 1972-1976 see Table 7.

F **State Capital Expenditures for Sewerage** from *Government Finance* series. Used "Total Capital Outlay" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 14; for 1978-1980 see Table 13; and for 1972-1976 see Table 9.

G **State O&M Expenditures for Sewerage** from *Government Finance* series. Used "Current Operation" under Direct Expenditures. For 1985-1987, see Table 8. For 1984 and earlier, State O&M was calculated in the spreadsheet by subtracting state capital expenditures (column F) from total state expenditures (column H).

H **Total State Expenditures for Sewerage** from *Government Finance* series. Used "Total" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 11; for 1978-1980 see Table 10; and for 1972-1976 see Table 7.

EXPENDITURES FOR NATURAL RESOURCES:

J **Local Capital Expenditures for Natural Resources** from *Government Finance* series. Used "Total Capital Outlay" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 14; for 1978-1980 see Table 13; and for 1972-1976 see Table 9.

K **Local O&M Expenditures for Natural Resources** from *Government Finance* series. Used "Current Operation" under Direct Expenditures. For 1985-1987, see Table 8. For 1984 and earlier, Local O&M was calculated in the spreadsheet by subtracting local capital expenditures (column J) from total local expenditures (column L).

L **Total Local Expenditures for Natural Resources** from *Government Finance* series. Used "Total" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 11; for 1978-1980 see Table 10; and for 1972-1976 see Table 7.

N **State Capital Expenditures for Natural Resources** from *Government Finance* series. Used "Total Capital Outlay" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 14; for 1978-1980 see Table 13; and for 1972-1976 see Table 9.

O **State O&M Expenditures for Natural Resources** from *Government Finance* series. Used "Current Operation" under Direct Expenditures. For 1985-1987, see Table 8. For 1984 and earlier, State O&M was calculated in the spreadsheet by subtracting state capital expenditures (column N) from total state expenditures (column P).

P **Total State Expenditures for Natural Resources** from *Government Finance* series. Used "Total" under Direct Expenditures. For 1985-1987 see Table 8; for 1977 and 1981-1984 see Table 11; for 1978-1980 see Table 10; and for 1972-1976 see Table 7.

Table F-2: FEDERAL GRANT ADJUSTMENTS

(millions of current dollars)

	EPA Construction Grants (Title II)*		EPA Water Quality Grants to States			
			Section 106**	Section 205(g)***	Section 205(j)***	Total
	R	T	U	W	Y	AA U+W+Y
1972	413 #		15 #			15
1973	684 #		20 #			20
1974	1,553 #		50 #			50
1975	1,938	Actual:	46			46
1976	2,790 ##	2429	46			46
1977	3,169 ##	3530	51			51
1978	3,187		53			53
1979	3,756		54			54
1980	4,343		49			49
1981	3,881		51			51
1982	3,756		51	50		101
1983	2,983		54	127	34	215
1984	2,623		54	83	23	160
1985	2,900		61	100 #	24 #	185
1986	3,113		62	93	19	174
1987	2,920		71	82	30	183

Footnotes for Table F-2

* Amounts are actual outlays from the annual Justification of Appropriation Estimates for Committee on Appropriations; except for those noted by #, which are adjusted outlays

An adjustment for transition quarter was made where noted by ##, as follows:

$2429 for 1976 and $3187 for 1978 sum to $5616, that sum divided by 2 equals $2808, the $3530 for 1977 minus $2808 equals $722; one-half of the $722 or $361 is distributed to 1976 [$2429 + $361 = $2790] and to 1977 [$2808 + $361 = $3169]

** Amounts are actual obligations from the annual Justification of Appropriation Estimates for Committee on Appropriations, except for those noted by #, which are budget authority

*** Amounts are actual obligations from the annual Justification of Appropriation Estimates for Committee on Appropriations, except for that noted by #, which is estimated obligations

R **EPA Construction Grants**. Title II Construction Grants began in 1972. Amounts are actual outlays from the annual Justification of Appropriation Estimates for Committee on Appropriations.

The amounts for 1976 and 1977 were adjusted to account for the transition quarter. The adjustment is made as follows: the actual outlays of $2429 for 1976 and $3187 for 1978 sum to $5616 and that sum divided by 2 equals $2808. The actual outlay of $3530 for 1977 minus $2808 equals $722. One-half of $722 or $361 is distributed to 1976 ($2429 + $361 = $2790) and the other half to 1977 ($2808 + $361 = $3169).

T Amounts for 1976 and 1977 are actual outlays from the annual Justification of Appropriation Estimates for Committee on Appropriations. The actual outlays for these two years were adjusted in (column R) to account for the transition quarter.

U **Section 106 grants**. Amounts are from the annual Justification of Appropriation Estimates for Committee on Appropriations, under the Abatement, Control and Compliance appropriation. For 1972-1974, amounts are budget authority. For 1975-1988, amounts are actual obligations.

W **Section 205(g) grants**. Amounts are from the annual Justification of Appropriation Estimates for Committee on Appropriations. Amounts are actual obligations, except for 1985 which is estimated obligations. Section 205 grants are under the Construction Grants appropriation. States receive section 205 funds as reserves from their Construction Grants allotment. Section 205(g) obligations started in 1982.

Y **Section 205(j) grants**. Amounts are from the annual Justification of Appropriation Estimates for Committee on Appropriations. Amounts are actual obligations, except for 1985 which is estimated obligations. Section 205 grants are under the Construction Grants appropriation. States receive section 205 funds as reserves from their Construction Grants allotment. Section 205(j) obligations started in 1983.

AA **Total EPA Water Quality Grants to States**. Amounts are the sum of section 106, 205(g), and 205(j) grants.

Table F-3: CALCULATION OF LOCAL WASTEWATER CAPITAL

(millions of current dollars)

	Adjusted EPA Construction Grants (EPA Const Grants - amount reserved for Section 205	Own Source: (Local Sewerage Capital - Adjusted EPA Const Grants)	Local Const Grants: (Local Match of Adj EPA Const Grants)	Local Match Formula	Local Wastewater Capital: (Own Source - Local Const Grants)
	AC R-(W+Y)	AE (B-AC)	AG AC*(Local Share)	AI (Local/Fed)	AK (AE-AG)
1972	413	1,678	103	(0.25/0.75)	1,575
1973	684	1,744	171	(0.25/0.75)	1,573
1974	1,553	1,087	388	(0.25/0.75)	699
1975	1,938	1,631	485	(0.25/0.75)	1,147
1976	2,790	1,165	698	(0.25/0.75)	468
1977	3,169	1,039	792	(0.25/0.75)	247
1978	3,187	993	797	(0.25/0.75)	196
1979	3,756	1,659	939	(0.25/0.75)	720
1980	4,343	1,685	1,086	(0.25/0.75)	599
1981	3,881	2,811	970	(0.25/0.75)	1,841
1982	3,706	1,954	927	(0.25/0.75)	1,028
1983	2,822	2,904	706	(0.25/0.75)	2,199
1984	2,517	3,033	629	(0.25/0.75)	2,404
1985	2,776	2,962	1,249	(0.45/0.55)	1,713
1986	3,001	3,295	1,350	(0.45/0.55)	1,945
1987	2,808	4,306	1,264	(0.45/0.55)	3,042

Footnotes for Table F-3

AC **Adjusted EPA Construction Grants**. Amounts for EPA Construction Grants (column R) were adjusted by subtracting amounts reserved for section 205 (the sum of column W and column Y).

AE **Own Source**. "Own Source" represents local capital expenditures for sewerage excluding federal funds from the construction grant program. "Own Source" is calculated by subtracting Adjusted EPA Construction Grants (column AC) from Local Capital Expenditures for Sewerage (column B).

AG **Local Construction Grants**. "Local Construction Grants" represents the local share of construction grant financing and is calculated by multiplying the amount for Adjusted EPA Construction Grants (column AC) by the local share of the "Local Match Formula." For 1972-1984, the local share is 25 percent. For 1985-1987, the local share is 45 percent.

AI **Local Match Formula**. This column presents the formula to determine the local share of the Local/Federal match for construction grants. Title II of the 1972 Federal Water Pollution Control Act established the construction grant program, with the local share for construction financing at 25 percent and the federal share at 75 percent. The 1981 Amendments to the Clean Water Act increased the local share to 45 percent and decreased the federal share to 55 percent for grant awards beginning in 1985.

AK **Local Wastewater Capital**. "Local Wastewater Capital" represents local capital expenditures for sewerage excluding local funds for construction grants. "Local Wastewater Capital" is calculated by subtracting Local Construction Grants (column AG) from "Own Source" (column AE).

Table F-4: ADJUSTMENT FOR 20 PERCENT OF NATURAL RESOURCE EXPENDITURES

(millions of current dollars)

	Adjusted State		Adjusted Local					
			Capital			O&M		
Year	Capital	O&M						
	AM F+(.2*N)	AN G+(.2*O)-AA	AO AK+(.2*J)	AP (1)	AQ AO+AP	AR C+(.2*K)	AS (2)	AT AR+AS
1972	108	371	1,621	29	1,650	1,154	3	1,157
1973	105	399	1,623	55	1,678	1,257	4	1,261
1974	126	407	757	78	835	1,531	5	1,536
1975	155	472	1,214	67	1,281	1,797	7	1,804
1976	147	535	535	78	613	2,119	9	2,128
1977	191	580	307	88	395	2,448	10	2,458
1978	255	641	255	143	398	2,800	10	2,810
1979	281	690	787	109	896	3,229	12	3,241
1980	348	761	704	93	797	3,702	13	3,715
1981	334	905	1,930	85	2,015	4,285	18	4,303
1982	374	917	1,101	91	1,192	4,974	17	4,991
1983	246	851	2,295	79	2,374	5,521	18	5,539
1984	279	940	2,521	94	2,615	5,955	20	5,975
1985	402	1,020	1,845	115	1,960	6,379	12	6,391
1986	380	1,167	2,090	86	2,176	6,960	12	6,972
1987	444	1,249	3,191	82	3,273	7,670	15	7,685

Footnotes for Table F-4

Natural Resources spending is defined by the Bureau of the Census as government activities to conserve, promote, and develop agriculture, fish and game, forestry, and other oil and water resources, including geological research, flood control, irrigation, drainage and conservation activities. After consultation with the Governments Division, Bureau of the Census, it was determined that 20 percent of Natural Resources expenditures represent Water Quality expenditures. Based on this assumption, amounts for Water Quality expenditures were adjusted to add 20 percent of Natural Resources expenditures.

AM **Adjusted State Water Quality Capital Expenditures**. State Capital Expenditures for Sewerage (column F) were adjusted by adding 20 percent of State Capital Expenditures for Natural Resources (column N).

AN **Adjusted State Water Quality O&M Expenditures**. State O&M Expenditures for Sewerage (column G) were adjusted by adding 20 percent of State O&M Expenditures for Natural Resources (column O). The result is adjusted by subtracting the amount for Total EPA Water Quality Grants to States (column AA).

AQ **Adjusted Local Water Quality Capital Expenditures**. Local Capital Expenditures for Sewerage (column AK) were adjusted by adding 20 percent of Local Capital Expenditures for Natural Resources (column J).

AT **Adjusted Local Water Quality O&M Expenditures**. Local O&M Expenditures for Sewerage (column C) were adjusted by adding 20 percent of Local O&M Expenditures for Natural Resources (column K).

