IMPACTS OF FEDERAL REGULATIONS, PAPERWORK, AND TAX REQUIREMENTS ON SMALL BUSINESS

Report Prepared for the

U.S. SMALL BUSINESS ADMINISTRATION

by

MICROECONOMIC APPLICATIONS, INC.

4354 WARREN STREET, N.W.

WASHINGTON, D.C. 20016

HENRY B. R. BEALE, PRINCIPAL INVESTIGATOR

KING LIN, CONSULTANT

September 10, 1998

This study was performed for the Office of Advocacy of the U.S. Small Business Administration, under Contract SBAHQ-95-C-0023

CONTENTS

EXECUTIVE SUMMARY

Costs of complying with regulations typically are disproportionately high for small businesses and governmental units. Unit compliance costs -- compliance costs per employee, per unit of output, or per dollar of revenue -- often are several times as high for very small entities than for large ones, and they are sometimes more than ten times as high.

The degree to which unit costs for small entities are higher varies from regulation to regulation and depends on the specific compliance activities for each regulation. The degree to which small entities suffer significant impacts as a result of high unit costs depends on whether compliance costs are absolutely large as well as disproportionately large, and on the extent to which regulatory flexibility alternatives were adopted.

Because of the variability of unit compliance costs and the potential for disproportionately high costs to very small entities, it is essential that agencies understand the costs for small entities and their potential for significant impacts. To accomplish this, they need to consider impacts on small entities and regulatory flexibility alternatives as an integral part of a regulatory impact analysis from the outset. Agencies do this effectively at times, but overall the performance is quite spotty. Far more consistent attention to costs and impacts on small entities is needed to make regulations cost-effective.

BACKGROUND

The potential for regulatory requirements to have disproportionate impacts on small businesses has long been a concern of the Office of Advocacy of the Small Business Administration (SBA), which began funding studies of regulatory impacts two decades ago. The most recent SBA-funded studies by Hopkins[1] used a macro approach, analyzing total regulatory costs to firms -- paperwork and reporting costs, capital compliance costs, and other operating and maintenance costs -- across all regulations.

This study is intended to provide a more "micro" examination of the impact of regulations on small businesses that focuses on individual regulations and IRS paperwork

---

[1] Thomas D. Hopkins, "A Survey of Regulatory Burdens." Report prepared for the U.S. Small Business Administration, Office of Advocacy, June 1995.
Thomas D. Hopkins, "Profiles of Regulatory Costs." Report prepared for the U.S. Small Business Administration, Office of Advocacy, November 1995.

requirements, rather than the broad groupings used by Hopkins. The analysis normalizes costs by computing unit costs per employee and/or per dollar of sales. Comparison of these unit costs for different size classes, allows disproportionate impacts on small businesses to be estimated.

METHODOLOGY

The study examined IRS paperwork burdens and two dozen specific regulations by four federal agencies, including:

- o Ten Occupational Safety and Health Administration (OSHA) regulations;
- o Twelve Environmental Protection Agency (EPA) regulations; and
- o Two other regulations by the FDA and USDA.

The study assessed the disproportionate regulatory costs on small business using several techniques:

- o A descriptive case study analysis of each regulation drew principally on the regulatory or economic impact analyses and the regulatory flexibility analyses for each regulation.
- o Linear regression analysis used two linear equation specifications relating the total regulatory cost to entity size that allowed marginal cost and average cost to differ and constrained marginal cost to equal average cost (i.e., constant returns to scale). The hypothesis that average unit compliance costs are larger for small entities than for large ones was tested by comparing results of these two specifications.
- o Analysis of indices of entity size and unit costs[2] compared the degree to which impacts on small entities are disproportionately large.

QUANTITATIVE FINDINGS ON DISPROPORTIONATELY HIGH COMPLIANCE COSTS FOR SMALL ENTITIES

Regression Results

The regression analysis included 28 sets of regression equations, of which:

- o Six had all of the characteristics of higher unit compliance costs for small entities than for large ones;
- o Eleven had most of the characteristics expected for higher unit compliance costs for small entities;

---

[2] The cost index was computed as the ratio of average unit costs of entities in each size class to the average unit cost of entities in the largest size class.

- Nine had characteristics consistent with similar unit costs of compliance activities for large and small entities (although three of these did not have sufficient data for meaningful tests of statistical significance); and

- Two had characteristics consistent with lower unit costs of compliance for small entities than for large ones.

Where more than one regulation affected a specific industry or sector, and data from these regulations could be pooled in one regression equation, four of the five industry equations indicated higher unit compliance costs for small entities.

Index Analysis

Cost indices directly measure the disproportionate impact on small entities as the ratio of the average unit cost of the smallest size class to the average unit cost of the largest size class. Results were as follows:

- The cost index was about 100 for IRS paperwork burdens; i.e., the average unit cost for the smallest businesses was about 100 times that of the largest businesses;

- The cost index for the median industry (or the mean cost index where two industries were involved) was unambiguously greater than one for three quarters (18) of the individual regulations studied. It was:
    - Between 4 and 30 for 10 regulations, including four regulations for which at least one industry had a cost index between 30 and 70,
    - Between 2 and 4 for four regulations, and
    - Between 1 and 2 for four regulations.

- The cost index was unambiguously less than one (i.e., the smallest businesses had lower unit costs than the largest businesses) for two regulations.

- The cost index was higher than one (and as high as 67) in some industry segments but, due to a partial exemption, less than one in other segments for four regulations.

Burdens That Were Proportionally the Same or Smaller for Small Businesses

The regression analysis and/or the index analysis indicated that 13 industry-regulation pairs (one regulation affecting an industry) had cost characteristics other than increasing returns to scale. Of these 13 industry-regulation pairs:

- Four involved complete or partial exemptions for small entities;

- Two were cases where the small entity appeared able to avoid regulatory costs by making appropriate strategic decisions;

- o Two appeared to have unit costs that did not vary much with firm size;

- o Five regulations appeared to have questionable assumptions or regression equation specification anomalies that spuriously produced this result.

Conclusions

The conclusion is that most regulations do impose costs on small entities that are disproportionately high -- sometimes proportionately very much larger. Most of the exceptions appear to be due either to regulatory flexibility measures or to flaws in the regulatory analysis. These exceptions point to the need for greater consistency in performing quality regulatory flexibility analysis.

FINDINGS ON FACTORS RELATED TO DISPROPORTIONATE SMALL-ENTITY COSTS

The case studies provided considerable information on individual factors that contribute to, or mitigate, disproportionate regulatory costs to small entities.

Factors Contributing to High Unit Compliance Costs for Small Entities

Technical Economies of Scale. Economies of scale exist when average costs fall as the size of the entity rises. Technical economies of scale occur when large-scale production is more efficient than small-scale production in one of two ways:

- **Engineering control equipment** has economies of scale that are a common source of disproportionately large costs for small entities.

- **Processes.** Economies of scale in control equipment may be large enough that it becomes cost-effective for small entities to utilize a different technology that is inherently less efficient but better suited to small scale.

Administrative and Development Costs. Regulatory compliance includes start-up activities that usually involve large economies of scale:

- **Familiarization, Planning, and Compliance Program Development.** Preparation for compliance with a regulation is an administrative activity that tends to be virtually a fixed cost over a substantial range of sizes of the affected entities.
- **Hazard Assessment.** Hazard assessment, which is explicitly required in some regulations, is a one-time activity with nearly fixed costs.

- **Paperwork and Reports.** Paperwork has many characteristics of a fixed cost, and the degree of disproportion in impacts on small entities is high.

- **Work Force Size.** A work force may be inefficiently small for compliance activities that involve direct interaction with employees, including training, worker notification and communication, and use of equipment in compliance.
- **Reformulation.** Changing the product or package is likely to have economies of scale, since costs that can be spread over more units in larger businesses.

- **Statistical Factors.** Even the statistical properties of large numbers can make the regulatory costs for small entities disproportionately large:

- **Monitoring.** As a purely statistical matter, there are very large economies of scale in achieving a given degree of precision in statistical sampling.

- **Risk Pooling.** Insurance entails extremely large cost savings for large entities that are able to pool risk over many diversified sources.

Population of Small Governmental Entities. Numerous powerful sources of high unit costs for small entities occur in regulations affecting small governmental entities, and the size differential among governmental entities is larger than among businesses. Small governments thus face the most disproportionately high costs of any type of entity.

Specific Factors Offsetting High Unit Costs for Small Entities

Reductions in compliance activities can offset the tendency for regulatory costs to small entities to be disproportionately large.

- **Tiered Regulations and Exemptions.** Regulatory flexibility -- tiering to simplify the requirements for small entities or exemption of the smallest entities -- reduces the impacts on small entities.

- **Specialization and Avoidance of Regulated Situations.** In a few cases, small entities tended to avoid lines of work to which regulatory provisions applied.

Factors Conducive to Constant Returns to Scale

Some compliance costs have roughly constant returns to scale because they are essentially proportional either to the number of workers or the output. Examples include the cost of personal protective equipment and costs related to production inputs, which tend to be proportional to output. The problem with identifying such costs is that Regulatory Impact Analyses (RIAs) tend to <u>assume</u> proportionality of costs and employment or output.

Conclusions

The different types of factors that contribute to disproportionately high regulatory costs for small entities come in different mixes that can make them difficult to assess. Nevertheless, there appear to be some discernable patterns:

- Costs that impose disproportionately the highest burden on small entities are:
  - Statistical properties of risk pooling and monitoring,
  - Fixed administrative costs, and
  - Technical economies of scale.

- In absolute terms, engineering costs are generally the largest source of burdens on small entities, although paperwork and statistical risk pooling can be absolutely quite large in individual regulations.

- Administrative costs are generally a relatively moderate source of disproportionate impacts on small entities.

- Costs related to the work force itself or to output tend not to create disproportionately large burdens for small entities.

- Regulatory flexibility in the form of tiered requirements or exemptions can be extremely effective in mitigating or eliminating disproportionately large burdens on small entities.

- When regulations affect only some industry activities, small businesses may minimize regulatory burdens by specializing away from those activities.

OTHER FINDINGS

Definitions of Small Entities

Units of Size. The different regulations use various measures of size in estimating impacts on small entities:

- o All OSHA regulations and some EPA regulations use number of employees;
- o Some EPA regulations and the FDA and IRS regulations use revenue;
- o Some EPA regulations and the USDA regulation use physical measures; and
- o EPA regulations applicable to governments use population.