Table F-5: WATER QUALITY RAW DATA RECAPITULATED IN TOTALS FOR CAPITAL & OPERATING COSTS

(millions of current dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Capital																
1	State Govt	108	105	126	155	147	191	255	281	348	334	374	246	279	402	380	444
2	Local Govt	1,650	1,678	835	1,281	613	395	398	896	797	2,015	1,192	2,374	2,615	1,960	2,176	3,273
3	Private	2,767	3,206	3,190	3,579	4,161	4,556	5,000	5,291	5,030	4,760	4,814	5,005	5,655	5,750	5,784	5,945
	Operating																
4	State Govt	371	399	407	472	535	580	641	690	761	905	917	851	940	1,020	1,167	1,249
5	Local Govt	1,157	1,261	1,536	1,804	2,128	2,458	2,810	3,241	3,715	4,303	4,991	5,539	5,975	6,391	6,972	7,685
6	Private																
7	Abatement	1,073	1,256	1,512	1,802	2,184	2,587	2,922	3,425	3,848	4,357	4,454	5,084	5,588	6,035	6,445	7,236
8	Res & Dev	64	73	57	68	78	91	99	107	110	108	116	167	172	181	190	199
9	Total Priv	1,137	1,329	1,569	1,870	2,262	2,678	3,021	3,532	3,958	4,465	4,570	5,251	5,760	6,216	6,635	7,435

Footnotes to Table F-5 for line:

1 Figures from Column AM, Table F-4

2 Figures from Column AQ, Table F-4

3 Figures from *Survey of Current Business*: 1972-1982 data from July 1986, Pollution abatement and control, Pollution Abatement, Business, On capital account, Table 9, Line 7; 1983-1987 figures from June 1989, Pollution abatement and control, Pollution Abatement, Business, On capital account, Table 6, Line 7

4 Figures from Column AN, Table F-4

5 Figures from Column AT, Table F-4

7 Figures from *Survey of Current Business*: 1972-1982 data from July 1986, Pollution abatement and control, Pollution Abatement, Business, On current account, Private, Table 9, Line 9; 1983-1987 figures from June 1989, Pollution abatement and control, Pollution Abatement, Business, On current account, Private, Table 6, Line 9

8 Figures from *Survey of Current Business*: 1972-1982 data from July 1986, Pollution abatement and control, Research and development, Private, Table 9, Line 20; 1983-1987 figures from June 1989, Pollution abatement and control, Research and development, Private, Table 6, Line 20

9 Sum of lines 7 and 8

Table F-6: WATER QUALITY RAW DATA CONVERTED FROM CURRENT DOLLARS INTO 1986 DOLLARS

(millions of 1986 dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Capital																
1	State Govt	274	247	269	313	278	335	405	401	460	409	440	274	301	409	380	431
2	Local Govt	4,170	3,942	1,780	2,581	1,157	695	634	1,276	1,053	2,469	1,401	2,638	2,818	1,994	2,176	3,173
3	Private	7,096	7,764	6,769	6,931	7,578	7,737	7,832	7,518	6,577	5,673	5,445	5,427	5,841	5,786	5,784	5,857
	Operating																
4	State Govt	936	939	868	952	1,011	1,020	1,019	983	1,005	1,109	1,077	946	1,013	1,037	1,167	1,210
5	Local Govt	2,925	2,964	3,275	3,635	4,020	4,324	4,467	4,615	4,904	5,272	5,864	6,158	6,441	6,502	6,972	7,450
6	Private	3,338	3,666	3,658	3,816	4,282	4,682	4,907	5,227	5,149	5,227	5,018	5,598	5,900	6,244	6,635	7,368
	Fixed-weighted indexes																
7	Priv Capital	0.390	0.413	0.471	0.516	0.549	0.589	0.638	0.704	0.765	0.839	0.884	0.922	0.968	0.994	1.000	1.015
8	Priv Operating	0.341	0.362	0.429	0.490	0.528	0.572	0.616	0.676	0.769	0.854	0.911	0.938	0.976	0.995	1.000	1.009
9	Government	0.396	0.426	0.469	0.496	0.529	0.569	0.629	0.702	0.757	0.816	0.851	0.900	0.928	0.983	1.000	1.031

Footnotes to Table F-6 for line:

1 Line 1, Table F-5, divided by line 9, Table F-6

2 Line 2, Table F-5, divided by line 9, Table F-6

3 Line 3, Table F-5, divided by line 7, Table F-6

4 Line 4, Table F-5, divided by line 9, Table F-6

5 Line 5, Table F-5, divided by line 9, Table F-6

6 Line 9, Table F-5, divided by line 8, Table F-6

Table F-7: CONVERSION OF WATER QUALITY FISCAL YEAR FIGURES TO CALENDAR YEAR FIGURES

(millions of 1986 dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Capital																
1	State Govt	261	258	291	296	307	370	403	430	435	424	357	287	355	395	405	431
2	Local Govt	4,056	2,861	2,181	1,869	926	664	955	1,164	1,761	1,935	2,020	2,728	2,406	2,085	2,675	3,173
3	Private	7,096	7,764	6,769	6,931	7,578	7,737	7,832	7,518	6,577	5,673	5,445	5,427	5,841	5,786	5,784	5,857
	Operating																
4	State Govt	938	903	910	981	1,015	1,019	1,001	994	1,057	1,093	1,012	979	1,025	1,102	1,189	1,210
5	Local Govt	2,944	3,120	3,455	3,828	4,172	4,395	4,541	4,760	5,088	5,568	6,011	6,299	6,472	6,737	7,211	7,450
6	Private	3,338	3,666	3,658	3,816	4,282	4,682	4,907	5,227	5,149	5,227	5,018	5,598	5,900	6,244	6,635	7,368

Footnotes to Table F-7 for line:

1, 2, 4, and 5. The 1972 calendar year expenditure equals the average of 1972 and 1973 fiscal year figures from Table F-6. The same holds true for all years except 1987, which is the 1987 figure from Table F-6.

3 and 6. Conversion was not required since data did not come from *Government Finance* series

Table F-8: DRINKING WATER CAPITAL AND OPERATING POLLUTION CONTROL COSTS

(millions of current dollars)

	Local Govt Expenditures For Water Supply		Total Expenditures For Water Supply		Baseline Expenditure For Water Treatment		SDWA Expenditures For Water Treatment		Total Expenditures For Water Treatment	
Year	Capital Outlays	O&M Expenditure	Capital Outlays	O&M Expenditures	Capital Outlays	O&M Expenditures	Capital Outlays	O&M Expenditures	Capital Outlays	O&M Expenditures
A	B	C	D	E	F	G	H	I	J	K
PRE-REGULATORY PERIOD										
1972	1,343	1,924	1,589	2,276	292	282	0	0	282	282
1973	1,435	2,120	1,698	2,508	312	311	0	0	311	311
1974	1,743	2,340	2,062	2,768	379	343	0	0	343	343
1975	2,111	2,686	2,497	3,178	460	394	0	0	394	394
1976	2,208	3,012	2,612	3,563	481	442	0	0	442	442
1977	2,302	3,588	2,723	4,245	501	526	0	0	526	526
1978	2,136	3,907	2,527	4,622	465	573	0	0	573	573
NIPDWR/TTHM PERIOD										
1979	2,671	4,399	3,160	5,204	576	631	28	118	659	748
1980	3,270	4,857	3,868	5,746	706	697	30	127	727	824
1981	3,718	5,634	4,398	6,665	803	810	33	137	842	946
1982	3,684	6,530	4,358	7,725	796	940	34	142	974	1,083
1983	3,753	7,105	4,440	8,405	810	1,024	36	151	1,060	1,174
1984	3,420	7,445	4,046	8,807	738	1,073	37	155	1,110	1,228
1985	4,133	8,301	4,889	9,820	892	1,197	39	165	1,237	1,362
1986	5,108	9,041	6,043	10,696	1,105	1,305	40	167	1,345	1,473
1987	5,982	9,936	7,077	11,754	1,295	1,436	41	173	1,477	1,609

Footnotes for Table F-8

FOOTNOTES FOR PRE-REGULATORY PERIOD: Expenditures for water treatment during the pre-regulatory period are computed as follows:

1. Total capital outlays (column B) and total O&M expenditures (column C) are taken from the U.S. Census *Government Finance* series for the years 1972 through 1978. These data represent **total expenditures by water systems operated by state, regional, and local government agencies.**

2. The Census data in columns B and C are multiplied by a factor of 1.183 to obtain estimates in columns D and E of **total expenditures by the water industry, including privately owned water systems that are not included in the Census of Governments**. The 1.183 factor is based on an analysis of the ratio of persons served by public versus private water systems and therefore assumes that expenditures are a function of population served.

3. Columns F and G present estimates of **baseline industry expenditures for water treatment during the pre-regulatory period**. These estimates are computed by multiplying total industry capital outlays and O&M expenditures in column D and E by 0.184 and 0.124, respectively. These factors are based on the EPA and Commerce Department studies described above.

4. Columns H and I representing **additional incremental expenditures for SDWA compliance** (above baseline expenditures for treatment) are occupied by zeros during the pre-regulatory period.

5. Columns J and K present **total expenditures for water treatment**, figured as the sums: F + H and G + I. During the pre-regulatory period, columns J and K are equivalent to columns F and G.

FOOTNOTES FOR NIPDWR/TTHM PERIOD: Expenditures for water treatment during the NIPDWR/TTHM period are computed as follows:

1. Total capital outlays (column B) and total O&M expenditures (column C) are taken from the U.S. Census *Government Finance* series for the years 1979 through 1987. The data points shown for 1988 are projections, based on linear regressions. These data represent **total expenditures by water systems operated by state, regional, and local government agencies.**

2. The Census data in columns B and C are multiplied by a factor of 1.183 to obtain estimates in columns D and E of **total expenditures by the water industry, including privately owned water systems that are not included in the Census of Governments.**

3. Columns H and I, **representing additional incremental expenditures for SDWA compliance during the NIPDWR/TTHM period**, present estimates of the costs of compliance with microbiological and trihalomethane regulations as well as monitoring costs, as discussed above.

4. Columns F and G present estimates of **baseline industry expenditures for water treatment during the NIPDWR/TTHM period**. These estimates are computed by first subtracting the SDWA expenditures of columns H and I from the total expenditures in columns D and E. Factors computed for treatment expenditures during the pre-regulatory baseline period (0.184 and 0.124) are then applied to the difference to derive an estimate of baseline treatment expenditures in the NIPDWR/TTHM period.

5. Columns J and K present **total expenditures for water treatment**, figured as the sums: F + H and G + I.

An alternative source for state government expenditures for implementing the 1986 Safe Drinking Water Act Amendments is *State Costs of Implementing the 1986 Safe Drinking Water Act Amendments*, August 1989, published by U. S. Environmental Protection Agency, Office of Drinking Water and Association of State Drinking Water Administrators.

Table F-9: DRINKING WATER CAPITAL AND OPERATING POLLUTION CONTROL COSTS

(millions of 1986 dollars)

	Local Govt Expenditures For Water Supply		Total Expenditures For Water Supply		Baseline Expenditure For Water Treatment		SDWA Expenditures For Water Treatment		Total Expenditures For Water Treatment	
Year	Capital Outlays	O&M Expenditure	Capital Outlays	O&M Expenditures	Capital Outlays	O&M Expenditures	Capital Outlays	O&M Expenditures	Capital Outlays	O&M Expenditures
A	B	C	D	E	F	G	H	I	J	K
PRE-REGULATORY PERIOD										
1972	3394	4862	4015	5751	739	713	0	0	739	713
1973	3372	4982	3989	5894	734	731	0	0	734	731
1974	3717	4990	4397	5903	809	732	0	0	809	732
1975	4255	5413	5033	6404	926	794	0	0	926	794
1976	4171	5690	4934	6731	908	835	0	0	908	835
1977	4049	6311	4790	7466	881	926	0	0	881	926
1978	3396	6212	4018	7349	739	911	0	0	739	911
NIPDWR/TTHM PERIOD										
1979	3804	6265	4500	7412	821	898	40	167	861	1066
1980	4317	6412	5107	7586	932	920	40	167	972	1087
1981	4555	6903	5389	8166	984	992	40	167	1024	1159
1982	4329	7673	5121	9077	935	1105	40	167	975	1272
1983	4172	7898	4935	9344	901	1138	40	167	941	1305
1984	3687	8026	4361	9494	795	1157	40	167	835	1324
1985	4205	8445	4974	9990	908	1218	40	167	948	1385
1986	5108	9041	6043	10696	1105	1305	40	167	1145	1473
1987	5799	9633	6861	11395	1255	1392	40	167	1295	1560
1988	4945	9418	5850	11142	1069	1361	40	167	1109	1528
SDWA 1986 AMENDMENTS PERIOD										
1989	5039	9727	6032	11685	1086	1397	71	178.1	1157	1575
1990	5133	10036	6147	12050	1106	1440	74	178.1	1180	1618
1991	5227	10344	6270	12417	1126	1484	86	179.3	1212	1663
1992	5322	10653	6967	13061	1146	1527	672	458.3	1818	1985
1993	5416	10962	7465	13548	1166	1570	1058	579.8	2224	2150
1994	5510	11270	7811	13913	1185	1614	1292	579.8	2478	2194
1995	5604	11579	8099	14501	1205	1657	1470	802.6	2675	2460
1996	5698	11888	8651	15016	1225	1700	1910	953.1	3135	2654
1997	5793	12197	8517	15382	1245	1744	1664	953.1	2909	2697
1998	5887	12505	8016	15820	1265	1787	1052	1026	2316	2813
1999	5981	12814	7301	16418	1284	1831	225	1259.3	1510	3090
2000	6075	13123	7412	16783	1304	1874	225	1259.3	1530	3133

Footnotes for Table F-9

FOOTNOTES FOR PRE-REGULATORY PERIOD: Expenditures for water treatment during the pre-regulatory period are computed as follows:

1. Total capital outlays (column B) and total O&M expenditures (column C) are taken from the U.S. Census *Government Finance* series for the years 1972 through 1978. Figures represent corresponding figures from Table F-8 divided by indexes from Table F-6, line 9. These data represent **total expenditures by water systems operated by state, regional, and local government agencies.**

2. The Census data in columns B and C are multiplied by a factor of 1.183 to obtain estimates in columns D and E of **total expenditures by the water industry, including privately owned water systems that are not included in the Census of Governments**. The 1.183 factor is based on an analysis of the ratio of persons served by public versus private water systems and therefore assumes that expenditures are a function of population served.

3. Columns F and G present estimates of **baseline industry expenditures for water treatment during the pre-regulatory period**. These estimates are computed by multiplying total industry capital outlays and O&M expenditures in column D and E by 0.184 and 0.124, respectively. These factors are based on the EPA and Commerce Department studies described above.

4. Columns H and I representing **additional incremental expenditures for SDWA compliance** (above baseline expenditures for treatment) are occupied by zeros during the pre-regulatory period.

5. Columns J and K present **total expenditures for water treatment**, figured as the sums: F + H and G + I. During the pre-regulatory period, columns J and K are equivalent to columns F and G.

FOOTNOTES FOR NIPDWR/TTHM PERIOD: Expenditures for water treatment during the NIPDWR/TTHM period are computed as follows:

1. Total capital outlays (column B) and total O&M expenditures (column C) are taken from the U.S. Census *Government Finance* series for the years 1979 through 1987. Figures represent corresponding figures from Table F-8 divided by indexes from Table F-6, line 9, for the years 1979-1987. The data points shown for 1988 are projections, based on linear regressions. These data represent **total expenditures by water systems operated by state, regional, and local government agencies.**

2. The Census data in columns B and C are multiplied by a factor of 1.183 to obtain estimates in columns D and E of **total expenditures by the water industry, including privately owned water systems that are not included in the Census of Governments.**

3. Columns H and I, **representing additional incremental expenditures for SDWA compliance during the NIPDWR/TTHM period**, present estimates of the costs of compliance with microbiological and trihalomethane regulations as well as monitoring costs, as discussed above.

4. Columns F and G present estimates of **baseline industry expenditures for water treatment during the NIPDWR/TTHM period**. These estimates are computed by first subtracting the SDWA expenditures of columns H and I from the total expenditures in columns D and E. Factors computed for treatment expenditures during the pre-regulatory baseline period (0.184 and 0.124) are then applied to the difference to derive an estimate of baseline treatment expenditures in the NIPDWR/TTHM period.

5. Columns J and K present **total expenditures for water treatment**, figured as the sums: F + H and G + I.

FOOTNOTES FOR SDWA 1986 AMENDMENTS PERIOD: Expenditures were projected based on an analysis of national impact estimates from final regulations on Flouride, Volatile Organic Chemicals, Surface Water Treatment, and Total Coliforms; proposed regulations for Phase II Synthetic Organic and Inorganic Chemicals, Lead and Copper; and prospective regulations covering Radionuclides, Phase V Synthetic Organic and Inorganic Chemicals, Arsenic, and Mandatory Disinfection of all public water supplies (from U.S. Environmental Protection Agency, Office of Drinking Water, *Estimates of the Total Benefits and Total Costs Associated with Implementation of the 1986 Amendments to the Safe Drinking Water Act*, November, 1989). It does not include estimated benefits and costs of forthcoming regulations governing disinfection by-products as the rulemaking is preliminary.

1. Columns F and G present projections of **baseline industry expenditures for water treatment during the SDWA 1986 Amendments period**. These estimates are based on a linear regression of the trend exhibited in baseline industry expenditures (expenditures for treatment net of SDWA expenditures) from 1972 to 1987 (i.e., the numbers directly above these entries in columns F and G).

2. Columns H and I present the **additional incremental expenditures for SDWA compliance during the SDWA 1986 Amendments period**.

3. Columns J and K present **total expenditures for water treatment**, figured as the sums: F + H and G + I.

Table F-10: DERIVATION OF PRIVATE CAPITAL AND OPERATING COSTS

(millions of 1986 dollars)

	EXISTING				NEW			
	Local Capital	Private Capital	Local O&M	Private O&M	Local Capital	Private Capital	Local O&M	Private O&M
Year								
Column	B	C	D	E	F	G	H	I
PRE-REGULATORY PERIOD								
1972	604	135	583	131	0	0	0	0
1973	600	134	597	134	0	0	0	0
1974	661	148	598	134	0	0	0	0
1975	757	169	649	145	0	0	0	0
1976	742	166	682	153	0	0	0	0
1977	720	161	756	169	0	0	0	0
1978	604	135	745	167	0	0	0	0
NIPDWR/TTHM PERIOD								
1979	703	157	871	195	0	0	0	0
1980	794	178	888	199	0	0	0	0
1981	837	187	947	212	0	0	0	0
1982	796	178	1,039	233	0	0	0	0
1983	769	172	1,066	239	0	0	0	0
1984	682	153	1,082	242	0	0	0	0
1985	774	173	1,132	254	0	0	0	0
1986	935	209	1,203	270	0	0	0	0
1987	1,058	237	1,274	285	0	0	0	0
1988	906	203	1,249	280	0	0	0	0
SDWA 1986 AMENDMENTS PERIOD								
1989	887	199	1,141	256	58	13	146	33
1990	904	202	1,177	264	61	14	146	33
1991	920	206	1,212	272	70	16	146	33
1992	936	210	1,248	279	549	123	374	84
1993	952	213	1,283	287	865	194	474	106
1994	968	217	1,318	295	1,056	236	474	106
1995	985	221	1,354	303	1,201	269	656	147
1996	1,001	224	1,389	311	1,560	349	779	174
1997	1,017	228	1,425	319	1,360	305	779	174
1998	1,033	231	1,460	327	859	192	838	188
1999	1,049	235	1,496	335	184	41	1,029	230
2000	1,066	239	1,531	343	184	41	1,029	230

Footnotes to Table F-10

The following footnotes apply for all categories:

Private drinking water costs are assumed to be 18.3 percent of local drinking water costs for population servced based on the following assumptions: 1) U.S. population of 240 million; 2) approximately 71 percent of population served by local government facilities (170.4 million) and 13 percent (31.2 million) served by private facilities. Therefore, 18.3 percent of local government costs (31.2 million divided by 170.4 million) represents private share.

Footnotes for column:

B Figures represent 81.7 percent of Column F, Table F-9

C Figures represent 18.3 percent of Column F, Table F-9

D Figures represent 81.7 percent of Column G, Table F-9

E Figures represent 18.3 percent of Column G, Table F-9

F Figures represent 81.7 percent of Column H, Table F-9

G Figures represent 18.3 percent of Column H, Table F-9

H Figures represent 81.7 percent of Column I, Table F-9

I Figures represent 18.3 percent of Column I, Table F-9

Table F-11: DRINKING WATER RECAPITULATED IN TOTALS FOR CAPITAL & OPERATING COSTS

(millions of 1986 dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Capital																
1	State	0	0	0	0	0	0	8	41	84	81	40	76	19	27	26	37
2	Local	604	600	661	757	742	720	604	703	794	837	796	769	682	774	935	1,058
3	Private	135	134	148	169	166	161	135	157	178	187	178	172	153	173	209	237
4	Total	739	734	809	926	908	881	739	861	972	1,024	975	941	835	948	1,145	1,295
	Operating																
5	State	0	0	0	0	0	0	19	17	20	27	33	33	33	26	38	47
6	Local	583	597	598	649	682	756	745	871	888	947	1,039	1,066	1,082	1,132	1,203	1,274
7	Private	131	134	134	145	153	169	167	195	199	212	233	239	242	254	270	285
8	Total	713	731	732	794	835	926	911	1,066	1,087	1,159	1,272	1,305	1,324	1,385	1,473	1,560

Footnotes to Table F-11

1 From annual issues of *Government Finances* published by U.S. Department of Commerce, Bureau of the Census.

2 Figures from Column B, Table F-10

3 Figures from Column C, Table F-10

4 Sum of lines 1 - 3

5 From annual issues of *Government Finances* published by U.S. Department of Commerce, Bureau of the Census.

6 Figures from Column D, Table F-10

7 Figures from Column E, Table F-10

8 Sum of lines 5 - 7

Table F-12: CONVERSION OF DRINKING WATER FISCAL YEAR FIGURES TO CALENDAR YEAR FIGURES

(millions of 1986 dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Capital																
1	State	0	0	0	0	0	4	25	63	83	60	58	47	23	27	31	18
2	Local	602	630	709	749	731	662	654	749	816	817	783	725	728	855	997	982
3	Private	135	141	159	168	164	148	146	168	183	183	175	162	163	191	223	220
4	Total	736	772	868	917	895	810	800	916	998	1,000	958	888	891	1,046	1,220	1,202
	Operating																
5	State	0	0	0	0	0	10	18	18	23	30	33	33	30	32	42	23
6	Local	590	598	623	665	719	750	808	879	918	993	1,053	1,074	1,107	1,168	1,239	1,261
7	Private	132	134	140	149	161	168	181	197	206	222	236	241	248	262	277	283
8	Total	722	731	763	814	880	919	988	1,076	1,123	1,216	1,289	1,315	1,355	1,429	1,516	1,544

Footnotes to Table F-12

1972 calendar year expenditure equals average of 1972 and 1973 fiscal year figures from Table F-11. The same holds true for all years except 1987, which is the 1987 figure from Table F-11.

APPENDIX G
ESTIMATION OF SOLID WASTE COSTS

This appendix provides documentation for the historical solid waste cost estimates presented in Chapter 5. The estimation of costs for each economic sector is first discussed. This is followed by an explanation of the methodology used to separate out that portion of total solid waste costs resulting from Federal requirements.

G.1. DERIVATION OF SOLID WASTE COSTS BY SECTOR

The derivation of historical solid waste costs by sector is discussed below. Future costs associated with existing solid waste programs were estimated by linearly extrapolating data on historical costs for each sector. Cost estimates associated with new Federal solid waste regulations were then added to the cost projections for existing solid waste programs. The derivation of costs for new Federal requirements is discussed in Appendix A.

G.1.1. *EPA and Non-EPA Federal Costs*

Estimates of historical EPA solid waste costs were derived from annual "EPA Justification of Appropriation Estimates for Committee on Appropriations" documents. For years 1972 through 1980, expenditures were reported as solid waste costs. Beginning in 1981, however, expenditures for solid waste were not broken out from other RCRA costs. To isolate solid waste expenditures in years after 1980, data on RCRA budgets for individual EPA regions supplied by the EPA Office of Resource Management were used. The regional budgets broke out solid waste costs from larger RCRA costs; we used the average percentage of regional RCRA budgets directed to solid wastes to calculate EPA solid waste costs for years after 1980.

Estimates of historical non-EPA Federal solid waste costs were derived from the Commerce Department pollution abatement cost data base. Since non-EPA Federal costs are not reported in the "Pollution Abatement Control Expenditures" (PACE) reports published in the *Survey of Current Business*, this data was taken directly from the Commerce survey results for each year 1972-1987.

G.1.2. *State and Local Government Costs*

Estimates of local government solid waste expenditures are reported in Tables G-1 through G-3. These were derived from the Commerce *Government Finances* annual reports for years 1972-1987. For years 1985-87, the data source reports solid waste capital and O&M costs at the local level. For previous years, however, the data source did not break out capital and O&M expenditures separately from total solid waste costs. To isolate capital and O&M cost estimates for these years, we applied the 1985-87 average percentages of total costs for capital and O&M costs to the 1972-84 total expenditure data.

State solid waste costs are not reported in the *Government Finances* series. They are believed to be very low since solid waste has traditionally been a local responsibility. No estimates of state costs are provided in this report.

G.1.3. *Private Costs*

Tables G-1 through G-3 also provide estimates of private costs for solid waste. These estimates were derived from the PACE reports.

G.2. DERIVATION OF FEDERALLY MANDATED COSTS

To date, the Federal government has played a very limited role in the solid waste area. The Federal government has been concerned with solid waste since the Solid Waste Act of 1965; however, Federal involvement has been limited to providing guidelines and financial assistance for the development of state solid waste management plans. Historically, there has been little action with regards to state plans at both the state and Federal levels.

The Resource Conservation and Recovery Act of 1976 did not much increase the Federal role. RCRA directed EPA to publish guidelines for solid waste management, including criteria for determining which facilities are sanitary landfills and which are open dumps. A narrow Federal effort was directed to closing open dumps or upgrading them to sanitary landfills. This effort was largely limited to requiring states to publish a list of their identified open dumps, however.

Due to the limited Federal requirements in the solid waste area, few solid waste costs have been pursuant to Federal measures. States incurred some costs for development of management plans, but no data are available on these expenditures. Moreover, it is likely that the publication of listings of open dumps motivated some dump owners to upgrade these facilities to sanitary landfills to avoid local citizen action, but no cost data is available on such compliance measures.

The data on local and private solid waste costs, which together account for the large majority of total solid waste costs, does not distinguish costs pursuant to Federal mandates from total costs. In order to provide an estimate of Federally-driven solid waste costs, we assumed that five percent of local and private costs were motivated by Federal measures in each of the years 1972-1987. Due to the limited Federal role in the solid waste area, it is doubtful that this is an underestimate; it most likely over-estimates Federally-driven costs somewhat. All EPA and non-EPA Federal costs for solid waste were treated as being pursuant to Federal mandates, however.