Specific measures were chosen because they were directly related to costs and/or benefits (employment and physical output); served as a proxy for physical output (revenue and population); or were closely related to the impacts. Employment is the most consistent measure to use for comparisons across diverse industries.

The Cutoff for "Small." "Small" is typically defined in one of the following ways:

- o A "large" and a " small" size class with a single cutoff;[3]
- o A range of three to six size classes, to provide more detailed information; or
- o Where more detailed industry information permits, a specification of a cutoff (as physical output or revenue) tailored to the way costs or impacts behave.

Impact Issues

"Significant Impacts." Disproportionately large impacts on small entities may or may not have much practical significance. The critical issue is whether absolute impacts are minimal or significant. The analysis showed the following:

- o Half of the regulations had essentially no significant impacts;

---

[3] Where employment is the measure of size, 20 employees is the usual cutoff, and 10 employees is occasionally used. These cutoffs are much smaller than the cutoffs (typically 500 employees) used in the Small Business Regulatory Enforcement and Fairness Act of 1996 (SBREFA), which was passed after all of the final rules covered by this study were published. It is generally advisable for agencies to consult with the SBA Office of Advocacy and otherwise to use the process outlined in SBREFA to develop appropriate alternative size cutoffs for regulatory flexibility analysis.

- One quarter of the regulations had costs of 1.0 to 3.0 percent of revenue in at least one industry; and

- One quarter of the regulations had costs in excess of 5.0 percent of revenue, or otherwise were probably significant and large in at least one industry.

High Unit Compliance Costs and Significant Impacts. Where regulatory costs for the smallest size class exceeded 1.0 percent of revenues in least one industry,[4] the outcomes were approximately equally divided into three categories:

- Economies of scale in regulatory compliance were minimal and play little or no apparent role in the significant impacts on small firms;

- Unit compliance costs for small entities were substantially higher, but impacts on the smallest size class were greatly reduced or eliminated by regulatory flexibility measures; or

- Impacts on small entities were significant and disproportionately large despite the use of regulatory flexibility measures.

Exhibit ES-1 provides information for each regulation in the study on the degree to which impacts on small entities were disproportionately high and/or significant, as well as the use of regulatory flexibility measures.

Conclusions

The disproportionately high costs to small entities do not necessarily mean that the impacts on those small entities will be significant. Costs on small entities may be disproportionately high but absolutely quite small. Conversely, economies of scale may be small, and other factors may make impacts significant. Exemptions or other regulatory flexibility measures can protect small entities from substantial economies of scale that would otherwise impose significant impacts. In some cases, however, inherently high unit compliance costs may overwhelm the regulatory flexibility alternatives that can be used without defeating the purpose of the regulation.

---

[4] The single rule of thumb of costs equal to 1.0 percent of revenue cannot possibly fully measure the significance of regulatory impacts, but it is a convenient benchmark for purposes of comparing the relative impact of costs of different regulations.

EXHIBIT ES-1: RELATIVE UNIT COMPLIANCE COSTS, COMPLIANCE COSTS AS A PERCENT OF REVENUE FOR SMALL ENTITIES, AND REGULATORY FLEXIBILITY MEASURES

Agency/Regulation	Average Unit Regulatory Cost Index[a,b]	Cost as a Percent of Revenue[a]	Regulatory Flexibility Measures
OSHA			
Concrete and Masonry Construction Safety	0.33	1.84%	None
Electrical Safety-Related Work Practices	3.71 - 4.27	0.0013% - 0.0045%	None
Electric Power Generation and Protective Equipment[c]	0.42 - 1.69	0.0033% - 0.03%	None
Lockout/Tagout	0.72	N.A.	None
Permit-Required Confined Spaces	2.73 - 34.63[d]	0.01% - 0.34%	None
Pers. Protective Equip.	1.22 - 3.97	N.A.	None
Process Safety Management Highly Hazardous Chemicals	0.71 - 37.4[e]	0.024% - 2.03%[f]	None

[a] A range indicates different values in different affected industries.

[b] Ratio of mean unit compliance cost for smallest entity size class to mean unit compliance cost of largest entity size class. Where available, cost per employee was used to measure unit cost; otherwise cost as a percent of revenue was used.

[c] Excludes line-clearance tree trimming.

[d] Quartile values of the cost index were: Q1=6.66; Median=8.59; Q3=14.50. Industries in the top quartile were Hotels and Other Lodging (14.50), Wood Products (15.20), Electric/Electronic Equipment (34.63).

[e] Quartile values of the cost index were: Q1=3.68; Median=6.66; Q3=14.45. Industries in the top quartile were Industrial Organic Chemicals (14.45), Primary Metals

(14.74), Petroleum Refining (20.5), Plastics and Resins (27.4), Drugs (31.2), and Textile Mill Products (37.4).

[f] Quartile values for percent of revenue were: Q1=0.058%; Median=0.133%; Q3=0.318%. Industries in the top quartile were Plastics & Resins (0.318%), Industrial Organic Chemicals (0.33%), Detergents (0.57%), Miscellaneous Chemical Products (0.92%), Asphalt Materials (1.05%), and Paints & Varnishes (2.03%).

EXHIBIT ES-1: RELATIVE UNIT COMPLIANCE COSTS, COMPLIANCE COSTS AS A PERCENT OF REVENUE FOR SMALL ENTITIES, AND REGULATORY FLEXIBILITY MEASURES

(Continued)

Agency/Regulation	**Average Unit Regulatory Cost Index[a,b]**	**Cost as a Percent of Revenue[a]**	**Regulatory Flexibility Measures**
Asbestos Final Revisions			
Construction	0.21 - 3.93[g]	0.03 - 0.28%	None
General Industry	4.0 - 66.3[h]	0.0013 - 1.1%[i]	None
Occupational Exposure to Cadmium	1.06 - 4.65	N.A.	None
Lead Exposure in Construction			None
High Exposure	1.24 - 4.89[j]	1.16% - 14.24%[k]	
Medium Exposure	1.22 - 3.65[l]	0.26% - 0.69%[l]	
Low Exposure	1.24 - 1.61	0.01% - 0.19%	

[g] Quartile values of the cost index were: Q1=0.86; Median=1.05; Q3=1.51. Industries in the top quartile were Operators of Apartment Buildings (1.51), Operators of Nonresidential Buildings (2.33), and Plumbing and Heating (3.93).

[h] Shipbuilding and Repair has a cost index of 66.3. Other industries have a cost index of 9.0 or less.

[i] The only industries with costs in excess of 0.1 percent of revenues are Coatings and Sealants (0.6%) and Gaskets and Packings (1.1%).

[j] Quartile values of the cost index were: Q1=1.24; Median=1.25; Q3=2.33. Industries in the top quartile were Operators of Other Buildings (2.33) and Structural Steel (4.89).

[k] Quartile values for percent of revenue were: Q1=1.97%; Median=2.54%; Q3=3.77%. Industries in the top quartile were Painting Contractors (3.77%) and Structural Steel (14.24%).

[l] Among medium-exposure industries, Floor Laying Contractors have the highest values of both variables.

EXHIBIT ES-1: RELATIVE UNIT COMPLIANCE COSTS, COMPLIANCE COSTS AS A PERCENT OF REVENUE FOR SMALL ENTITIES, AND REGULATORY FLEXIBILITY MEASURES
(Continued)

Agency/Regulation	Average Unit Regulatory Cost Index[a,b]	Cost as a Percent of Revenue[a]	Regulatory Flexibility Measures
EPA			
Acid Rain Implementing Regulations			
Small, Under 250 MW	0.86 - 1.22	0.94% - 1.34%	Exemption
Small, Over 250 MW	0.05 - 6.76[m]	0.06% - 7.42%[m]	None
Phaseout of Ozone Depleting Chemicals	1.11 - 5.24	0.61%	None
Fuels/Fuel Additives Registration	0.55 - 1.17	0.002% - 0.012%	Partial Exemption
PCE: Dry Cleaning			
Very Small, No Controls	0.23 - 0.94	0.78%	Exemption
Other Small/Very Small	1.08 - 5.54	0.40% - 4.85%	None
Air Emission Standards for Hazardous Waste Facilities	1.08	0.28%	None
Underground Petroleum Storage Tanks Financial			

Responsibility			
Retail Motor Fuel	4.34	N.A.[n]	Options
General Industry	36.50	N.A.	Options
Local General Government	19.28	N.A.	Options
OCPSF Effluent Guidelines			
Direct Dischargers	0.00	0.00%	Exemption
Indirect Dischargers	66.6	N.A.[o]	None
Disposal of Sewage Sludge	1.26 - 8.38	0.214% - 0.493%	None

[m] Fuels make a critical difference in impacts. Gas accounts for the low values. The cost index is much higher for oil (5.99) and coal (6.76). Cost as a percent of revenue is also much higher for oil (6.57%) and coal (7.42%).

[n] Substantial numbers of closures were predicted as a result of the accompanying UST technical standards.

[o] Closures were predicted in the Regulatory Impact Analysis.