Table G-1: SOLID WASTE RAW DATA FROM *GOVERNMENT FINANCES* & *SURVEY OF CURRENT BUSINESS*

(millions of current dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	AVG
	Local Government																	
1	Total Expend	1,565	1,718	1,915	2,125	2,302	2,336	2,727	2,992	3,322	3,777	4,137	4,364	4,710	5,212	5,834	6,462	
2	Capital	235	258	287	319	345	350	409	449	498	567	621	655	707	717	951	1,059	
3	Operating	1,330	1,460	1,628	1,806	1,957	1,986	2,318	2,543	2,824	3,210	3,516	3,709	4,004	4,495	4,883	5,403	
4	Cap % of Total														0.14	0.16	0.16	0.15
5	O&M % of Total														0.86	0.84	0.84	0.85
	Private																	
6	Capital	273	355	424	414	464	556	599	771	882	966	853	805	1,030	1,239	1,194	1,375	
	Operating																	
7	Abatement	1,838	2,107	2,422	2,646	3,058	3,581	3,905	4,765	5,356	6,238	5,727	6,127	7,158	7,737	8,907	9,985	
8	Res & Dev	12	10	13	21	20	21	16	11	19	18	20	28	29	31	32	35	
9	Total O&M	1,850	2,117	2,435	2,667	3,078	3,602	3,921	4,776	5,375	6,256	5,747	6,155	7,187	7,768	8,939	10,020	

Footnotes for Table G-1

1 Figures from "Sanitation other than sewage" in issues of *Government Finances* series: 1972-1976 data from Table 7; 1977 data from Table 11; 1978-1980 data from Table 10; 1981-1984 data from Table 11; and 1985-1987 data from Table 8

2 Figures for 1972-1984 represent 15% of line 1. 15% represents the average percentage of total expenditures for capital costs for the years 1985-1987.

3 Figures for 1972-1984 represent 85% of line 1. 85% represents the average percentage of total expenditures for operating costs for the years 1985-1987.

4 1985-1987 line 2 divided by line 1. AVG = average of line 4 percentages for 1985-1987

5 1985-1987 line 3 divided by line 1. AVG = average of line 5 percentages for 1985-1987

1972-1982 figures from "Solid Waste" column, *Survey of Current Business*, July 1986

6 Pollution abatement and control, Pollution Abatement, Business, On capital account, Table 9, Line 7

7 Pollution abatement and control, Pollution Abatement, Business, On current account, Private, Table 9, Line 9

8 Pollution abatement and control, Research and development, Private, Table 9, Line 20

1983-1987 figures from "Solid Waste" column, *Survey of Current Business*, June 1989

6 Pollution abatement and control, Pollution Abatement, Business, On capital account, Table 6, Line 7

7 Pollution abatement and control, Pollution Abatement, Business, On current account, Private, Table 6, Line 9

8 Pollution abatement and control, Research and development, Private, Table 6, Line 20

9 Sum of lines 7 and 8

Table G-2: SOLID WASTE RAW DATA RECAPITULATED IN TOTALS FOR CAPITAL & OPERATING COSTS

(millions of current dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Local Government																
1	Capital	235	258	287	319	345	350	409	449	498	567	621	655	707	717	951	1,059
2	Operating	1,330	1,460	1,628	1,806	1,957	1,986	2,318	2,543	2,824	3,210	3,516	3,709	4,004	4,495	4,883	5,403
	Private																
3	Capital	273	355	424	414	464	556	599	771	882	966	853	805	1,030	1,239	1,194	1,375
4	Operating	1,850	2,117	2,435	2,667	3,078	3,602	3,921	4,776	5,375	6,256	5,747	6,155	7,187	7,768	8,939	10,020
	Fixed-weighted price indexes																
5	Government	0.386	0.418	0.461	0.494	0.524	0.553	0.583	0.639	0.687	0.782	0.840	0.882	0.924	0.959	1.000	1.040
6	SW Bus Cap	0.373	0.390	0.432	0.489	0.523	0.568	0.622	0.684	0.762	0.848	0.907	0.947	0.968	0.970	1.000	1.053
7	SW Bus O&M	0.388	0.420	0.466	0.495	0.525	0.552	0.579	0.635	0.681	0.778	0.835	0.876	0.920	0.957	1.000	1.037

Footnotes for Table G-2

1 Recapitulation of Line 2, Table G-1
2 Recapitulation of Line 3, Table G-1
3 Recapitulation of Line 6, Table G-1
4 Recapitulation of Line 9, Table G-1

Lines 5, 6, and 7: Selected fixed-weighted price indexes (1982), *Survey of Current Business*, converted to 1986 index.

1972-1982 indexes taken from July, 1986 issue
1983-1987 indexes taken from June, 1989 issue

Table G-3: SOLID WASTE RAW DATA CONVERTED FROM CURRENT DOLLARS INTO 1986 DOLLARS

(millions of 1986 dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Local Government																
1	Capital	609	617	623	645	659	634	701	702	725	724	738	743	764	748	951	1,018
2	Operating	3,449	3,496	3,528	3,656	3,732	3,591	3,975	3,977	4,108	4,104	4,185	4,208	4,331	4,688	4,883	5,194
	Private																
3	Capital	733	911	980	847	887	980	963	1,126	1,157	1,140	941	850	1,064	1,277	1,194	1,305
4	Operating	4,766	5,042	5,228	5,388	5,862	6,528	6,769	7,519	7,891	8,042	6,885	7,029	7,813	8,113	8,939	9,665

Footnotes for Table G-3

1 Line 1, Table G-2, divided by line 5, Table G-2

2 Line 2, Table G-2, divided by line 5, Table G-2

3 Line 3, Table G-2, divided by line 6, Table G-2

4 Line 4, Table G-2, divided by line 7, Table G-2

Table G-4: CONVERSION OF LOCAL GOVERNMENT SOLID WASTE FISCAL YEAR TO CALENDAR YEAR FIGURES

(millions of 1986 dollars)

	Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	Local Government																
1	Capital	613	620	634	652	646	668	702	713	725	731	741	753	756	849	984	1,018
2	Operating	3,473	3,512	3,592	3,694	3,661	3,783	3,976	4,042	4,106	4,144	4,196	4,270	4,510	4,786	5,038	5,194
	Private																
3	Capital	733	911	980	847	887	980	963	1,126	1,157	1,140	941	850	1,064	1,277	1,194	1,305
4	Operating	4,766	5,042	5,228	5,388	5,862	6,528	6,769	7,519	7,891	8,042	6,885	7,029	7,813	8,113	8,939	9,665

Footnotes for Table G-4

1972 calendar year expenditure equals average of 1972 and 1973 fiscal year figures from Table G-3. The same holds true for all years except 1987, which is the 1987 figure from Table G-3.

Table G-5: DISTRIBUTION OF EPA HAZARDOUS WASTE AND SOLID WASTE, 1981-1990

(millions of current dollars)

Source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1 EPA Reported Hazardous Waste	157	124	127	135	151	205	252	258	254	263	307
2 Subtitle D Percent	9.40%	0.00%	0.00%	0.00%	1.35%	1.44%	1.40%	2.70%	4.10%	5.57%	5.72%
3 Subtitle D Dollars	15	0	0	0	2	3	4	7	10	15	18
4 Hazardous Waste	142	124	127	135	149	202	248	251	243	249	290

Footnotes for Table G-5

1 From annual EPA Justification of Appropriation Estimates for Committee on Appropriations

2 From EPA Office of the Controller

3 Line 1 multiplied by Line 2

4 Line 1 minus Line 3

Table G-6: DISTRIBUTION OF EPA HAZARDOUS WASTE AND SOLID WASTE, 1981-1990

(millions of 1986 dollars)

Source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1 EPA Reported Hazardous Waste	201	147	144	146	157	205	242	237	223	223	250
2 Subtitle D Dollars	19	0	0	0	2	3	3	6	9	12	14
3 Hazardous Waste	182	147	144	146	155	202	239	231	214	210	236
4 Fixed-weighted price indexes	0.782	0.840	0.882	0.924	0.959	1.000	1.040	1.090	1.136	1.182	1.228

Footnotes for Table G-6

1 Line 1, Table G-5, divided by Line 4, Table G-6

2 Line 2, Table G-5, divided by Line 4, Table G-6

3 Line 3, Table G-5, divided by Line 4, Table G-6

4 Fixed-weighted price indexes described in Chapter 1

Table G-7: ADJUSTMENT OF PRIVATE MANUFACTURING HAZARD WASTE TO REMOVE DEPRECIATION

(millions of current dollars)

Source	1983	1984	1985	1986
1 Hazardous Waste Operating Cost	574	770	943	1,136
2 Total pollution abatement operating cost	9,078	10,003	10,676	11,108
3 Total pollution abatement depreciation	1,696	1,903	2,044	2,030
4 Millions of current dollars	466	624	762	928
5 Fixed-weighted price indexes	0.876	0.920	0.957	1.000
6 Millions of 1986 dollars	533	678	796	928

Footnotes for Table G-7

1 Table 4a, Operating costs by form of pollutants abated, Solid waste, Hazardous, All Industries
2 Table 4a, Operating costs by form of pollutants abated, Total, All Industries
3 Table 5a, Operating cost, By kind of cost, Depreciation, All Industries
4 Line 1 minus ((Line 1/Line 2) X Line 3)
5 Fixed-weighted price indexes described in Chapter 1
6 Line 4 divided by line 5

APPENDIX H
ESTIMATION OF SUPERFUND, UST, AND FEDERAL HAZARDOUS WASTE COMPLIANCE COSTS

This appendix provides background information on the data sources, assumptions, and derivations used to develop the cost estimates for the Superfund remediation program, the underground storage tank (UST) technical standards and financial responsibility rules, and non-EPA Federal facility RCRA- and Superfund-related compliance activities. The cost estimates for these programs are presented in Chapter 5.

H.1. SUPERFUND COSTS

H.1.1. *EPA Costs*

The estimates of historical EPA expenditures for Superfund activities are based on actual budget obligations from the CERCLA Trust Fund (the Fund) for years 1981-1989, and estimated obligations for year 1990, as reported by the EPA Office of Emergency and Remedial Response (OERR).[1] Estimates of future EPA costs are based on straight line extrapolation of historical capital and operation and maintenance (O&M) costs using simple regression models.

Estimates of EPA capital costs include Fund obligations for all response activities except those relating to remedial action O&M. These include costs for: 1) remedial investigation and feasibility studies; 2) remedial design studies; 3) remedial actions; 4) other response actions such as preliminary site evaluations, and; 5) removal actions.

Estimates of EPA O&M costs include Fund obligations for: 1) research and development; 2) enforcement; 3) management and support; 4) assistance to other Federal agencies; and 5) remedial action O&M activities.

H.1.2. *Private Costs*

Estimates of private sector costs for investigation and cleanup activities were derived using unit cost and level of activity data from: 1) two recent EPA reports to Congress on the progress of the Superfund program (hereafter referred to as the "1989 Progress Report" and the "1990 Progress Report");[2] 2) the Regulatory Impact Analysis for proposed revisions to the National Contingency Plan published in 1989

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[1] "Superfund Obligations History Chart" supplied by the Office of Program Evaluation, EPA Office of Emergency and Remedial Response.

[2] (a) US EPA, *Progress Toward Implementing Superfund Fiscal Year 1987: Report to Congress*, Office of Solid Waste and Emergency Response, EPA 540/8-89/003, April 1989; and (b) US EPA, *Progress Toward Implementing Superfund Fiscal Year 1989: Report to Congress*, Office and Emergency and Remedial Response, March 1990.

(hereafter referred to as "NCP RIA")[3]; and 3) activity pricing factors reported by OERR. The various steps used to calculate private costs, including the various assumptions and projection techniques employed are outlined below.

In the first step, unit cost estimates were identified for the following activities: removals, remedial investigation and feasibility studies (RIs), remedial design studies (RDs), and remedial actions (RAs). For removals, a unit cost estimate of $.525 million was used. This estimate represents the current average cost for this activity as reported by OERR. For both RIs and RDs, a unit cost estimate of $.750 million reported by OERR was used.

The unit cost estimates for RAs vary each year according to the mix of containment versus treatment remedies utilized in that year. The following average capital and O&M unit costs associated with containment and treatment remedies were obtained from the NCP RIA (p. 2-11):

Remedy	Capital Cost	Operating Cost
Containment	$ 4.483 M	.612 M
Treatment	17.237 M	.340 M

These unit costs were multiplied by estimates of the distribution of treatment (which includes non-source controls) versus containment remedies associated with RAs conducted in past years and expected for future RAs to derive average unit RA capital and O&M costs for each of the years 1982-2000. The actual distributions of RAs using treatment and containment remedies for the years 1982-1987 were obtained from the 1989 Progress Report (p. 41); the expected distributions for years after 1987 were taken from the NCP RIA (p. 3-4). They are:

Year	Containment	Treatment
1982-84	57%	43%
1985	61%	39%
1986	39%	61%
1987	25%	75%
1988-2000	20%	80%

[3] US EPA, *Regulatory Impact Analysis in Support of the Proposed Revisions to the National Oil and Hazardous Substances Pollution Contingency Plan*, Prepared by ICF, Inc., September 1988.

Multiplying the above distributions for each year by the unit capital and O&M costs produces the following weighted average estimates of RA capital and O&M costs which were used for the RA cost derivations:[4]

Year	Capital Cost	Operating Cost
1982-84	$ 9.967 M	$ .495 M
1985	9.457 M	.506 M
1986	12.263 M	.446 M
1987	14.049 M	.408 M
1988-2000	14.686 M	.394 M

In the second step, actual activity levels over past years for removals, RIs, RDs, and RAs by Potentially Responsible Parties (PRP-led) were obtained from the EPA progress reports and used to predict future activity levels. Activity data for years 1981-1987 came from the 1989 Progress Report (pp. 22, 36, and 43); data for 1988 and 1989 came from the 1990 Progress Report (pp. 6, 20). The activity data for years 1981-1989 were then applied in simple regression models to predict PRP-led investigation, removals, and remediation activities for years 1988-2000. For example, actual levels of PRP-led removals over years 1981-1987 were regressed against time. The resulting parameter estimates were then multiplied by each of the years 1990-2000 to estimate the number of PRP-led removals for these years. (The projections for PRP-led removals, RIs, RDs, and RAs for each of the years 1990-2000 are given in Table H-1.)

In the third step, the actual and predicted activity levels were multiplied by the relevant unit costs to estimate total costs PRPs for each activity over the years 1981-2000. The activity data for RIs, RDs, and RAs for any year represent first starts in that year. Historically, these activities last well beyond one year. For simplicity in the calculation of annual costs, however, first starts in any year are treated as being completed in that year. This is consistent with the Fund budget obligations data used to derive EPA costs.

In the final step, the various capital and annual costs to the private sector associated with the four activities were summed to find the total capital and annual costs to each sector for the years 1981-2000. Investigation and design costs, removal costs, and RA capital costs were summed to find total capital costs over each year of the estimation period. Private O&M costs are for remedial action O&M activities.

[4] The estimates for years 1988-2000 correspond to the current $15 million average remedial action capital cost reported by the 1990 Progress Report (p. 11).

H.1.3. *State Costs*

Estimates of state capital costs for Superfund remediation are based on estimates of historical and projected future EPA capital costs. State capital costs arise because under CERCLA and SARA states are required to assume ten percent of Fund-led RA capital costs. Estimates of state capital costs were derived by assuming that estimated EPA capital costs represent 90 percent of total governmental capital costs, and state costs the remainder.

The law also required that states assume ten percent of first-year O&M costs associated with Fund-led remedial actions, and 100 percent of O&M costs in subsequent years.[5] Estimates of Fund-led RA O&M costs were derived by multiplying estimates of actual and projected future Fund-led remedial actions by an estimated unit cost for this activity. The estimates of historical and predicted future levels of Fund-led remedial actions are presented in Table H-1. The state share of total Fund-led O&M costs were derived using the cost allocation formula stated above.

H.1.4. *Non-EPA Federal Costs*

The Superfund costs for non-EPA federal agencies presented in Chapter 5 represent the estimated combined expenditures by the U.S. Department of Energy and the U.S. Department of Defense for Superfund investigation and clean-up activities. These two agencies account for the large majority of non-EPA Federal compliance expenditures pursuant to Superfund. The derivation of these estimates is discussed in Section H.4.

H.2. UST TECHNICAL STANDARDS

The incremental capital and O&M costs for this recently promulgated rule were derived using discounted per-tank costs and timing information provided by the 1988 Regulatory Impact Analysis for UST technical standards[6] (hereafter referred to as "Technical RIA"). Costs for the rule were apportioned over time based on requirements set by the rule and assumptions made by the Technical RIA. In all cases, the discounting factor based on 3 percent over 30 years was eliminated to show nominal (i.e. undiscounted) costs. The resulting per-tank costs were then used to find total industry and municipal

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[5] SARA amended CERCLA to provide that the costs of restoring ground and surface waters to levels protective of human health are to be treated as part of the costs of remedial action and not as an O&M cost allocable to states. As a result, states are only responsible for 10 percent of such costs as opposed to 100 percent if they were considered O&M costs. In our cost calculations, however, we attributed all post first-year O&M costs to states.

[6] ICF Inc., *Regulatory Impact Analysis of Technical Stqndards for Underground Storage Tanks: Volume 1,* Prepared for the US EPA Office of Underground Storage Tanks, August 1988.

costs for the estimated population of 1.717 million tanks[7] affected by the rule.

The final rule, which went into effect in 1989, requires UST replacement/upgrade to meet new tank integrity standards, the institution of release detection monitoring UST systems, and periodic tank tightness testing. The derivation of capital costs for these requirements are discussed below. There are two components of capital costs: tank, pipe, and component replacement, and installation of leak detection equipment.

In order to estimate the incremental costs of the rule for replacement/upgrade of tanks, pipes, and components, we subtracted the base case per-tank replacement costs shown in Exhibit 4-2 (p. 4-4) from the final rule per-tank replacement costs shown in Exhibit 4-5 (p. 4-10). The total net discounted replacement cost per tank was estimated as $6207. The rule requires replacement/upgrade of tanks and components by the tenth year after the regulation goes into effect (i.e. 1998) unless component failure occurs prior to that time. Failure rates for each year prior to year 10 were derived using estimates in Exhibit 7-2 (p. 7-5), showing probabilities of high- and low-cost release events and the probability of tank replacement or repair because of a release event. The probability that replacement would be necessary was derived by adding the probabilities of high- and low-cost events and multiplying this by the probability that tank replacement would be necessary if a release event occurred. During the first 5 years that the rule is in effect, a failure rate of 2.8 percent was estimated; during the following 4 years, a rate of 1.14 percent was estimated. The sum of probabilities for years 1 through 9 were subtracted from 100 to estimate the probability that tank replacement would not be required until year 10; the estimated percentage of tanks that would be replaced in year ten was therefore 81.44 percent.[8] These probabilities were used to apportion tank replacement/ upgrade costs over the first ten years of the period.

Leak detection is required to be phased in over the first five years of the rule based on the age of tanks. The Technical RIA assumes that half of all tanks will be fitted with observation wells, while the other half will opt for annual tank testing until replacement or upgrade, with observation wells required ten years thereafter. Costs for installation of observation wells were therefore divided in half: one half was distributed over the first five years during which wells would be installed according to tank age, and the other half applied in year 20 when the remaining tanks will be required to have wells installed. The

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[7] It should be noted that the UST population estimate is probably too high, resulting in an upward bias in our cost estimate. The assumption of constant UST population used in the RIA's cost analysis is inconsistent with the same RIA's Economic Impact Analysis, which predicts a significant decline in the number of small petroleum retal outlets due to the impact of the rule. Recent evidence has shown that this is indeed the case: on net, the UST poulation has been declining in recent years at an annual rate of 2-4 percent.

[8] In recent years, tank replacement has run about 4-6 percent annually. This suggests that by the year 1997, fewer than 81 percent of the UST population will need to be upgraded or replaced--perhaps closer to 60 percent. In addition to replacements due to failure, many tanks are being replaced voluntarily or in response to state requirements. Thus, year 10 (1997) replacement costs should be lower than our estimated costs, but early tank replacement should result in higher costs over the first nine years of the program than given by our estimates.

number of tanks required to be replaced over the 5-year phase-in period was derived using Exhibit 2-1 (p. 2-8) showing age distributions of steel- and fiberglass- reinforced tanks. Age distributions for each type of tank were multiplied by the percentage of the total population for each given in Exhibit 2-7 (p. 2-26). For instance, tanks between 15 and 20 years of age need to be replaced in year 3 or to commence annual monitoring. Steel tanks are the only tanks of this age and comprise 24 percent of the steel tank population, which in turn comprise 89 percent of the total tank population. Because the RIA assumes only half of such tanks will elect to have leak equipment installed, the percentage of tanks incurring such costs in year 3 will be (24 percent) x (89 percent) x (50 percent) = 10.68 percent. For tanks less than 15 years old, percentages for steel tanks and for fiberglass-reinforced tanks are each calculated in this manner and then summed. Thus, total capital costs for leak detection are apportioned among years 1 through 5 (when half of the tank population will have observation wells installed) and year 20 (when the remaining half of the tank population will have wells installed). The total capital costs were taken from the Technical RIA's discounted per-tank costs for leak detection equipment, shown in Exhibit 4-5 (p. 4-10) at a net discounted cost of $1091. For the sake of simplicity, the yearly distributions do not include estimates of component failure and replacement prior to year 10. (Note that the Technical RIA estimates 36 percent of steel tanks are 20 years or older. Since the rule requires tanks 25 years and older or of unknown age to be tested during the first year, we needed to estimate what portion of the 36 percent represented the oldest age category. Richard Braddock of EPA estimated that 60 percent of the 36 percent were tanks 25 years or older, and 40 percent were between 20 and 25 years old.

Annual O&M costs for underground storage tanks have four components: (1) annual tank and pipe testing; (2) annual line leak testing; (3) annual observation well monitoring; and (4) annual cathode protection testing.

Annual tank and pipe testing may be used as a means of leak detection for tanks. As discussed above, the other alternative for leak detection is installation of leak detection equipment, or observation wells. Following the Technical RIA's assumption that half of the tank population will be fitted with equipment and the other half tested annually, we derived annual tank and pipe testing costs in the following manner.

Because leak detection requirements are based on tank age, tank and pipe testing is phased in over the first five years at the same rate as that calculated above for installation of observation wells. Annual testing costs differ from equipment costs because they are cumulative. For example, in year three, equipment costs are incurred by 10.68 percent of the tank population. By contrast, testing costs in year three are incurred by 26.7 percent of the tank population: 10.68 percent representing tanks for which testing is begun in year three, 6.23 percent representing tanks for which testing began in year two, and 9.79 percent representing tanks for which testing began in year one. By year five testing is done for half of the tank population, which continue to be tested until year 10, when all tanks must be replaced or upgraded. Five years after replacement/upgrade, tanks are required to be tested again. The discounted per-tank cost of annual tank and pipe testing is shown in Exhibit 4-4 as $2161. Because the costs are cumulative, the sum of the percentages equal more than 50 percent; thus the percentages could not be applied directly to apportion the total cost. Instead the costs are distributed proportionally based on each year's portion of the sum of all percentages. This new group of percentages was used to apportion the total per-tank testing costs.

Annual line leak testing must be in place by year two. Testing costs are assumed to begin in year three for all tanks. The net per-tank cost of line leak testing is obtained by subtracting the base case cost shown in Exhibit 4-1 (p. 4-3) from the rule's cost shown in Exhibit 4-4 (p. 4-8). Because the Technical RIA calculates costs over a 30-year period, the cost of line leak testing is distributed evenly among years three through 30.

Annual per-tank observation well monitoring costs are shown in Exhibit 4-4 of the Technical RIA. Costs are incremented during the first 5 years as 50 percent of the tank population are fitted with wells and monitoring begins. From years 5 through 20 costs are constant as all tanks within this 50 percent are monitored annually. In year 20 the remaining 50 percent of tanks that had opted for annual tank testing are required to have observation wells installed, and so from years 21 through 30, 100 percent of the tank population must be monitored. The annual monitoring cost were therefore apportioned according to each year's portion of the sum of all percentages.

Annual cathode protection testing for existing tanks is required for tank upgrades. The timing of testing costs relates to two factors—the age of tanks, which determines when they will be subject to the rule, and the type of cathodic system installed. Cathodic protection systems must be tested within 6 months of installation and every three years thereafter; impressed current cathodic systems must be inspected every 60 days; and owners and operators must maintain records to demonstrate compliance. In view of the unknown variability of these costs, average costs were assumed to occur on an annual basis. The phase-in of tanks subject to testing follows the schedule for tank and pipe replacement discussed earlier. The estimated rates of tank failure and replacement are, as noted previously, estimated at 2.8 percent during the first 5 years; testing these new or upgraded tanks which must be cathodically protected would therefore occur during years 2 through 6, with the total number incremented yearly as new tanks become subject to the rule. During years 6 through 10, an estimated 1.14 percent of tanks will fail and be replaced, requiring these tanks to be tested as well. In year 10 (1998) the remaining tanks will be upgraded or replaced, resulting in 100 percent of the tank population being tested from year 11 through 30. The total cost for cathodic protection testing is distributed proportionally over 30 years based on each year's portion of the sum of percentages of tanks affected for the 30-year period.

The technical standards rule also requires UST owners and operators to perform corrective action for leaking UST systems. Corrective action costs for years 1 through 10 were derived using the RIA estimates of corrective action probabilities and costs associated for high- and low-cost release events given in Exhibit 7-2 (p. 7-5). The cost of corrective action for a release event is multiplied by the probability of an event occurring, which is then multiplied by the number of tanks. The result is an estimate of per-tank corrective action costs. These costs were calculated for high- and low-cost release events occurring each year. Estimates of high- and low-cost events were then added to produce an estimate of annual corrective action costs, which change at five year intervals. Due to the required replacement of the oldest tanks during the first five years of the rule, estimated discounted per-tank corrective action costs decline from $3,419 per year for years one through five to $659 for years six through ten.

The Technical RIA did not provide any information concerning how much of corrective action costs are capital costs and how much are O&M costs. To break down corrective action costs in this way, we assumed that 85 percent of total costs would be capital costs, and the remainder O&M costs.

In the last step, capital costs for tank replacement/upgrade, leak detection equipment, and corrective action were summed for each year over the period 1989-2000. The same was done for the various O&M cost components. Costs were allocated to the private sector and the local government sector (which also includes state governments) based on the estimated share of total UST systems owned by these sectors. UST costs were not calculated for non-EPA federal facilities because such costs are included in the larger category of Federal facility RCRA costs discussed in Section H.4, which could not be separated out.