EXHIBIT ES-1: RELATIVE UNIT COMPLIANCE COSTS, COMPLIANCE COSTS AS A PERCENT OF REVENUE FOR SMALL ENTITIES, AND REGULATORY FLEXIBILITY MEASURES

(Continued)

Agency/Regulation	**Average Unit Regulatory Cost Index[a,b]**	**Cost as a Percent of Revenue[a]**	**Regulatory Flexibility Measures**
Drinking Water: Lead & Copper	21.25	N.A.	Several
Drinking Water: Phase V Chemicals	26.6[p]	1,709%[p]	None
SARA Title III			
Below Reporting Threshold	12.3	0.021%	Exemption
Above Reporting Threshold	12.5	0.207%	None
FIFRA	1.03	N.A.	None
FDA			

Food Labeling			
No Health Claims Made	2.4	0.116%	Exemption
Health Claims Made	12.7	0.616%	None
USDA			
Pathogen Reduction & HACCP[q]			
First Year Costs	16.6 - 32.6	2.04% - 2.95%	Several
Recurring Annual Costs	12.0 - 22.3	0.96% - 1.33%	Several

ABBREVIATIONS AND ACRONYMS

ADL	Arthur D. Little
BAT	Best Available Technology Economically Available
BCT	Best Conventional Pollution Control Technology
BOD	Biochemical Oxygen Demand
BPT	Best Practicable Control Technology Currently Available
CAA	Clean Air Act
CEMS	Continuous Emissions Monotoring System
CFE	Commercial Food Service Establishment
CFC	Chlorofluorocarbon
cfm	Cubic Feet per Minute
CWA	Clean Water Act
EPA	Environmental Protection Agency
f/cc	Fibers per Cubic Centimeter
FDA	Food and Drug Administration

F/FA	Fuel/Fuel Additives
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FSIS	Food Safety and Inspection Service
GW	Gigawatt
HACCP	Hazard Analysis and Critical Control Point
HEPA	High Efficiency Particulate Accumulator
HVAC	Heating, Ventilation, and Air Conditioning
IPP	Independent Power Producer
IRS	Internal Revenue Service
KWH	Kilowatt Hour
lb/mmBtu	Pounds per Million British Thermal Units
LEPC	Local Emergency Planning Commission
LEV	Local Exhaust Ventilation
MCF	Methyl Chloroform
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MGD	Million Gallons per Day
mg/l	Milligrams per Liter
MSDS	Material Safety Data Sheet
MW	Megawatt
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDWR	National Primary Drinking Water Regulations

NSPS	New Source Performance Standards
OCPSF	Organic Chemicals, Plastics, and Synthetic Fibers
OSHA	Occupational Safety and Health Administration
PCE	Perchloroethylene
PEL	Permissible Exposure Limit
POTW	Publically Operated Water Treatment Works
PPE	Personal Protection Equipment
ppm	Parts per Million
ppmw	Parts per Million by Weight
PSES	Pretreatment Standards for Existing Sources
PSM	Process Safety Management
PSNS	Pretreatment Standards for New Sources
PWS	Public Water System
RCRA	Resource Conservation and Recovery Act

RFA Regulatory Flexibility Analysis

RIA Regulatory Impact Analysis

SARA Superfund Amendments and Reauthorization Act

SBA U.S. Small Business Administration

SDWA Safe Drinking Water Act

SECL Separate Engineering Control Limit

SERC State Emergency Response Commission

SIC Standard Industrial Classification

SOP Standard Operating Procedure

TQC Total Quality Control

TSDF Treatment, Storage, and Disposal Facility

TSS Total Suspended Solids

TWA Time Weighted Average

USDA U.S. Department of Agriculture

UST Underground Storage Tank

---

[p] Based on very small systems having a problem with Antimony. If all very small systems are considered, the cost index is about 8.

[q] Based on the "high-cost" scenario (which results in lower cost ratios than the "low-cost" scenario).

I. INTRODUCTION

A. BACKGROUND

1. Early Studies

The potential for regulatory and reporting requirements to have disproportionate impacts on small businesses has long been a concern of the Office of Advocacy of the U.S. Small Business Administration (SBA). SBA began funding studies of regulatory impacts in the late 1970s, and this first wave of studies continued through the mid 1980s. Early studies looked at small-business impacts from a number of perspectives, but most provided either a highly aggregated or a fragmented picture of regulatory impacts on small businesses.

Theoretical Underpinnings. Many of the early studies began with a discussion of the causes of disproportionate impacts on small businesses, which was based on economic theory. Such a discussion typically relied on economies of scale.[5] Treatment of economies of scale ranges from hypothetical numerical examples of spreading of fixed regulatory costs to illustrate the concept of economies of scale[6] to a relatively elaborate application of the theory of the firm to draw implications of changes in costs, market share, and exit.[7]

Another perspective likened regulatory costs to an excise tax. This insightful comparison made the important policy point that disproportionate impacts on small businesses act as a regressive tax. Regressive taxes are not generally desirable, particularly in view of their anti-competitive effects.[8]

Early studies also pointed out that, in some respects, very small firms might incur disproportionately small costs of compliance, at least relative to moderately small and medium sized firms. Very small firms are often exempted by statute or practice from

---

[5] Examples include: Robert E. Berney, "The Cost of Government Regulation on Small Business: An Update." Report prepared for the U.S. Small Business Administration, Office of Advocacy, September 1980, pp. 7-18. Booz Allen & Hamilton, Inc, "Impact of Environmental Regulations on Small Business," Report prepared for the U.S. Small Business Administration, Office of Advocacy, May 1982. William A. Brock and David S. Evans, "The Economics of Regulatory Tiering," *RAND Journal of Economics*, XVI, No. 3 (Autumn 1985). Peter B. Pashigian, "The Effect of Environmental Regulation on Optimal Plant Size and Factor Shares." Center for the Study of the Economy and the State Working Paper 25 (Chicago, April 1983). Jack Faucett Associates, "Economies of Scale in Regulatory Compliance: Evidence of the Differential Impacts of Regulation by Firm Size." Report prepared for the U.S. Small Business Administration, Office of Advocacy, December 1984.

[6] Berney, pp. 14-18.

[7] Brock & Evans, 1982.

[8] Berney, 1980, pp. 3-4.

provisions of tiered regulations, so that they incur no compliance costs.[9] Similarly, monitoring and enforcement may be, in effect, tiered by agencies.[10] In addition, very small firms tend to produce few products, so that they may be subject to fewer regulatory requirements.[11]

Compliance costs for small firms may not be fixed; they may vary with strategic choices. Firms face strategic choices in compliance, and agencies face strategic choices in enforcement. Thus the compliance process is really a stochastic problem related to ease (or cost) of compliance, perceived urgency of compliance, and policy uncertainty. Cole and Sommers observed that firms have options that include a range of compliance from none to full, innovation to avoid compliance, and challenging the requirement. Agencies also make choices on monitoring and detection strategies and on enforcement when violations are detected. The actual compliance costs to a firm will depend both on the strategies selected and on the detection/enforcement outcome, which is a matter of probability. Cole and Sommers conclude that regulatory costs to small firms will be far more variable, although on average higher, than costs to larger firms.[12]

Methodological Approaches. Several of the early studies[13] utilized surveys of companies to collect data on compliance costs. Most of these studies used a "macro" approach that generally employed a measure of costs of all regulations for firms, and compared these aggregate measures of regulatory impact across firm size. Some studies provided industry detail, but others did not, and this limited the clarity of the results.[14] Questions often were qualitative or required ordinal responses (e.g., "light," "medium," or "heavy") rather than collecting quantitative data. While questions did disaggregate responses (e.g., by regulating agency or a typology of compliance

---

[9] Roland J. Cole and Paul Sommers, "Costs of Compliance in Small and Moderate-Sized Businesses." Report prepared for the Small Business Administration, Office of Advocacy, 1980, p. 4. David S. Evans, "The Differential Effect of Regulation Across Plant Size: Comment on Pashigian," *Journal of Law and Economics*, XXIX (April 1986), 187-199.

[10] Evans, 1986, p. 198.

[11] Cole and Sommers, pp. 18-20.

[12] Roland J. Cole and Paul Sommers, "Complying with Government Requirements: The Costs to Small and Larger Businesses." Report prepared for the Small Business Administration, Office of Advocacy, 1981, pp. 10-17.

[13] Arthur Andersen & Co., "Analysis of Regulatory Cost on Establishment Size." Report prepared for the U.S. Small Business Administration, Office of Advocacy, October 1979. Roland J. Cole and Philip D. Tegeler, *Government Requirements of Small Business* (Lexington: D.C. Heath and Company, 1980). Cole and Sommers, 1980. Cole and Sommers, 1981.

[14] Cole and Sommers, 1980, pp. 25-27.

activities[15]), such disaggregation was done in different questions, so that different facets of burden could not be analyzed jointly.

Some studies looked to market structure for evidence of economies of scale in regulatory compliance and disproportionate impacts on small firms. Booz-Allen & Hamilton examined changes in three measures of market structure: Concentration ratios, lower tail ratios (shares of small firms), and turnover.[16] Pashigian compared industry shares of large and small establishments before extensive regulation had occurred and in the most recent data.[17] While Pashigian found that disproportionate impacts on small firms did occur, this approach was not very useful or illuminating. Moreover, Pashigian's results were challenged.[18] Brock and Evans also concluded that "there is no credible evidence that environmental or health and safety regulations have had a widespread disparate impact on smaller manufacturing plants."[19]

Evans used ex post data on actual compliance costs to measure relative impacts of EPA air quality regulations and OSHA regulations as a whole.[20] He examined the costs in large and small firms and establishments in the manufacturing sector at the two-digit and four-digit SIC level. Evans' data, however, had limitations. For EPA regulations, the data addressed only operating costs. For OSHA, fines were used as a proxy for compliance costs, which made the results highly questionable.

Several studies looked at specific industries and various groups of regulations. Arthur Andersen used survey data to examine the relationship between establishment size and total regulatory costs, EPA regulatory costs, and OSHA regulatory costs in the electrical machinery industry.[21] Berney and Swanson reported the results of several studies of a particular industry (as well as some survey-based "macro" studies).[22] Knight and Harju analyzed compliance costs of OSHA regulations (principally concerning

---

[15] Cole & Sommers, 1981, p. 5.

[16] Booz Allen & Hamilton.

[17] Pashigian, 1983.

[18] Evans, 1986, p. 198.

[19] Brock & Evans, The Economics of Small Business, (New York, N.Y.: Holmes & Meier, 1986), p. 136.

[20] David S. Evans, "An Analysis of the Differential Impact of EPA and OSHA Regulations Across Firm and Establishment Size in the Manufacturing Industries." Report prepared for the U.S. Small Business Administration, Office of Advocacy, July 1985.

[21] Arthur Andersen, 1979.

[22] Robert E. Berney and James Swanson, "The Regressive Impact of Government Regulations: Some Theoretical and Empirical Evidence," *American Journal of Small Business*, VI, 3, (January-March 1982).

safety) using case studies of eight establishments in SIC 34, which were equally stratified by size (large and small) and by accident history (high and low).[23] The general problem with these studies was that they were too narrowly targeted to allow generalization.

Jack Faucett Associates performed a more systematic study that selected 14 specific regulations and the industries most affected by them.[24] This study relied on estimates of cost found in the Regulatory Impact Analysis and/or Regulatory Flexibility Analysis (or, in a few cases, another study). Regulatory costs were normalized by being divided by median employees (or, in some cases, a physical measure) for each size class, and these measures of impact were compared across establishment size classes. The study then used regression analysis to generalize these results to industry as a whole.