H.3. UST FINANCIAL RESPONSIBILITY REQUIREMENTS

The Regulatory Impact Analysis for the Petroleum-containing UST financial responsibility rule of 1988[9] (hereafter referred to as "Financial RIA") presents discounted costs for the rule concerning UST financial responsibility requirements. The distribution of annual costs discussed in this section is based on the RIA estimates of costs that are incremental to those imposed by the UST technical standards rule. Discounting factors are "backed out" for all costs shown in the RIA for purposes of this study. Because the Financial RIA focuses on costs to retail motor fuel marketers, the costs presented in the study reflect the same emphasis. Also, the rule affects private and municipal UST systems only. Five percent of total estimated costs for the rule were allocated to municipalities, and the remainder to the private sector based on the proportion of UST systems owned by each of these sectors.

The incremental discounted cost per tank for tank replacement, upgrading, and leak detection is shown in Exhibit 4-6 (p. 4-14) as a single figure: $911. Because capital and annual costs are not distinguished within this amount, we applied the same proportional relationship that existed between total discounted incremental capital and annual costs in the RIA for technical standards: capital costs of $7,298 and O&M costs of $2,674 per tank. The result is an estimated discounted capital cost per tank of $665 and a discounted annual cost per tank of $246.

The capital cost is assumed to occur in year two because the rule requires all owners or operators of USTs must demonstrate evidence of financial responsibility within 21 months of the rule's effective date. The rule requires petroleum marketing firms owning 100 or more USTs to show evidence of financial responsibility within 9 months of the effective date. The rule also requires non-petroleum marketing firms with tangible net worth of more than $20 million to show evidence of financial responsibility by the effective date of the rule. Exhibit 3-1 (p. 3-3) was used to estimate the percentage of USTs owned by firms that fall into these categories. Using the EPA's estimated average of 4.1 USTs per retail motor fuel outlet and the number of outlets per firm given in Exhibit 3-1 (p.3-3), we obtained an estimate of the average number of USTs per firm for each category of firm size in Exhibit 3-1. The results showed that approximately 0.2 percent of firms owned 100 or more USTs and are therefore subject to the earliest compliance dates; these firms own approximately 33 percent of USTs within the retail motor fuel marketing sector. Firms owning less than 100 USTs constitute 99.8 percent of the sector and own approximately 67 percent of USTs.

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[9] US EPA, *Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks*, Office of Underground Storage Tanks, October 1988.

The cost to firms resulting from financial responsibility requirements are tied to firms' ability to obtain liability insurance. The RIA assumes that firms estimated to own 100 or fewer USTs are assigned an aggregate liability limit of $1 million, while all other firms are assigned an aggregate liability limit of $2 million (p. A-15). The RIA also assumes that any firm with a net worth ten times its assigned aggregate is assumed to use the financial test and/or to guarantee its subsidiaries (p. A-15). For firms for which assets-by-net-worth data are available, it was assumed that net worth would constitute 50 percent of the firm's assets (p. A-15). These assumptions were applied to estimate the percentage of firms that would use the financial test, based on the distribution of total assets among firms owning retail motor fuel outlets shown in Exhibit 3-3. The exhibit shows the number of firms and the number of outlets owned by firms according to total asset amounts. Based on the RIA's assumptions stated above, firms owning more than 100 USTs must have a net worth of at least $20 million in order to use the financial test. Assuming that new worth amounts to 50 percent of total assets, firms in the three highest asset categories appear to coincide with firms that face the early compliance dates because each owns approximately the 33 percent of USTs in the retail petroleum marketing sector. (The estimate of firms using the financial test is approximate because the third category of net worth ranges from $5 million to $50 million.) Therefore, for the purposes of this analysis it was assumed that firms owning 33 percent of USTs would be able to self-insure.

It was assumed that 67 percent of USTs within the retail petroleum marketing sector and in other sectors would need to be covered by an outside form of insurance. According to the Financial RIA, all USTs within the agriculture and local government sectors will need to seek insurance coverage. For the purposes of this analysis it was assumed that these firms would be able to self insure.

H.4. FEDERAL FACILITY HAZARDOUS WASTE COSTS

Reliable estimates of future Federal facility compliance costs pursuant to RCRA and CERCLA are unavailable at this time given the uncertainty over the magnitude of Federal corrective action and remediation needs. However, estimates of non-EPA Federal hazardous waste-related compliance costs were calculated using recent years' budget appropriations data and estimates of future budget needs in this area for the two most important Federal players—the Department of Energy (DOE) and the Department of Defense (DOD). These agencies are discussed separately below and the costs shown in Table H-2.

H.4.1. *Department of Energy Costs*

Data on actual DOE budget appropriations associated with hazardous waste and Superfund activities for years 1989 and 1990, and estimated budgets for years 1991-1996 were obtained and used to derive

DOE cost estimates for these years.[10] DOE costs in subsequent years are assumed to remain at year 1996 levels.

DOE budget expenditures reported for "Environmental Restoration" are used to represent Superfund costs. DOE defines these as costs for "cleanup of inactive hazardous and radioactive waste sites at all DOE facilities and some non-DOE sites for which DOE has some responsibility". DOE budget estimates for "Waste Operations" are used to represent hazardous waste costs. DOE reports that this category of costs involves all compliance activities relating to the treatment, storage, and disposal of hazardous wastes. DOE also reports costs for "Corrective Activities". These costs represent compliance activities pursuant to a variety of environmental laws, and were not used for this analysis.

H.4.2. *Department of Defense Costs*

Historical costs for the DOD were derived from a 1988 agency report on its environmental restoration program.[11] DOD costs for years 1990-1991 are based on actual and estimated budget appropriations reported by the Congressional Budget Office.[12] The DOD source reports costs for years 1984-1986 for two categories of activities: "Installation Restoration Program (IRP)" and "Hazardous Waste Disposal" (HWD). DOD defines IRP costs as those to "identify, investigate, and cleanup contamination from hazardous substances and wastes on installations and at formerly used properties". We used costs for this program to represent Superfund costs; costs for HWD were used to represent RCRA costs. To estimate that portion of total DOD costs directed to HWD in years 1987-1991, which are not reported in the data source, we assumed that they were 25 percent of reported IRP costs. This represents the average percentage of total DOD costs for HWD reported for years 1984-1986.

No information on DOD costs for years after 1991 are available. To estimate DOD costs for these years, we assumed that total costs in future years would increase at the same annual rate shown by our estimates of DOE costs in future years. We then assumed that 75 percent of total DOD costs projections for future years would be for Superfund activities, and the remainder for RCRA activities, which corresponds to the DOD cost allocations in previous years.

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[10] The data for DOE actual FY 1989 and 1990 appropriations were obtained from a March 1990 unpublished Draft Report by the Congressional Budget Office entitled "Federal Facility Hazardous Waste Liabilities". The estimates of budget needs for years 1991-1996 were obtained from: US Department of Energy, *Environmental Restoration and Waste Management: Five Year Plan, 1992-1996*, June 1990.

[11] U.S. Department of Defense, *Defense Environmental Restoration Program: Annual Report to Congress FY 1987*, March 1, 1988.

[12] See footnote 10.

H.4.3. *Total Federal Facility Costs*

For each of the years 1989-2000, the estimates of DOE and DOD Superfund costs were combined to show Federal facility costs for this program. The same was done for DOD and DOE costs for hazardous waste operations to show total Federal facility costs for associated with RCRA.

A further adjustment to the Federal facility costs estimates was performed to break them into capital and O&M cost components. Since no information was available on the components of Federal facility costs, it was assumed that 85 percent of compliance costs are capital costs, and the remainder O&M costs. These capital and operating costs are shown in Table H-2 as well as in Tables 5-1 and 5-2 of Chapter 5.

Table H-1: ACTUAL AND PROJECTED LEVELS OF SUPERFUND INVESTIGATION AND REMEDIATION ACTIVITIES, YEARS 1980-2000

	Level of Activity[2]							
	Fund-Led[3]				PRP-Led[4]			
Year	Rem	RI	RD	RA	Rem	RI	RD	RA
1980	7	0	0	0	0	0	0	0
1981	28	21	5	0	0	0	0	0
1982	60	32	4	9	1	3	0	0
1983	129	112	7	9	10	11	5	2
1984	208	127	16	16	62	28	5	9
1985	196	129	19	8	86	59	10	7
1986	175	37	26	12	58	46	19	9
1987	254	127	70	35	50	56	24	19
1988	220	93	69	51	108	57	30	21
1989	236	70	63	57	86	87	94	51
1990	304	117	71	65	103	84	71	52
1991	331	121	81	72	115	95	83	58
1992	358	127	90	79	127	106	95	65
1993	386	132	99	86	139	116	107	71
1994	413	137	109	94	151	127	118	78
1995	440	143	118	101	164	137	130	84
1996	467	148	128	108	176	148	142	91
1997	495	153	137	115	188	158	159	97
1998	522	159	146	122	200	169	166	104
1999	549	164	156	130	212	180	178	110
2000	577	169	165	137	224	190	189	117

[1] Data for the years 1980-1989 represent historical activity levels. Data for years 1990-2000 are projections based on straight-line extrapolation from actual levels.

[2] The data represent first starts for the following activities:

Rem: Removals
RI: Remedial Investigation and Feasibility Studies
RD: Remedial Design Studies
RA: Remedial Actions

[3] Activities inititated by EPA and funded through the Superfund.

[4] Activities initiated and paid for by Potentially Responsible Parties.

Sources:

1. Data for years 1980-1987 were taken from: US EPA, *Progress Toward Implementing Superfund FY 1987: Report to Congress*, Office of Solid Waste and Emergency Response, April 1989.

2. Data for years 1989-90 were taken from: US EPA, *Progress Toward Implementing Superfund Superfund FY 1989: Report to Congress*, Office of Emergency and Remedial Response, March 1990.

Table H-2: COST ESTIMATES FOR FEDERAL FACILITY COMPLIANCE WITH RCRA AND CERCLA

(millions of 1986 dollars)

Source	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Hazardous Waste Costs																	
Department of Energy[1]	NA	NA	NA	NA	NA	905	1,142	1,504	3,253	3,380	3,642	3,261	3,113	3,113	3,113	3,113	3,113
Department of Defense[2]	24	40	61	81	89	113	130	177	324	375	390	403	381	381	381	381	381
Total Hzrd Waste Costs	24	40	61	81	89	1,018	1,272	1,681	3,577	3,755	4,032	3,664	3,494	3,494	3,494	3,494	3,494
Superfund Costs																	
Department of Energy[1]	NA	NA	NA	NA	NA	491	620	824	1,506	1,743	1,813	1,873	1,769	1,769	1,769	1,769	1,769
Department of Defense[2]	91	186	246	325	353	451	521	708	1,295	1,499	1,560	1,612	1,522	1,522	1,522	1,522	1,522
Total Superfund Costs	91	186	246	325	353	942	1,141	1,532	2,801	3,242	3,373	3,485	3,291	3,291	3,291	3,291	3,291
Capital Costs[3]																	
Hazardous Waste	20	34	52	69	76	865	1,081	1,429	3,040	3,192	3,427	3,114	2,970	2,970	2,970	2,970	2,970
Superfund	77	158	209	276	300	801	970	1,302	2,381	2,756	2,876	2,962	2,797	2,797	2,797	2,797	2,797
Operating Costs[3]																	
Hazardous Waste	4	6	9	12	13	153	191	252	537	563	605	550	524	524	524	524	524
Superfund	14	28	37	49	53	131	171	230	420	486	506	523	494	494	494	494	494

Footnotes to Table H-2

[1] Department of Energy (DOE), hazardous waste and Superfund costs for years 1989 and 1990 are based on actual budget appropriations data obtained from a March 1990 unpublished draft report by the Congressional Budget Office entitled "Federal Facility Hazardous Waste Liabilities". The estimates for years 1991-1996 are based on estimated budget needs for these years reported in: US Department of Energy, *Environmental Restoration and Waste Management: Five Year Plan, 1992-1996*, June 1990. The reported DOE estimates for "Waste Operations" were used to represent hazardous waste costs, and the reported estimates for "Environmental Restoration" were used to represent CERCLA costs. It was assumed that costs in years 1997-2000 would remain at year 1996 levels.

[2] Department of Defense (DOD) hazardous waste and Superfund costs for years 1984-1988 were obtained from: US Department of Defense, *Defense Environmental Restoration Program: Annual Report to Congress FY 1987*, March 1, 1988. The reported DOD costs for "Hazardous Waste Disposal" (HWD) were used to represent RCRA costs, and

reported costs for the "Installation Restoration Program" (IRP) were used to represent Superfund costs. DOD costs for years 1990-1991 are based on actual and estimated budget appropriations reported by the Congressional Budget Office (see footnote 1 above). To estimate that portion of total DOD costs directed to HWD in years 1987-1991, which were not reported by the data sources, it was assumed that they were 25 percent of reported IRP costs; this represents the average percentage of total DOD costs for HWD reported for years 1984-1986. No information on DOD costs for years after 1991 are available. To estimate DOD costs for these years, we assumed that total costs in future years would increase at the same annual rate shown by our estimates of DOE costs in future years. It was assumed that 75 percent of total DOD costs projections for future years would be for Superfund activities, and the remainder for RCRA activities, which corresponds to the DOD cost allocations in previous years.

[3] To disaggregate total costs into capital and O&M cost components, it was assumed that 85 percent of total costs are capital costs and the remainder O&M costs, reflecting a rule-of-thumb commonly applied in the analysis of hazardous waste corrective action programs.