Findings. Taken as a whole, the early studies fairly consistently found evidence that small firms or establishments incurred higher regulatory compliance costs per employee or per dollar of sales than larger firms. Exceptions included Arthur Andersen,[25] whose smallest size class was far too broad (0-1,500 employees or $0-$7,500,000 in sales) meaningfully to reflect small firms as a group, and Evans,[26] whose study used only data on operating costs. Knight and Harju also found that accident histories played a far larger in compliance costs than firm size. Cole and Sommers found that costs were more variable for small firms than for moderate-sized firms[27] and that 50 employees was a reasonable point estimate of the upper end of "small," although 20 to 100 employees was a reasonable range and it was better to examine industries individually than use a single value.[28]

Most of these studies had one of two limitations. Some used a "macro" approach utilizing data that reflected all regulations affecting a firm and tended to be rather qualitative, imprecise, and undocumented in their measures of costs. The "micro" studies, except for the Jack Faucett Associates study, focused so narrowly on specific industries that generalization was not possible.

---

[23] James W. Knight and Douglas J. Harju, "The Impact of OSHA on Small Manufacturers." Report prepared for the Small Business Administration, Office of Advocacy, 1982.

[24] Jack Faucett Associates, 1984.

[25] Arthur Andersen, 1979.

[26] Evans, 1985.

[27] Cole & Sommers, 1980, pp. 20-25.

[28] Cole & Sommers, 1981, pp. 177-179.

2. More Recent Analysis

Thomas Hopkins of the Rochester Institute of Technology has done the most recent and extensive analysis of regulatory impacts on firms of different sizes.[29] SBA has built on these findings.[30]

A Survey of Regulatory Burdens. In this study, Hopkins used a macro approach focusing on total costs to firms across all regulations. His survey data were collected from 360 individual enterprises selected randomly from 15 4-digit SIC industries (five Wholesale & Retail Trade, seven Service, and three manufacturing) and stratified into four size classes (1-19, 20-99, 100-499, and 500-999 employees). General questions ranked the degree of burden in 20 regulatory areas and asked about other aspects of regulation, offering three ranking responses (e.g., substantial, moderate, little). Data on total enterprise regulatory costs were collected for three categories of regulations:

- o Paperwork and reporting costs, measured by:
  - Percent of owner/senior management time,
  - Hours of clerical staff time,
  - Average hourly compensation for clerical staff, and
  - Percent of total revenues used to pay costs of:
    - . Tax-related paperwork, and
    - . All other paperwork;

- o Capital compliance costs, measured by:
  - Total capital expenditures, and
  - Percent of capital expenditures due to regulation; and

- o Other operating and maintenance costs incurred because of regulation, measured as the percent of total revenues.

The survey also asked for the percentages of total regulatory burden attributable to tax related recordkeeping, payroll recordkeeping/reporting, environmental protection, worker health and safety, ADA accessibility/disability, and other regulations.

Hopkins's aggregated quantitative findings can be briefly summarized as follows:

- o For all categories of regulatory cost, the smallest firms had substantially higher regulatory costs than the largest firms.

---

[29] Thomas D. Hopkins, "A Survey of Regulatory Burdens." Repart prepared for the U.S. Small Business Administration, Offic of Advocacy, June 1995. Thomas D. Hopkins, "Profiles of Regulatory Costs," Report prepared for the U.S. Small Business Administration, Office of Advocacy, November 1995.

[30] U.S. Small Business Administration, Office of Advocacy, "The Changing Burden of Regulation, Paperwork, and Tax Compliance on Small Business: A Report to Congress," (Washington, D.C., October 1995).

- By most measures, firms with fewer than 50 employees as a group generally had above-average regulatory costs (measured as a percent of revenue or per employee), while firms with 50 or more employees as a group generally had below-average costs.

- Tax compliance paperwork and payroll recordkeeping were overwhelmingly the most burdensome regulatory areas, particularly for small firms, which reported that these two areas accounted for 79 percent of total regulatory burden.

Profiles of Regulatory Costs. In this study, Hopkins used an even more macro approach to develop estimates of regulatory costs for the economy as a whole. The analysis drew on a wide variety of sources (including Hopkins' own previous work) to present estimates of total cost of regulatory burdens and of costs of major types of regulation -- environmental, process (i.e., paperwork), economic-transfer, economic-efficiency, and other social -- as well as trends for these costs. Hopkins also disaggregated regulatory costs by impact on businesses or individuals; by sector of the economy; and by size of business.

Hopkins' methodology can be described as synthesis of disparate studies and assumptions that are calibrated by the results of other studies. The treatment of impacts by size of business illustrates this process. Based on the results of his own Survey of Regulatory Burdens, Hopkins assumed that small firms (fewer than 20 employees) bear per-employee regulatory costs that are 30 percent above average; large firms (500 or more employees) bear per-employee regulatory costs that are 30 percent below average; and intermediate firms (20 to 499 employees) bear the remainder of regulatory costs. Hopkins then reviewed other studies and found that these assumptions probably understate the disproportionate impact on small firms for tax-related process burdens, and that in other areas the collective findings are contradictory but provide no particular indication of how his assumptions might be changed to be more accurate. Hopkins then used sensitivity analysis (alternative assumptions of 20 percent and 10 percent) to check his results.

Hopkins found that total regulatory burden fell through about 1988 and has generally risen since then. Burdens of economic regulations have generally fallen steadily. The recent overall increase in regulatory burden has been driven largely by burdens of environmental regulation. Hopkins' estimates of regulatory burden by firm size are driven by the assumptions described above.

B. OVERVIEW OF THIS STUDY

This study is intended to complement Hopkins' recent work by providing a more "micro" examination of the impact of regulations on small businesses. Its objective is to produce estimates of the differential regulatory burden by firm size, but the approach focuses on individual regulations and IRS paperwork requirements as a class, rather than the broad groupings used by Hopkins. The objective is to produce estimates that can be extrapolated to industry as a whole and can be updated. Because the study draws largely on analysis of individual regulations, however, it will not directly produce estimates of total regulatory cost. Instead, the regulatory costs will be normalized by being computed per employee and per dollar of sales and compared across size classes. By comparing these normalized costs for different size classes, we will be able to estimate disproportionate impacts on small business as percentages of mean impacts -- much the way Hopkins summarizes his disparities in Profiles of Regulatory Costs.

The analysis of relative regulatory impacts in this study focuses on several types of regulations:

- o Worker safety and health regulations promulgated by OSHA;
- o Environmental regulations promulgated by the EPA;
- o Food labeling and safety regulations; and
- o Paperwork burdens associated with complying with IRS regulations related to business payment of taxes and related activities.

For environmental regulations, worker safety and health regulations, and food regulations, we will base the analysis on the regulatory analysis that accompanied the regulations. This approach is quite similar to that used over a decade ago by Jack Faucett Associates.[31] For IRS paperwork burdens, there exists only one general source for estimation of all paperwork burdens,[32] and this source is seriously flawed and not well suited for analysis of differential impacts. In this area, therefore, the approach will be considerably more descriptive and will analyze factors and specific tax code provisions that cause differential burdens to small businesses, as well as ways that those differential burdens may be exaggerated or can be minimized.

The remainder of the report is organized into the following chapters:

- o Chapter 2 provides the detailed analysis of individual worker safety and health, environmental, and food regulations;
- o Chapter 3 presents an analysis of IRS paperwork burdens;
- o Chapter 4 presents an econometric analysis of differential costs by size of business; and
- o Chapter 5 assesses the degree of economies of scale in different compliance activities, as shown in the detailed studies;
- o Chapter 6 presents findings about definitions of size and significant impacts.

---

[31] Jack Faucett Associates, 1984.

[32] Arthur D. Little, Inc. "Development of Methodology for Estimating the Taxpayer Paperwork Burden," Final Report to Department of the Treasury, Internal Revenue Service, June 1988.

II. ANALYSIS OF INDIVIDUAL REGULATIONS

This chapter compares the relative impacts of two dozen regulations[33] on small and large businesses. The analysis relies principally on the Regulatory Impact Analysis, Economic Impact Analysis, or Regulatory Flexibility Analysis conducted by the agency involved. We attempted to get a cross-section of regulations that would include both costly and inexpensive regulations.

The analysis assessed overall compliance costs and calculated costs per employee (or other normalizing variable, such as revenue). This calculation was done for large businesses, small businesses, and (in some cases) intermediate size classes. A compliance cost ratio -- defined as the mean per-employee (or other variable) cost of small businesses divided by the mean per-employee cost of the largest businesses -- was then computed to assess the degree of disproportionate impact on small businesses.

In many respects the analysis is constrained by data and the sources. A number of caveats should be kept in mind.

- A regulation could be included in the study only if the available analysis examined small-business impacts in a meaningful way. Where no analysis of impacts by business size was done, the regulation could not be included. Agencies often assume away the issue by estimating costs as being entirely proportional to labor (or revenues). In most instances, we excluded such regulations, although a few are included where the type of costs makes the assumption appear reasonable rather than arbitrary.

- The measures of business size used in the analysis varied among agencies and regulations. The common measures are:
  - Number of employees,
  - Pounds, gallons, or other physical measure of output,
  - Revenue (or value of shipments or equivalent measure), and
  - Population of local governments or number of households served.

  Analysis generally uses employment and revenue size, with employment being selected when only one measure is used. Employment was not always available, however, so that other variables had to be used in some regulations. Thus the size measures used are not comparable across all regulations. We decided not to attempt to covert other measures into employment size, since this conversion could cause imprecision and distortions of its own.

- Twenty employees is most often the cut-off between small businesses and larger ones that is used in regulatory analysis. Both OSHA and EPA seem reasonably content with this cut-off. Even when employment data are available, however,

---

[33] These 24 regulations include ten OSHA regulations, twelve EPA regulations, one FDA regulation, and one USDA regulation.

other cut-offs are used. This is particularly likely when statutory provisions include an exemption or other regulatory flexibility measure. It also occurs when the agency realizes that some other size is a more meaningful cut-off in terms of the way costs behave.

- The term "business" must be used with care. In fact, most data on size refer to establishments (plants or operations in one location) rather than enterprises (the legal entity that is the company). As a practical matter, most small businesses do have only one establishment, so that cost estimation based on establishment data is reasonably accurate. The problem arises with large businesses that own multiple establishments, some of which may be "small" by the definitions used. They may enjoy multi-plant economies of scale in some regulatory compliance activities, or they may engage in cross-plant subsidization to mitigate the financial impacts on small establishments that might force a one-establishment firm out of business. Such factors may make the disproportionate impact on small firms even greater than the single-establishment cost analysis indicates.