APPENDIX I
ESTIMATION OF TOXIC SUBSTANCES CONTROL COSTS

This appendix contains background data and documentation for the toxic substances control costs presented in Chapter 6. Table I-1 contains private capital costs, annualized capital costs, O&M costs, and total annual costs associated with existing chemical regulation pursuant to TSCA Section 6. All of the capital costs and most of the O&M costs are for three PCB regulations. The O&M costs also reflect certain information provision requirements for existing chemicals.

Tables I-2 and I-3 contain data for costs to the private sector and EPA associated with new chemical regulation. The EPA cost estimates are associated with TSCA Section 5 only; they are thus less than the total EPA cost estimates presented in Chapter 6. All new chemical regulation costs reflect annual costs only (capital costs are insignificant). Data for the years 1979-1988 were estimated by EPA staff; the annual cost estimates for years 1990-2000 are based on linear projections of historical costs. The data presented in Tables I-1 through I-3 are summarized in Table I-4.

Table I-1: INDUSTRY COST OF EXISTING CHEMICAL REGULATION PURSUANT TO TSCA SECTIONS 4, 6, 8 & 12

(millions of 1986 dollars)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Capital (a)	19.50	0.00	0.00	0.00	42.94	23.09	121.22	119.73	116.98	114.13	109.74	89.29
Annual												
Capital (b)	1.84	1.84	1.84	1.84	5.89	8.07	19.52	30.82	41.86	52.63	62.99	71.42
O & M (c)	85.44	102.13	74.85	70.17	71.75	64.91	60.48	62.56	54.58	53.91	50.6	53.66
Total Annual Costs	87.28	103.97	76.69	72.01	77.64	72.98	80.00	93.38	96.44	106.54	113.59	125.08

Table I-1A: INDUSTRY COST OF EXISTING CHEMICAL REGULATION PURSUANT TO TSCA SECTIONS 4, 6, 8 & 12

(millions of 1986 dollars)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Capital (a)	89.29	89.29	89.29	89.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual											
Capital (b)	79.85	88.28	96.70	105.13	105.13	105.13	105.13	105.13	105.13	105.13	105.13
O & M (c)	50.25	47.85	46.14	45.11	41.99	41.15	40.49	39.84	39.23	38.65	38.09
Total Annual Costs	130.10	136.13	142.84	150.24	147.12	146.28	145.62	144.97	144.36	143.78	143.22

Footnotes for Tables I-1 and I-1A

(a) Reflects the capital costs associated with three separate regulations under TSCA Section 6 restricting the manufacture, use, and distribution of PCBs. The estimates were derived from the RIAs for these rules and compiled by OTS staff.

(b) Reflect capital costs associated with PCB rules annualized at 7 percent over 20 years.

(c) Reflect O&M costs associated with PCB rules plus O&M costs for 24 chemical testing rules under TSCA Section 4; 34 Section 8(d) rules for submission of unpublished health and safety studies; 39 8(a) rules for submission of production information (including the 1977 TSCA Inventory, the 1986 Inventory Update, and the comprehensive Assessment Information Rule) and; Section 12(b) for export notification. All estimates were derived from the RIAs for the above rules and compiled by OTS staff.

Table I-2: INDUSTRY COST OF NEW CHEMICAL REGULATION PURSUANT TO TSCA SECTION 5

(millions of 1986 dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
PMN Filing Costs (a)	0.05	1.77	3.33	4.54	6.76	5.95	7.05	7.95	8.06	10.65
5(E) SNUR w/o testing (b)	0.00	0.01	0.00	0.01	0.05	0.10	0.18	0.23	0.20	0.12
5(E) SNUR with Ecotox testing (c)	0.00	0.03	0.07	0.04	0.23	0.12	0.11	0.16	0.11	0.19
5(E) SNUR with Health testing (d)	0.00	0.07	0.12	0.08	0.27	0.15	0.14	0.20	0.15	0.23
Total Annual Costs	0.05	1.87	3.52	4.68	7.32	6.32	7.48	8.54	8.53	11.18

Table I-2A: INDUSTRY COST OF NEW CHEMICAL REGULATION PURSUANT TO TSCA SECTION 5*

(millions of 1986 dollars)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
PMN Filing Costs (a)	--	--	--	--	--	--	--	--	--	--	--	--
5(E) SNUR w/o testing (b)	--	--	--	--	--	--	--	--	--	--	--	--
5(E) SNUR with Ecotox testing (c)	--	--	--	--	--	--	--	--	--	--	--	--
5(E) SNUR with Health testing (d)	--	--	--	--	--	--	--	--	--	--	--	--
Total Annual Costs	11.92	13.01	14.10	15.18	16.27	17.36	18.44	19.53	20.61	21.70	22.79	23.87

Footnotes for Tables I-2 and I-2A

* Data for PMNs and SNURs for years 1989-2000 were not supplied by OTS staff, and projections were made for the totals of these actions only and not for each individual category. The total annual costs associated with all PMNs and SNURs for the years 1989-2000 were projected by regressing the total annual costs for these categories over the years 1972-1988 against time.

(a) Reflect annual costs of filing pre-manufacturing (PMN) review notices prior to the manufacture, process, or import of new chemicals not on the TSCA Inventory. Estimates were calculated by OTS staff based on an average cost of $4,700 per PMNS submission.

(b) Reflect annual costs of Significant New Use Rule (SNUR) requirements that do not require additional testing. Estimates were derived from economic analyses and compiled by OTS staff.

(c) Same as b except include requirements for testing of ecological effects (Ecotox).

(d) Same as b except include requirements for Ecotox testing.

Table I-3: EPA COST OF NEW CHEMICAL REGULATION PURSUANT TO TSCA SECTION 5

(millions of 1986 dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
PMN Filing Costs (a)	0.00	4.43	8.37	11.39	16.98	14.95	17.71	19.95	20.24	26.73
5(E) SNUR w/o testing (b)	0.00	0.05	0.00	0.04	0.21	0.40	0.71	0.91	0.81	0.47
5(E) SNUR with Ecotox testing (c)	0.00	0.02	0.16	0.07	0.60	0.28	0.25	0.42	0.28	0.50
5(E) SNUR with Health testing (d)	0.00	0.02	0.16	0.07	0.60	0.28	0.25	0.42	0.28	0.50
Total Annual Costs	0.00	4.52	8.68	11.59	18.40	15.90	18.93	21.70	21.60	28.19

Table I-3A: EPA COST OF NEW CHEMICAL REGULATION PURSUANT TO TSCA SECTION 5*

(millions of 1986 dollars)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
PMN Filing Costs (a)	--	--	--	--	--	--	--	--	--	--	--	--
5(E) SNUR w/o testing (b)	--	--	--	--	--	--	--	--	--	--	--	--
5(E) SNUR with Ecotox testing (c)	--	--	--	--	--	--	--	--	--	--	--	--
5(E) SNUR with Health testing (d)	--	--	--	--	--	--	--	--	--	--	--	--
Total Annual Costs	30.18	32.95	35.72	38.49	41.25	44.02	46.79	49.56	52.33	55.09	57.86	60.63

Footnotes for Tables I-3 and I-3A

* Data for PMNs and SNURs for years 1989-2000 were not supplied by OTS staff, and projections were made for the totals of these actions only and not for each individual category. The total annual costs of reviewing all PMNs and SNURs for the years 1989-2000 were projected by regressing the total annual costs for these categories over the years 1972-1988 against time.

(a) Reflect annual costs of reviewing pre-manufacturing (PMN) review notices prior to the manufacture, process, or import of new chemicals not on the TSCA Inventory. Estimates were calculated by OTS staff based on an average cost of $11,800 per PMN submission reviewed.

(b) Reflect annual costs of imposing Significant New Use Rule (SNUR) requirements that do not require additional testing. Estimates were derived from economic analyses and compiled by OTS staff.

(c) Same as b except include requirements for testing of ecological effects.

(d) Same as b except include requirements for Ecotox testing.

Table I-4: SUMMARY TABLE FOR TSCA

(millions of 1986 dollars)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Capital Costs															
Private							20	0	0	0	43	23	121	120	117
Operating Costs															
EPA for New Chem								0	5	9	12	18	16	19	22
Private							85	102	77	74	76	72	67	70	63

Table I-4A: SUMMARY TABLE FOR TSCA

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Capital Costs															
Private	117	114	110	89	89	89	89	89	0	0	0	0	0	0	0
Operating Costs															
EPA for New Chem	22	22	28	30	33	36	38	41	44	47	50	52	55	58	61
Private	63	62	62	66	63	62	61	61	59	60	60	60	61	61	62

Footnotes for Tables I-4 and I-4A

Private Capital Costs: From Tables I-1 and I-1A, first line.

EPA: Cost of new chemical regulation only from Table I-3, last line.

Private Operating Costs: Sum of “O & M” line from Tables I-1 and I-1A and the last line of Tables I-2 and I-2A.

APPENDIX J
ESTIMATION OF PESTICIDE CONTROL COSTS

This appendix provides background data and documentation for the individual components of pesticide control costs presented in Chapter 6. The data reflect annual operation, maintenance, and administrative costs only (capital costs are insignificant) for the years 1972-2000. Costs are provided for four affected sectors: private industry, states, EPA, and the U.S. Department of Agriculture (USDA).

The private industry costs include costs to pesticide registrants (i.e. manufacturers) for compliance with various regulatory requirements, including research, packaging, disposal, and storage, as well as costs due to pesticide cancellations and suspensions. The private industry costs also include costs to agricultural pesticide users for farmworker safety and applicator certification/training. The time-series estimates for many of the cost categories are based on one data point for year 1980 derived from: *Regulatory Impact Analysis: Data Requirements for Registering Pesticides Under FIFRA* (1982). For the most part, estimates for years 1972-1980 are assumed to increase linearly from zero in year 1972 to the RIA estimate for year 1980. Estimates for years beyond 1980 are then either assumed to remain constant at 1980 levels or to grow annually by some fixed factor. For certain cost categories, estimates for years 1990-2000 are assumed to increase substantially due to new requirements that are expected to be promulgated in the near future. In most cases, these new requirements reflect new provisions pursuant to the 1988 FIFRA amendments.

Costs to states include costs associated with applicator certification and training, farmworker safety, and enforcement. U.S. Department of Agriculture (USDA) costs include those associated with assessing pesticide residues in food products, and applicator certification and training. EPA costs are primarily for administering FIFRA abatement and control programs, but also include grants made to states for applicator certification and training, and enforcement.

It should be noted that regulatory initiatives for controlling pesticides in groundwater are still in the developmental stage. Should EPA adopt an aggressive policy in this area, future costs could be considerably greater than those shown.

Table J-1: PRIVATE COMPLIANCE COSTS FOR FIFRA

(millions of 1986 dollars)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
FIFRA Related R&D (a)															
NACA Firms	38.90	47.72	54.33	59.59	77.74	101.01	109.18	113.87	125.67	121.03	133.49	141.59	140.28	211.50	186.00
Other Firms	4.58	4.34	6.04	5.59	7.07	10.10	11.08	11.68	12.03	12.22	13.81	14.38	13.82	21.56	19.00
Child res. packaging (b)	0.00	0.52	0.97	1.34	1.70	2.02	2.28	2.45	2.27	3.41	4.46	5.50	6.44	7.34	7.64
Reg. of establishments (c)	0.00	0.85	1.57	2.16	2.74	3.27	3.69	3.96	4.14	3.94	3.86	3.86	3.86	3.87	3.92
Books/records (d)	0.00	2.23	4.12	5.72	7.24	8.64	9.73	10.48	10.96	10.43	10.21	10.20	10.19	10.25	10.38
Inspections (e)	0.00	0.09	0.16	0.20	0.27	0.32	0.36	0.38	0.40	0.38	0.37	0.38	0.37	0.37	0.38
Disp/Storage (exRCRA) (f)	21.62	21.34	20.62	19.89	19.66	19.51	19.10	18.36	17.51	16.65	16.31	16.31	16.29	16.37	16.58
Farmworker Safety (g)	0.00	0.00	22.13	20.48	19.43	18.52	18.99	17.52	16.04	14.67	14.96	14.38	14.88	15.40	16.00
Applic. cert./training (h)	0.00	0.00	0.00	0.00	79.51	67.34	61.71	52.55	44.12	46.45	46.03	46.46	47.82	49.28	52.00
Fees (registration) (i)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cancellations/Suspensions (j)															
past	0.00	32.71	29.52	24.97	45.39	42.51	110.30	160.91	121.51	100.90	72.51	47.05	111.59	40.26	29.95
future	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	65.10	109.80	139.46	139.94	260.74	273.23	346.41	392.16	354.67	330.09	316.00	300.10	365.54	376.19	341.85

Table J-1A: PRIVATE COMPLIANCE COSTS FOR FIFRA

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
FIFRA Related R&D (a)															
NACA Firms	186.00	167.15	179.27	198.88	220.35	243.70	269.84	298.79	330.53	366.01	405.23	449.11	497.67	550.89	609.71
Other Firms	19.00	16.43	17.74	19.61	22.41	24.28	27.08	29.88	32.68	36.41	40.15	44.82	49.49	55.09	60.69
Child res. packaging (b)	7.64	7.88	8.12	8.42	8.52	8.62	8.72	8.83	8.93	9.04	9.15	9.26	9.37	9.48	9.60
Reg. of establishments (c)	3.92	3.94	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Books/records (d)	10.38	10.43	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48
Inspections (e)	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Disp./Storage (exRCRA) (f)	16.58	16.66	16.74	17.41	20.02	22.22	24.67	27.38	30.39	33.73	37.44	41.56	46.13	51.21	56.84
Farmworker Safety (g)	16.00	15.46	14.94	88.70	154.06	154.06	154.06	154.06	154.06	154.06	154.06	154.06	154.06	154.06	154.06
Applic. cert./training (h)	52.00	52.17	51.35	54.15	56.02	85.90	56.02	57.89	59.76	61.62	63.49	65.36	67.23	69.09	70.96
Fees (registration) (i)	0.00	0.00	0.00	37.25	32.96	13.59	14.14	14.71	15.29	15.91	16.55	17.21	0.00	0.00	0.00
Cancellations/Suspensions (j)															
past	29.95	88.15	67.10	48.03	38.28	28.94	19.61	9.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
future	0.00	0.00	0.00	65.36	268.91	397.76	489.26	543.42	560.22	560.22	560.22	560.22	560.22	560.22	560.22
Totals	341.85	378.64	370.08	552.64	836.35	993.89	1078.22	1159.10	1206.69	1251.84	1301.11	1356.42	1398.99	1464.87	1536.91

Footnotes for Table J-1 and J-1A

(a) Research and Development costs (include regulation-related expenditure on toxicology, metabolism, environmental chemistry, residue analysis, and registration). Estimates for National Agricultural Chemicals Association (NACA) firms for the years 1972-1987 are based on annual surveys of basic producers, performed by NACA. Estimates for NACA firms for the years 1988-2000 are based on an assumed 10.75% annual rate of growth over 1987 base level. Estimates for other firms are based on the assumption that firms which are not part of the NACA incur an amount equal to about 10 percent of the R&D costs incurred by the NACA firms.