A. CONCRETE AND MASONRY CONSTRUCTION SAFETY STANDARDS

1. Objective and Summary of the Regulation

This regulation was intended to provide employees in the construction industry with a safer work environment and to reduce the frequency and severity of construction accidents and injuries. OSHA examined a number of accidents that occurred in concrete and masonry work. These included collapses of several large buildings under construction as well as many masonry wall collapses at smaller construction sites. OSHA identified hazards that contributed to the accidents which caused worker injury and death. Two of the hazards identified were formwork failure and the collapse of masonry walls.

Current rules did not adequately address these hazards. The revisions promulgated in this regulation consist primarily of work practices and procedures, including requirements for reinforcing steel, concrete placement, equipment formwork, precast concrete, and masonry construction. The bracing of masonry walls during construction and the stoppage of work while loads are moved overhead are the two most costly components. Integrated into daily construction operations, the safety procedures were intended to reduce the potential for occupational accidents and injuries and enhance the safety of the workplace.

2. Estimated Costs of Compliance With the Regulation

OSHA detailed the types of costs incurred under the regulation, including labor and material costs to erect bracing and caution tape along masonry walls, to set up structural supports for precast concrete, and to not allow work under overhead loads. All of the costs associated with the standard are construction costs. There are no new recordkeeping requirements and no requirements of large capital expenditures.

Exhibit A-1 shows OSHA's estimates of compliance cost. The total cost of full compliance with the revised standard (which includes some measures necessary to bring firms into compliance with existing standards) was $43.8 million. The largest components of this cost were for masonry bracings ($25.8 million) and overhead load

EXHIBIT A-1: COMPLIANCE COSTS BY PROVISION

Provision		Estimated Compliance Cost
Current Standard		$ 5,613,295
Incremental Cost of Revised Standard		
Overhead Loads	$10,076,354	
Masonry Bracing	$25,758,510	
Precast Bracing	$ 1,534,659	
General Formwork Provision	$ 1,534,659	
TOTAL		$38,184,420
Total Cost of Revised Standard		$43,797,715

EXHIBIT A-2: COMPLIANCE COSTS BY INDUSTRY

Industry	Estimated Compliance Cost ($ millions)	Estimated Compliance Cost as a Percent of Revenue
General Contractors	$ 8.70	0.04 %
Heavy Construction	$ 5.41	0.03 %
Masonry and Stonework	$26.13	1.84 %
Carpentering	$ 0.55	0.03 %
Concrete Work	$ 1.03	0.04 %
Excavation and Foundation	$ 0.86	0.03 %
Special Trade Contractors	$ 1.11	0.06 %
Total	$43.80	0.09 %

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.
requirements ($10.1 million). Masonry bracings refers to requirements that wooden bracing be erected around masonry walls during their construction. Overhead loads refers to requirements that no work take place below concrete buckets or precast members that are being hoisted during multistory construction. The costs of overhead load requirements stem from lost productivity and disruption as work is stopped for the movement of loads.

The industry most affected by the standards is masonry and stonework (SIC 1741), followed by heavy construction, general contracting, and several other construction related fields. See Exhibit A-2. Heavy construction was estimated to have compliance costs of $5.41 million and general contracting costs were calculated at $8.70 million. These large compliance costs represent small percentages of revenue in those fields, only 0.029 percent and 0.044 percent, respectively. Exhibit A-2 shows that compliance costs do not rise above 0.057 percent of revenue in any of the affected industries, except for masonry and stonework, where estimated compliance costs of $26.13 million would be 1.836 percent of revenues.

3. Effects of the Regulation on Small Establishments

OSHA concluded in the RFA that the concrete and masonry standards would affect a substantial number of small entities but that the economic impact on these entities would not be significant or disproportionate to impacts on large entities.

A majority of impacts was estimated to fall on the masonry and stonework industry (SIC 1741), for which estimated compliance costs were $26.13 million. OSHA calculated compliance costs per firm for four size classes of firms in this industry. Based on the assumption that there are no economies of scale or important capital expenditure requirements associated with the standard, OSHA estimated that compliance costs are distributed by size class in proportion to revenues. Revenues in the industry were reportedly $1,397 million, and total estimated compliance costs were $26.13 million (both in 1987 dollars). Thus OSHA estimated compliance costs to be $ 0.0184 per dollar of revenue regardless of size of the business.

This critical assumption that compliance costs are proportional to revenue drives the results. The assumption appears to be reasonable, since compliance costs stem only from actual revenue-generating work, not from recordkeeping requirements, capital expenditures, or other fixed costs. Erection of bracing and elimination of work under overhead loads are costs that will be incurred only as projects are done. In fact, if smaller establishments are assumed to work on fewer multi-story construction projects, the overhead loads requirement would actually impose lower costs on them than on large establishments.

Estimates of impacts by establishment size are summarized in Exhibit A-3. In the two smallest size classes (1-9 employees and 10-49 employees) compliance costs are $339 and $3,331 per establishment, respectively. Compliance costs per employee can be calculated from data on number of employees in each size class. Estimated compliance costs per employee actually diminish as establishment size decreases. For large establishments, compliance estimated costs are $382 per employee, while for very small establishments they are $126 per employee. This result is plausible if larger projects that involve overhead load costs and masonry bracing (which is required primarily for walls over eight feet in height) have a higher revenue per employee and are undertaken more often by large firms.

4. Conclusion

The concrete and masonry construction safety standards appear to have disproportionately small costs for small businesses. The smallest businesses were found to have one third the cost per employee as the largest businesses. Two factors appear to account for this. It appears reasonable to conclude that compliance costs (at least for any type of construction site) are roughly proportional to the number of sites. Proportionally lower costs for smaller businesses are consistent with the suggestion that small construction firms work very few sites of the type where these regulations apply.

EXHIBIT A-3: COMPLIANCE COSTS BY SIZE CLASS FOR MASONRY AND STONEWORK COMPANIES (SIC 1741)

	Size of Establishment				
Total/	**1 - 9**	**10-49**	**50-99**	**100+**	**Average**
Percent of Revenue Generated by Size Class	21.99%	36.54%	14.17%	27.30%	100.00%
Revenue Generated by Size Class ($ millions)	$312	$519	$201	$388	$1,420
Number of Establishments	16,983	2,867	200	97	20,147
Number of Employees	45,511	52,938	13,465	18,653	130,567
Compliance Costs ($ millions)	$ 5.75	$ 9.55	$ 3.70	$ 7.13	$26.13
Compliance Cost per Dollar of Revenue	$ .0184	$ .0184	$ .0184	$ .0184	$ .0184
Compliance Cost per Establishment	$ 339	$ 3,331	$18,500	$73,505	$ 1,297
Compliance Cost per Employee	$126	$180	$274	$382	$200

Cost Ratio[a]	0.33	0.47	0.72	-

[a] Ratio of cost per employee in individual size class to cost per employee in largest size class.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

B. OSHA ELECTRICAL SAFETY-RELATED WORK PRACTICES STANDARD

1. Objective and Summary of the Regulation

In this regulation, OSHA set forth new electric safety work practice requirements for general industry. The requirements apply to work performed on or near exposed electrical equipment, whether energized or deeneregized. At the time of the rule, OSHA estimated that there were more than 100 electrical accident fatalities per year in general industry. The standard was intended to prevent a large number of these fatalities and also to reduce substantially the number of injuries related to electrical shocks and burns.

The two primary electrical safety work practices required by the regulation[34] were:

- o The training of all qualified and high-risk employees (Section 1910.332); and
- o Lockout/tagout of all deenergized circuits (Section 1910.333).

Qualified and high-risk employees are those whose job duties include working on or near electrical equipment that poses a significant risk of injury. Such workers were required to receive both classroom and on-the-job training to prevent and deal with electrical hazards. Lockout/tagout of deenergized circuits was required so as to reduce the risk of their unexpected reenergization during maintenance operations.

2. Estimated Costs of Compliance With the Regulation

For training and lockout/tagout requirements, OSHA's cost estimation methodology consisted of determination of current industry practices; development of unit costs of complying with the standard; and aggregation of the unit costs. Each requirement is discussed in turn below.

Training. OSHA identified 25 occupational categories with risk of exposure to electrical hazards. OSHA divided them into three training categories, according to the extent and complexity of procedures for prevention of electrical hazards: High level training (1.5 hours), average level training (1 hour), and minimal level training (0.5 hours). OSHA estimated the percent of employees in each occupational category that needed to be trained. To estimate unit training costs, OSHA:

[34] OSHA also considered familiarization with the rule but concluded that familiarization costs would be zero, since "general knowledge of the practices outlined in this standard already exist."

- o Estimated employee hourly earnings for each occupational category (calculated as the basic rate times a factor of 1.2);

- o Estimated trainer hourly earnings for each occupational category (calculated as the employee hourly earnings times a factor of 1.17);

- o Prorated trainer hourly earnings to each employee under the assumption that a training class would contain three employees;

- o Multiplied the employee hourly earnings plus the prorated trainer hourly earnings times the number of hours of training for each occupational category; and

- o Multiplied unit training costs for each occupational category times the number of employees in that category to be trained.

Unit costs per employee trained, which were estimated by this procedure, ranged from $5.98 to $34.36, depending on the occupational category. The weighted average unit cost was $21.79. OSHA estimated total first-year training costs of the standard to be $71.5 million.

Lockout/Tagout. OSHA started with the assumption that 100 percent of establishments covered by the Generic Lockout/Tagout rule already had a lockout/tagout program in place. OSHA noted that the generic standard did not cover the Oil and Gas Extraction or the Finance, Insurance, and Real Estate sector, and OSHA assumed that the current rule would also require additional locks and tags in manufacturing establishments. OSHA assumed that:

- o Large and medium manufacturing establishments would require:
  - Four additional locks,
  - One additional tag, and
  - Twenty-four incidences of execution of locking (at 2 minutes each);

- o Establishments in Oil and Gas Extraction and in Fire, Insurance, and Real Estate would require:
  - Two locks,
  - One tag, and
  - Six incidences of execution of locking; and

- o All other establishments would require six additional incidences of execution of locking.

OSHA estimated unit costs of locks and tags and a wage rate for executing locking; computed per-establishment costs according to the assumptions above; and multiplied these costs by the number of establishments. OSHA's estimated total lockout/tagout costs to be $3.1 million.

3. Effects of the Regulation on Small Establishments

For the regulatory flexibility analysis, OSHA selected two industries -- Meat Packing (SIC 2011) and Household Electrical Appliances (SIC 3631) -- as being representative of industry. Using the assumptions described above, OSHA developed compliance cost estimates for a small firm and a large firm in each of these industries. These estimates are shown in Exhibit B-1.

In the meat packing industry, OSHA misapplied the unit costs for employee training in a small firm. The unit cost is based on the assumption that of three employees in a training class, but only one meat packing employee is trained in each small firm. For training one employee, the entire cost of a trainer -- not a pro-rated share -- must be included in the unit cost. Thus for the small firm training one employee, unit training cost is $31.35, 44 percent higher than the OSHA estimate.

EXHIBIT B-1

TYPICAL COMPLIANCE COSTS FOR SMALL AND LARGE FIRMS

Industry/Compliance Action	Small Firms		Large Firms	
	Number of Units	Costs	Number of Units	Costs
MEAT PACKING				
Training[a]	1	$21.79	19	$414.01
Lockout/Tagout				
Execution[b]	6	$ 3.12	24	$ 12.48
Locks[c]	2	$12.00	4	$ 24.00
Tags[d]	1	$ 1.06	1	$ 1.06
Total Costs		$37.97		$451.55
HOUSEHOLD ELECTRICAL APPLIANCES				
Training[a]	3	$65.37	82	$1,786.78
Lockout/Tagout				
Execution[b]	6	$ 3.12	24	$ 12.48
Locks[c]	2	$12.00	4	$ 24.00
Tags[d]	1	$ 1.06	1	$ 1.06
Total Costs		$81.55		$1,824.32

[a] OSHA's estimated unit cost is $21.79, based on a weighted average unit cost of all occupational categories.

[b] OSHA's estimated unit cost is $ 0.52.

[c] OSHA's estimated unit cost is $ 6.00.

[d] OSHA's estimated unit cost is $ 1.06.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

The relative costs of small and large firms are driven entirely by assumptions about the number of employees to be trained and the numbers of locks, tags, and executions. Nevertheless, some observations can be made about the potential for economies of scale to impose disproportionately large costs on small firms:

- o A small firm with fewer than three employees to train will have higher training costs per employee than large firms with larger training classes.

- o For lockout/tagout, OSHA estimated a disproportionately large number of executions, locks, and tags for small firms.[35] Even with constant unit cost, this situation will result in disproportionately large impacts on small firms.

- o The number of employees to be trained is critical in determining whether costs will be disproportionately high. A comparison between the two industries shows that assumptions about both the number of employees to be trained in a small firm and the ratio of employees to be trained in large firms to the number of employees to be trained in small firms are critical.

Exhibit B-2 shows the relative costs for large and small establishments in the two industries selected by OSHA. Training costs in small meat packing plants have been adjusted as described above. The results relative to revenue are mixed; because OSHA assumed high training costs for large household electrical appliance manufacturers, compliance costs as a percent of revenue are higher here for large establishments than for small ones. Otherwise, compliance costs as a percent of revenue are higher for

[35] Additional locks and tags in the two industries used for regulatory flexibility analysis violates OSHA's assumption that small manufacturing firms would not need additional locks or tags. This type of sloppiness -- along with the use of an average training cost for a specific industry and sector-wide estimates of several variables -- makes the results for any one industry highly suspect. Imprecision in measuring the degree of disproportionate impacts on small firms, however, does not necessarily mean that the analysis was meaningless, since OSHA's purpose was to determine whether impacts on small firms are insignificantly small. OSHA's finding on this point seems clear.

small establishments than for large ones. Results for compliance cost per employee, however, are unequivocal. Per-employee compliance costs for small establishments are four times as large as for large establishments.

4. Conclusion

The electrical safety-related work practices standard has costs per employee that are four times as high for the smallest manufacturing businesses as for large businesses. Most of this difference in cost per employee stems from inefficiencies of training very small groups of employees. Lockout/tagout costs, while absolutely quite small, are disproportionately much higher -- 20 to 30 times the cost per employee -- for the smallest manufacturing businesses than for large ones.

These results reflect the difference between disproportionate impacts and significant impacts. While the costs for small establishments are disproportionately large, in absolute terms these impacts are minuscule. Thus OSHA was justified in a finding of no significant impact on a substantial number of small entities.

EXHIBIT B-2: COMPLIANCE COSTS BY FIRM SIZE

Industry/Compliance Action	Small Firm	Large Firm
MEAT PACKING		
Training		
Cost per Establishment	$ 31.35[a]	$ 414.01
Cost per Employee	$ 5.37	$ 1.75
Cost as a Percent of Revenue	0.000858 %	0.000225 %
Cost Ratio[b]	3.09	-
Lockout/Tagout		
Cost per Establishment	$ 16.18	$ 37.54
Cost per Employee	$ 2.77	$ 0.16
Cost as a Percent of Revenue	0.000443 %	0.000020 %
Cost Ratio[b]	17.31	-
Total		
Cost per Establishment	$ 47.53	$ 451.55
Cost per Employee	$ 8.14	$ 1.91
Cost as a Percent of Revenue	0.001300 %	0.000245 %
Cost Ratio[b]	4.27	-
HOUSEHOLD ELECTRICAL APPLIANCES		
Training		
Cost per Establishment	$ 65.37	$1,786.78
Cost per Employee	$ 12.37	$ 4.02
Cost as a Percent of Revenue	0.003568 %	0.024030 %

Cost Ratio[b]	3.08	-
Lockout/Tagout		
Cost per Establishment	$ 16.18	$ 37.54
Cost per Employee	$ 3.03	$ 0.08
Cost as a Percent of Revenue	0.000883 %	0.000505 %
Cost Ratio[b]	37.87	-
Total		
Cost per Establishment	$ 81.55	$1,824.32
Cost per Employee	$ 15.26	$ 4.11
Cost as a Percent of Revenue	0.004452 %	0.024535 %
Cost Ratio[b]	3.71	-

[a] Revised estimate, based on training one employee.

[b] Ratio of compliance cost per employee for a small establishment to compliance cost per employee for a large establishment.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

C. OSHA ELECTRIC POWER GENERATION & PROTECTIVE EQUIPMENT RULE

1. Objective and Summary of the Regulation

This standard addresses the work practices used during the operation and maintenance of electric power generation, transmission, and distribution facilities. It includes requirements relating to enclosed spaces, hazardous energy control, working near energized parts, grounding for employee protection, line clearance tree trimming, and work in generating plants. Employees performing operation or maintenance work on electric power installations are exposed to very high voltages and energized parts of the power system. Compliance with the requirements will reduce the number of injuries and fatalities involving electrical contact, flash burns, and thermal burns. OSHA estimated that the regulation would prevent at least 59 fatalities and 323 lost-workday injuries per year.

The final standard includes provisions for electrical protective equipment, CPR training, lockout/tagout, equipment inspections, and live-line maintenance work procedures. Most of benefits are expected to be achieved in electric utilities.

2. Estimated Costs of Compliance With the Regulation

The industries affected by the regulation were identified as utilities, contract power line workers, line-clearance tree trimmers, independent power producers, industrial cogenerators, high voltage customers, and high voltage contractors. The compliance costs of the regulation are broken out by industry in Exhibit C-1. Total compliance costs with the standard were estimated at $40.9 million in the first year and $20.6 million recurring in subsequent years. The first year costs represent initial expenditures for program development and equipment. Recurring costs include refresher training, equipment maintenance, work practice modifications, and inspections. Costs were estimated by calculating current equipment prices, and labor rates and hours necessary to implement safety and training procedures.

The equipment costs include gloves, sleeves, insulating blankets, covers, and line hose used in maintenance and testing of power lines. Training costs stem from the requirement that the "employer train employees to recognize and avoid all of the potential hazards associated with working on electrical lines and equipment." Other costs are related to the provision of first aid kits and CPR training. Costs associated with lockout/tagout, equipment inspections, and live-line maintenance are primarily related to lost productivity through modified work procedures.

3. Effects of the Regulation on Small Establishments

OSHA determined that several regulated industries did not contain small businesses (fewer than 20 employees). These industries include:

- o Industrial cogenerators;
- o High-voltage customers; and
- o High-voltage contractors.

Exhibit C-2 shows costs by establishment size (revenue) of the remaining industries.

EXHIBIT C-1:

TOTAL COMPLIANCE COSTS BY INDUSTRY FOR OSHA REGULATIONS ON

ELECTRIC POWER GENERATION AND ELECTRICAL PROTECTIVE EQUIPMENT

Industry	First Year Costs	Annual Recurring Costs
Utilities	$ 13,743,374	$ 9,754,633
Contract Power Line Workers	$ 1,623,738	$ 1,623,738
Line Clearance Tree Trimmers	$ 4,449,525	$ 1,842,357
Independent Power Producers	$ 4,385,317	$ 1,187,092
Industrial Cogenerators	$ 6,734,578	$ 2,775,258
High-Voltage Customers	$ 9,351,530	$ 2,735,590

High-Voltage Contractors	$ 648,504	$ 648,504
Total	**$ 40,936,566**	**$ 20,567,172**

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

EXHIBIT C-2:

COMPLIANCE COSTS BY ESTABLISHMENT SIZE FOR OSHA REGULATIONS ON ELECTRIC POWER GENERATION AND ELECTRICAL PROTECTIVE EQUIPMENT

Industry/Cost	**Small Size (1 - 19)**	**Large Size (≥ 20)**
ELECTRIC UTILITIES		
Electric Services (SIC 491)		
Initial Costs		
Cost per Establishment	$ 319	$ 8,035
Cost as a Percent of Revenue	0.0046%	0.0085%
Annual Costs[a]		
Cost per Establishment	$ 226	$ 5,698
Cost as a Percent of Revenue	0.0033%	0.0060%
Combination Electric and Other		

Utility Services (SIC 493)		
Initial Costs		
Cost per Establishment	$ 319	$ 8,035
Cost as a Percent of Revenue	0.0188%	0.0449%
Annual Costs[a]		
Cost per Establishment	$ 226	$ 5,698
Cost as a Percent of Revenue	0.0133%	0.0319%
INDEPENDENT POWER PRODUCERS		
Electric Services (SIC 491)		
Initial Costs		
Cost per Establishment	$ 1,591	$12,746
Cost as a Percent of Revenue	0.0228%	0.0135%
Annual Costs[a]		
Cost per Establishment	$ 425	$ 3,401
Cost as a Percent of Revenue	0.0061%	0.0036%
Combination Electric and Other Utility Services (SIC 493)		
Initial Costs		
Cost per Establishment	$ 1,591	$12,746
Cost as a Percent of Revenue	0.0941%	0.0712%
Annual Costs[a]		
Cost per Establishment	$ 425	$ 3,401
Cost as a Percent of Revenue	0.0251%	0.0190%

EXHIBIT C-2: (continued)

COMPLIANCE COSTS BY ESTABLISHMENT SIZE FOR OSHA REGULATIONS ON

ELECTRIC POWER GENERATION AND ELECTRICAL PROTECTIVE EQUIPMENT

Industry/Cost	**Small Size (1 - 19)**	**Large Size (≥ 20)**
CONTRACTOR POWER LINE WORKERS		
Electric Services (SIC 491)		
Initial Costs		
Cost per Establishment	$ 503	$ 8,946
Cost as a Percent of Revenue	0.0072%	0.0095%
Annual Costs[a]		
Cost per Establishment	$ 503	$ 8,946
Cost as a Percent of Revenue	0.0072%	0.0095%
Combination Electric and Other Utility Services (SIC 493)		
Initial Costs		
Cost per Establishment	$ 503	$ 8,946
Cost as a Percent of Revenue	0.0297%	0.0500%
Annual Costs[a]		
Cost per Establishment	$ 503	$ 8,946
Cost as a Percent of Revenue	0.0297%	0.0500%
LARGE LINE-CLEARANCE TREE TRIMMERES		
Shrub and Tree Services (SIC 0783)		
Initial Costs		
Cost per Establishment	$ 688	$58,955
Cost as a percent of Revenue	0.5532%	1.1407%
Annual Costs[a]		
Cost per Establishment	$ 285	$24,411
Cost as a percent of Revenue	0.2290%	0.4723%

[a] Annual costs are estimated by multiplying initial costs by the industry-wide ratio of annual costs to total costs, based on Exhibit C-1.