(b) All estimates are based on two data points: one for year 1980 that was estimated in *Regulatory Inpact Analysis: Data Requirements for Registering Pesticides under FIFRA (1982)*, p. 97 (hereinafter referred to as the 1982 RIA), and one for 1985 based on OPP staff calculation of full compliance costs. Estimates for years 1972-1979 are assumed to start at zero and increase linearly until the 1980 estimate is reached. Estimates for 1981-1985 are assumed to increase linearly from the 1980 base estimate until the OPP estimate of full compliance is reached in 1985. For years 1986-2000, costs are assumed to rise by 1.2% per year, reflecting growth in the number of products requiring packaging.

(c) (d) and (e) Estimates are based on the estimate for year 1980 given in the 1982 RIA. Estimates for years 1972-1979 are assumed to start at zero and increase linearly until the 1980 estimate is reached. Estimates for years 1980-2000 are assumed to remain constant at 1980 levels.

(f) Same as footnote C, except that costs for years 1990-2000 are assumed to increase over 1989 levels by 11.5% anually to reflect expanded requirements for disposal and storage expected to be implemented within the next several years.

(g) Based on EPA Office of Pesticide Programs (OPP) staff estimates. Estimates for years 1989 and 1990 reflect new requirements pursuant to a proposed rule to revise worker protection standards (53 FR 25970; 7/8/88) derived from the RIA for this rule. Estimates for 1991-2000 assumed to remain constant at year 1990 estimated level.

(h) Estimate for year 1980 comes from the 1982 RIA. Estimates for years 1976-1979 and 1981-2000 based on OPP staff estimates. Estimate for year 1991 reflects expanded certification and training expected to be promulgated within the next few years, which is expected to significantly raise compliance costs in year 1991 only. Estimates for 1992-2000 based on 1990 estimate plus an assumed annual 3% growth rate.

(i) Reflect two fees pursuant to the 1988 FIFRA amendments: 1) Product registration and maintenance fee; and 2) Active Ingredient registration fee. The product registration fee is an annual fee for each registered product that runs for nine years only, beginning in 1989. Cost estimates for this fee are based on an assumed 18,000 product registrants in 1989, and an additional 18,000 in 1990. The Active Ingredient (AI) fee is a one-time fee for each AI. Cost estimates for this fee are based on a total of 419 AIs, 60% of which pay fees in 1989, and the remainder in 1990.

(j) Reflect costs for past and expected future pesticide cancellations/suspensions. Data and documentation for individual pesticide actions are presented in Tables J-1B and J-1C.

Table J-1B: PESTICIDE CANCELLATION/SUSPENSION COSTS, 1972-86

(millions of 1986 dollars)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Past Actions															
DDT		32.71	29.52	24.97	20.21	14.90	9.91	5.37							
A/D-C/H					25.18	21.20	18.23	15.99	12.29	7.60	3.71				
Mercury															
Paint						6.41	4.81	3.49	1.76						
Other Uses							9.18	7.37	4.96	2.44					
Kepone															
Chlorobenzilate									0.27	0.23	0.21	0.17	0.14	0.11	0.83
Endrin									2.94	2.48	2.01	1.55	1.14	0.72	0.32
DBCP							68.18	63.58	42.89	42.05	30.69	19.62	9.57		
2,4,5T/Silvex								65.11	56.40	46.09	35.89	25.71	16.79		
EDB															
Soil													51.01	39.43	28.80
Fruit													32.94		
Total Past Actions	0.00	32.71	29.52	24.97	45.39	42.51	110.30	160.91	121.51	100.90	72.51	47.05	111.59	40.26	29.95

Footnotes for Table J-1B

Based on EPA Office of Pesticide Programs (OPP) staff estimates.

Table J-1C: PROJECTED PESTICIDE CANCELLATION/SUSPENSION COSTS, 1986-2000

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Past Actions (a)															
Chlorobenzilate	0.83	0.62	0.43	0.22	0.00										
Endrin	0.32	0.58	0.37	0.19	0.00										
EDB															
Soil	28.80	18.36	9.34	0.00											
Fruit															
Dinoseb		68.60	56.96	47.62	38.28	28.94	19.61	9.34							
Total Past Actions	29.95	88.15	67.10	48.03	38.28	28.94	19.61	9.34							
Future actions															
Bromoxynil (a)				65.36	82.17	61.62	41.08	20.54							
Other future actions (b)					186.74	336.13	448.18	522.88	560.22	560.22	560.22	560.22	560.22	560.22	560.22
Total Future Actions				65.36	268.91	397.76	489.26	543.42	560.22	560.22	560.22	560.22	560.22	560.22	560.22
Totals	29.95	88.15	67.10	113.39	307.19	426.70	508.87	552.75	560.22	560.22	560.22	560.22	560.22	560.22	560.22

Footnotes for Table J-1C

(a) Based on EPA Office of Pesticide Programs (OPP) staff estimates.

(b) Future costs are based on an assumed three actions per year at an initial cost of $200 million each in 1988 dollars (1 major at $100M, 1 intermediate at $75M, 1 minor at $25M). Initial costs for each action are assumed to decrease linearly to zero in six years.

Table J-2: STATE COMPLIANCE COSTS FOR FIFRA

(millions of 1986 dollars)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Certification/Training (a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.55	5.21	3.67	3.11	2.21	2.23	2.77	2.50
Enforcement (b)	0.46	0.43	0.40	0.37	0.35	2.53	12.03	19.42	17.51	14.55	14.96	14.38	13.82	14.99	14.00
Farm Worker Safety (c)	0.00	0.00	0.00	0.37	0.35	0.34	0.32	0.44	0.40	0.37	0.35	0.55	0.53	0.51	0.50
Cancellation/Suspensions (d)															
Product Registration (e)															
Registration Fees (f)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	0.46	0.43	0.40	0.74	0.71	2.86	12.34	25.40	23.13	18.58	18.41	17.15	16.58	18.28	17.00

Table J-2A: STATE COMPLIANCE COSTS FOR FIFRA

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Certification/Training (a)	2.50	2.61	2.52	3.27	2.52	3.27	2.61	2.71	2.80	2.89	2.99	3.08	3.17	3.27	3.36
Enforcement (b)	14.00	12.66	12.23	12.32	12.89	13.45	13.91	14.38	14.94	15.50	16.62	16.81	17.55	18.21	18.86
Farm Worker Safety (c)	0.50	0.48	0.47	7.00	3.27	3.27	3.27	7.47	3.73	3.73	3.73	3.73	8.40	4.67	4.67
Cancellation/Suspensions (d)															
Product Registration (e)															
Registration Fees (f)	0.00	0.00	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.00	0.00	0.00
Totals	17.00	15.75	16.15	23.53	19.61	20.92	20.73	25.49	22.41	23.06	24.28	24.56	29.13	26.14	26.89

Footnotes for Tables J-2 and J-2A

(a) Estimated at 1.5 times the amount of EPA grants (i.e. states assume 60 percent of total costs).

(b) For years 1972 - 1976: staff estimate of $200,000 is used.
For years 1977 - 2000: estimated at 1.5 times the amount of EPA grants (i.e. states assume 60 percent of total costs).

(c) Costs are based on EPA Office of Pesticide Programs (OPP) staff estimates.
(d) Cancellation/Suspension—minor, not estimated.
(e) Product Registration—not estimated.
(f) Registration Fees—very minor—$1 million/year. Years 1988-1997 only; reflecting nine-year period for fees pursuant to the 1988 FIFRA amendments.

Table J-3: EPA PESTICIDE PROGRAMS COSTS

(millions of 1986 dollars)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
FIFRA Appropriations (a)	26.25	32.95	34.65	35.70	52.16	54.61	38.64	57.34	52.74	50.31	39.53	35.88	37.86	45.83	41.02
Enforcement Grants (b)	0.00	0.00	0.00	0.00	0.00	1.70	7.99	12.91	11.70	9.68	10.01	9.62	9.25	9.98	9.32
Certification/ Training Grants (c)	0.00	0.00	0.00	0.00	13.25	8.08	3.64	5.11	4.81	3.55	2.88	2.10	2.13	2.67	2.50
Totals	26.25	32.95	34.65	35.70	65.41	64.39	50.27	75.36	69.25	63.53	52.42	47.61	49.23	58.48	52.84

Table J-3A: EPA PESTICIDE PROGRAMS COSTS

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
FIFRA Appropriations (a)	41.02	41.02	48.20	100.11	103.32	49.21	51.17	53.22	55.37	57.61	59.94	62.37	64.89	67.51	70.21
Enforcement Grants (b)	9.32	8.41	8.12	8.22	8.59	8.96	9.06	9.62	9.99	10.36	10.74	11.20	11.67	12.14	12.61
Certification/ Training Grants (c)	2.50	2.42	2.43	2.80	2.43	3.27	2.52	2.61	2.71	2.80	2.89	2.99	3.08	3.17	3.27
Totals	52.84	51.85	58.75	111.13	114.34	61.44	62.75	65.45	68.07	70.77	73.58	76.56	79.65	82.82	86.09

Footnotes for Tables J-3 and J-3A

(a) Estimates for years 1972-1987 are based on actual OPP budget data. Estimates for years 1988-1990 are based on actual OPP appropriations data that includes $6.8 million in disposal funds for FY 88 and $60 million in disposal funds for FY89 and FY90. Estimates for years 1991-2000 are based on 1989 base appropriations (i.e. without disposal funds) plus an assumed annual increase of four percent.

(b) Represent grants to states for FIFRA enforcement. Estimates for years 1977-1989 are based on actual OPP budget data. Estimates for years 1990-2000 are based on 1989 costs, plus an assumed annual growth of four percent.

(c) Represent grants to states for training and certification of pesticide applicators. Estimates for years 1976-1989 are based on actual OPP budget data. Estimates for years 1988-1991 are based on estimates from a draft RIA for new regulations currently under development. Estimates for years 1992-2000 are based on 1990 estimate plus an annual increase of $0.9 million.

Table J-4: NON-EPA FEDERAL (USDA ONLY) COMPLIANCE COSTS

(millions of 1986 dollars)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Certification/Training (a)															
(in-kind matching funds)	0.00	0.00	0.00	0.00	13.25	8.08	3.64	5.11	4.81	3.55	2.88	2.10	2.13	2.67	2.50
NPIAP (b)	0.00	0.00	0.00	0.00	0.00	12.63	11.87	10.22	8.69	7.95	6.90	6.64	6.38	6.16	5.50
Totals	0.00	0.00	0.00	0.00	13.25	20.71	15.51	15.33	13.50	11.49	9.78	8.74	8.50	8.83	8.00

Table J-4A: NON-EPA FEDERAL (USDA only) COMPLIANCE COSTS

(millions of 1986 dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Certification/Training (a)															
(in-kind matching funds)	2.50	2.42	2.43	2.80	2.43	3.27	2.52	2.61	2.71	2.80	2.89	2.99	3.08	3.17	3.27
NPIAP (b)	5.50	5.31	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Totals	8.00	7.73	7.10	7.47	7.10	7.94	7.19	7.28	7.38	7.47	7.56	7.66	7.75	7.84	7.94

Footnotes for Tables J-4 and J-4A

(a) In-kind matching funds provided by USDA to support certification and training programs equal in cost to EPA's grants in this area (OPP staff estimate).

(b) National Pesticide Impact Assessment Program - program of USDA. Staff estimates.