Electric Utilities. For electric utilities, average initial compliance costs for small establishments are about 4 percent of average initial compliance costs for large establishments. Annual compliance costs are 70 percent of initial compliance costs. Compliance cost ratios[36] are:

- o 0.55 for Electric Services and
- o 0.42 for Combination Electric and Other Utility Services.

Independent Power Producers. For independent power producers, average initial compliance costs for small establishments are about 12 percent of average initial compliance costs for large establishments. Annual compliance costs are just over one quarter (27 percent) of initial compliance costs. Compliance cost ratios are:

- o 1.69 for Electric Services and
- o 1.32 for Combination Electric and Other Utility Services.

The relatively high ratio of small-business initial costs to large-business initial costs, together with the relatively small ratio of annual costs to initial costs, suggest that independent power producers need a relatively large amount of investment in equipment to comply with the regulations. This is consistent with economies of scale that could cause the high compliance cost ratios found in this industry.

Contractor Power Line Workers. For contractor power line workers, average initial compliance costs for small establishments are about 5 percent of average initial compliance costs for large establishments. Annual compliance costs are equal to initial compliance costs. Compliance cost ratios are:

- o 0.76 for Electric Services and
- o 0.59 for Combination Electric and Other Utility Services.

Line-Clearance Tree Trimming. For tree trimming for line clearance, average initial compliance costs for small establishments are only about one percent of average initial compliance costs for large establishments. Annual compliance costs are less than half (41 percent) of initial compliance costs. Provision of first aid kits to employees, a cost that is directly related to the number of employees, is a major element in compliance costs for small businesses. The compliance cost ratio is 0.48.

4. Conclusion

---

[36] Defined as the ratio of compliance cost per dollar of revenue for small firms to compliance cost per dollar of revenue for large firms.

This rule does not disproportionately impact small businesses. Most of the equipment costs appear directly proportional to the number of employees. Training and planning requirements, which are usually subject to moderate scale economies, seem to be more informal than in other cases. It is not clear, however, why the costs for small businesses are disproportionately low.

D. OSHA CONTROL OF HAZARDOUS ENERGY SOURCES (LOCKOUT/TAGOUT) STANDARDS

1. Objective and Summary of the Regulation

This standard addresses practices and procedures that are necessary to disable machinery or equipment and to prevent the release of potentially hazardous energy while maintenance and servicing activities are being performed. Its purpose is to prevent the unexpected energization or start-up of machines, and the release of hazardous energy. The standard requires that lockout be used for equipment that is designed with a lockout capability unless the employer can demonstrate that utilization of tagout provides full employee protection. Lockout refers to the placing of a lock on an energy-isolating device, such that it cannot be operated until the lock is removed. Tagout refers to the placing of a prominent warning device such as a tag on an energy-isolating device to indicate that the equipment may not be operated until the tag is removed. Energy-isolating devices are circuit breakers, disconnect switches, slide gates, and other devices used to block and isolate energy.

The implementation of the standard involves several steps: (1) The purchase of locks and tags; (2) Modification of equipment such that it will accept locks and tags; (3) Planning of appropriate procedures and training of employees in these procedures; and (4) Modification of work practices to include lockout and tagout. OSHA predicted that compliance with the standard would create a safer working environment for employees dealing with hazardous energy sources. OSHA estimated that compliance would prevent 85 percent of those accidents identified as caused by inadequate or nonexistent lockout or tagout procedures. Based on this assumption, OSHA estimated that the standard would have prevented 122 fatalities and approximately 60,000 injuries in 1984.

2. Estimated Costs of Compliance With the Regulation

Exhibit D-1 provides the OSHA estimates of compliance costs for the standard broken out into five major categories (locks, tags and other items; equipment modifications; work practice modifications; planning and implementation; and training.) The costs given are for those firms deemed to be in "high impact" industries. High-impact industries are those in which a large number of maintenance operations involving energy sources are performed annually. OSHA estimated that the average maintenance worker in a high impact industry performs 75 scheduled maintenance operations involving energy sources annually in small, medium, and large establishments and 36 scheduled maintenance operations in very small establishments. In low-impact industries, only six such scheduled maintenance operations are performed. The five largest high-impact industries are machinery, transportation equipment, electrical power, paper, and metal fabrication. Total first year compliance costs associated with the lockout/tagout standard in high impact sectors are estimated to be $183.5 million. After the first year, which includes one time costs for equipment modifications, planning, and initial training, costs were estimated to be $123.1 million annually. Total first year costs in low impact sectors were estimated to be $24.6 million, with annual recurring costs of $9.0 million.

The largest compliance costs ($65.55 million) are associated with the work practice modifications necessitated by the standard. These costs, incurred through lost productivity and time spent locking and unlocking relevant equipment, are expected to cost the same in the first year as in subsequent years. In the first year, work practice modifications represent 35 percent of the total compliance cost, with that percentage rising to 54 percent annually after the first year. The costs of the actual hardware (locks, tags, chains, etc.) necessary to comply with the standard were estimated to be only $8.58 million in the first year and $4.32 million in recurring costs. As estimated, the hardware costs comprise less than 5 percent of total compliance costs in high impact industries.

The cost estimates were also provided on a per employee basis. Total first year compliance costs with the standard were estimated to cost $120.17 per employee across all sizes of establishments. Recurring costs were estimated at $80.62 per employee. Cost differentials across size categories are shown in Exhibit A and are discussed below.

The analysis of compliance costs and their importance requires considering their size in relation to operating costs and profits. For this issue, OSHA relied on estimates provided by Eastern Research Group, detailing average operating costs and net incomes for establishments in the manufacturing sector across size classes. The weighted average across size classes of firms shows that first year costs of compliance with the standard ($791 per establishment) represent 0.038 percent of operating costs and 1.49 percent of net income on average. Recurring costs ($530 per establishment) were estimated to average 0.025 percent of operating costs and 1.001 percent of net income. OSHA concluded that these costs would not impose a significant cost burden on firms. This argument is bolstered by the fact that, in the high impact areas, 108,474 firms are already in compliance with the standard, and are competing with the 231,977 not in compliance for which the costs are calculated.

3. Effects of the Regulation on Small Establishments

The compliance cost estimates shown in Exhibit A are broken out by size class of establishment. The categories are: Very Small (1-19 employees), Small (20-99 employees), Medium (100-249 employees), and Large (250 or more employees). OSHA estimates of compliance cost per employee are very similar for Small, Medium, and Large establishments and are lower for Very Small establishments. Very small establishments were estimated to have first year compliance costs of $89.26 per employee and annual costs of $57.95 per employee in subsequent years. The per employee costs have the narrow ranges of $123 - $127 for the first year and $84 - $86 in subsequent years for the other size classes.

OSHA estimates indicate that compliance costs are not disproportionately borne by small establishments on a per employee basis. The methodology of calculating costs explains why very small firms show lower costs. OSHA's assumption is that maintenance workers in small, medium, and large establishments perform an average of 75 scheduled maintenance operations per year that involve energy sources. Maintenance workers in very small establishments are assumed to perform only 36 such operations annually. This assumption drives the results. Most costs of the standard (55 percent of recurring costs) are imposed by work practice modifications, rather than by capital expenditures. These costs are wholly dependent upon the number of maintenance operations performed, a function of productivity. There do not seem to be economies of scale in compliance; thus it is probably fair to assume that (aside from the number of scheduled maintenance operations per maintenance worker) per employee compliance costs do not change much with establishment size.

EXHIBIT D-1: COMPLIANCE COSTS OF THE LOCKOUT/TAGOUT STANDARD

	Very Small	Small	Medium	Large	Total
Number of Establishments	176,382	46,513	7,758	1,324	231,977
Number of Employees	236,400	633,000	354,600	303,000	1,527,000
Locks, Tags, and Other Items					
First Year Costs					
Total ($ millions)	$1.4	$5.8	$3.2	$2.8	$13.1
Per Employee ($)	$9.92	$9.16	$9.02	$9.24	$ 8.58
Recurring Costs					
Total ($ millions)	$0.6	$2.9	$1.7	$1.4	$ 6.6
Per Employee ($)	$2.54	$4.58	$4.79	$4.79	$ 4.62
Equipment Modifications					
First Year Costs					
Total ($ millions)	$0.0	$14.0	$7.0	$6.0	$27.0
Per Employee ($)	$0.00	$22.12	$19.74	$19.80	$17.68
Recurring Costs					
Total ($ millions)	$0.0	$0.0	$0.0	$0.0	$ 0.0
Per Employee ($)	$0.00	$0.00	$0.00	$0.00	$ 0.00
Work Practice Modifications					
First Year Costs					
Total ($ millions)	$11.5	$42.4	$24.3	$21.9	$101.1
Per Employee ($)	$48.65	$66.98	$68.53	$72.28	$65.55
Recurring Costs					
Total ($ millions)	$11.5	$42.4	$24.3	$21.9	$101.1
Per Employee ($)	$48.65	$66.98	$68.53	$72.28	$65.55
Planning and Implementation					
First Year Costs					
Total ($ millions)	$5.9	$10.3	$5.0	$2.7	$23.9
Per Employee ($)	$24.96	$16.27	$14.10	$8.91	$15.65
Recurring Costs					

Total ($ millions)	$1.3	$6.9	$3.5	$2.3	$14.0
Per Employee ($)	$5.50	$10.90	$9.87	$7.59	$ 9.17
Training					
First Year Costs					
Total ($ millions)	$2.4	$8.3	$4.6	$4.0	$19.3
Per Employee ($)	$10.15	$13.11	$12.97	$13.20	$12.64
Recurring Costs					
Total ($ millions)	$0.3	$1.0	$0.6	$0.5	$ 2.3
Per Employee ($)	$1.27	$1.58	$1.69	$1.65	$1.51

EXHIBIT D-1: COMPLIANCE COSTS OF THE LOCKOUT/TAGOUT STANDARD (Continued)

	Very Small	Small	Medium	Large	Total
Total Costs					
First Year Costs					
Total ($ millions)	$21.1	$80.8	$44.2	$37.3	$183.5
Per Employee ($)	$89.26	$127.65	$124.65	$123.10	$120.17
Recurring Costs					
Total ($ millions)	$13.7	$53.2	$30.0	$26.1	$123.1
Per Employee ($)	$57.95	$84.04	$84.60	$86.14	$80.62
Compliance Cost Ratios					
First Year Costs	0.72	1.04	1.01	-	
Recurring Costs	0.67	0.98	0.98	-	

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

Differential impacts across size classes are also shown in the calculation of compliance costs as percentages of operating costs. The data show that first year compliance costs as a percentage of operating costs are 0.028 percent for very small firms, 0.047 percent for small firms, 0.038 percent for medium firms, and 0.032 percent for large firms. The recurring costs are scaled similarly across size classes. Again, the assumption of fewer maintenance operations at very small firms causes them to have lower costs. Compliance costs are highest as a percent of operating costs for small establishments and decrease for medium and large establishments.

4. Conclusion

Lockout/tagout compliance costs are roughly proportional to employment except for the smallest businesses, which incur only about two thirds the cost per employee as larger establishments. These results, however, are driven principally about assumptions on the number of maintenance operations performed in each size establishment. Any results, therefore, are rather tenuous.

E. OSHA PERMIT-REQUIRED CONFINED SPACES STANDARD

1. Objective and Summary of the Regulation

Many workplaces contain spaces which are considered "confined" because their configurations hinder the activities of any employees who must enter, work in, and exit them. Employees who work in confined spaces often face increased risk of exposure to serious hazards. In some cases, confinement itself poses entrapment hazards. In other cases, confined space work keeps employees closer to hazards, such as asphyxiating atmospheres or the moving parts of a mixer, than they would be otherwise. OSHA defines a "permit-required confined space" as a space which meets the definition of a confined space and poses health or safety hazards.

This regulation is intended to reduce the risk attendant to entering permit required confined spaces (permit spaces). It requires that an employer assess the workplace to determine the existence of any permit spaces. Spaces that are found can be classified as "tested and ventilated" or as "full permit-required." Periodic testing is required to monitor the condition of the atmosphere within the space.

For a space to be classified as tested and ventilated, an employer must demonstrate through atmospheric testing that mechanical ventilation and/or respiratory protection for employees is sufficient to render the space safe for working. The employer must train employees who are to work in the space as to the proper safety procedures and must inform non-entrants of the hazards. Also, the employer must post signs explaining the dangers of the space.

Full permit-required spaces are those which contain a hazardous environment not eliminated by ventilation. For these spaces, an employer must provide mechanical ventilation, respiratory protection, training, and notification procedures, just as with tested and ventilated spaces. Additionally, the employer must provide retrieval devices, rescue teams, and attendants for employees working in the spaces. Permits must be issued in order to authorize work within the spaces.

2. Estimated Costs of Compliance With the Regulation

OSHA estimated the costs of compliance with the regulation by combining industry process information, data on current compliance rates, unit costs for required equipment, and hourly labor rates. OSHA's estimate of the total cost of compliance with the standard across all industries was $202.4 million. The largest components of that cost are found to be atmospheric testing ($46.6 million), respiratory protection ($38.6 million), and the provision of attendants for full permit-required spaces ($37.3 million). Exhibit E-1 shows total costs by provision.

Some of the costs of compliance were estimated on a per-establishment or a per-space basis. Such costs include:

- o Establishment of an entry permit system;
- o Provision of training for employees; and
- o Provision of appropriate equipment to meet the hazards of particular spaces.

These costs will be incurred regardless of the frequency of entry into spaces at an establishment. Because of their "fixed cost" nature, these costs are potentially more expensive per employee for small establishments than for large establishments.

Provisions of the standard that can be calculated on a per-entry basis include:

- o Administering the permit;
- o Performance of safety procedures such as testing, ventilation, and isolation techniques prior to and/or during entry;
- o Provision of an attendant when required; and

- o Replacement of consumable inputs (e.g. dust masks), depending on their use (number of entries).

These costs are likely to vary on a per-employee or per-revenue basis, because the number of entries into a permit space is also likely to be proportional to the number of employees or production.

The costs most likely to impact small establishments more than large establishments are those requiring large capital expenditures or those characterized by significant economies of scale. The components of the permit space standard most likely to meet these criteria are the purchase of atmospheric testing and mechanical ventilation equipment. Training and notification of employees also can be subject to economies of scale.

OSHA identified 34 industry groups (2-digit SIC code) which it felt would be affected by the standard. OSHA calculated compliance costs per provision per industry group. The highest estimated costs were found in utilities (SIC 49) where they were estimated at $72.6 million annually. This is due to a large number of permit space entries and a large number of establishments not in compliance with the standard. Costs were also found to be particularly high in water (SIC 494) and sewage (SIC 495) utilities. Other affected industries with relatively high compliance costs included wholesale trade/nondurable with annual costs of $15.8 million, fabricated metal products with annual costs of $13.5 million, and electric/electronic equipment with annual costs of $13.4 million.

EXHIBIT E-1

PERMIT-REQUIRED CONFINED SPACES STANDARD

SUMMARY OF ANNUAL COMPLIANCE COSTS, BY PROVISION

Cost Provision	Annual Compliance ($ 1,000s)
Establish Permit Entry Program/System	$ 10,955
Training	$ 9,204
Inform Non-Entrants	$ 7,968

Isolation Procedures	$ 1,753
Mechanical Ventilation	$ 27,541
Respiratory Protection	$ 38,616
Atmospheric Testing	$ 46,573
Vehicle / Pedestrian Barriers	$ 128
Attendant	$ 37,285
Retrieval Devices	$ 3,185
Permit Issuance	$ 17,800
Rescue Teams	$ 1,360
Total	**$202,370**

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

3. Effects of the Regulation on Small Establishments

In the Regulatory Flexibility Analysis, OSHA defined small establishments as those with fewer than 20 employees. For the 34 affected industries, OSHA provided the number of small and large establishments, total compliance costs, and average revenue and profit per establishment. Compliance cost per establishment and compliance cost as a percent of revenue and profit were calculated from these data. For most of the industries, compliance costs are relatively insignificant compared to both revenues and profits. The focus of the analysis was on the 12 industries in which cost for small establishments is greater than 0.02 percent of revenue or greater than 0.50 percent of profit. Exhibit E-2 shows estimated costs by establishment size in these industries.

Exhibit E-2 shows the number of establishments and OSHA estimates of costs per establishment. Data on establishment size from County Business Patterns were used to calculate the average number of employees per small and large establishment for each industry group. Compliance costs per employee were then calculated from these figures and the compliance cost estimates.

Compliance costs per employee at small establishments range from a low of $30 in Hotels and Other Lodging (SIC 70) to a high of $316 in Private Utilities (SIC 49). The average compliance cost per employee in the twelve selected industries is $116. For large establishments, compliance costs range from a low of $2 per employee in Hotels and Other Lodging (SIC 70) and Wood Products Except Furniture (SIC 24) to a high of $57 per employee in Agricultural Services (SIC 07). Compliance costs were estimated to be $25 per employee for large establishments in private utilities. Across the twelve industries, compliance costs per employee at large establishments average $13.5 per employee.

The disproportionate effect of the regulation on small establishments can best be seen in the ratio of the small-establishment cost per employee to the large-establishment cost per employee. For the twelve industries this compliance cost ratio ranges from 2.73 to 34.63 and averages 8.59. On average, therefore, small establishments bear compliance costs per employee eight and a half times as large as those borne by large establishments. Large establishments pay more for compliance than small establishments, but the costs increase far more slowly than employment.

4. Conclusion

The permit-required confined spaces standard imposes disproportionately large costs on small businesses. The most likely reasons for the cost differentials evidenced in the statistics -- per-employee costs for small businesses averaging 8.6 times per-employee costs for large establishments -- are high fixed costs involved in equipment purchase. As stated above, the largest component of the estimated compliance cost is atmospheric testing. Testing requires expensive monitoring equipment. The equipment can be used to monitor multiple spaces, since monitoring occurs at periodic time intervals, rather than continuously. Thus it is cost-effective for firms to use the equipment to monitor several confined spaces, providing a significant economy of scale. Large equipment purchases for ventilation are probably also important factors in the disproportionate costs, and respiratory protection and economies of scale in paperwork are also subject to some degree of economies of scale.

EXHIBIT E-2

PERMIT-REQUIRED CONFINED SPACES STANDARD

ANNUAL COMPLIANCE COSTS, BY SIZE OF ESTABLISHMENT

Industry/Cost	Small Establishments (1 - 19 Employees)	Large Establishments (20 or More Employees)
Agricultural Services		
Number of Establishments	10,349	515
Average Employees	3.6	54.4
Average Cost	$ 607	$ 3,102
Cost per Employee	$ 169	$ 57
Cost as a % of Revenue	0.34%	0.064%
Compliance Cost Ratio[a]	2.96	-
Food and Kindred Products		
Number of Establishments	5,294	4,942
Average Employees	6.8	130.3
Average Cost	$ 843	$ 1,621
Cost per Employee	$ 124	$ 12
Cost as a % of Revenue	0.03%	0.003%
Compliance Cost Ratio[a]	9.97	-
Wood Products Except Furniture		
Number of Establishments	5,813	4,477
Average Employees	5.4	75.4
Average Cost	$ 175	$ 161
Cost per Employee	$ 33	$ 2
Cost as a % of Revenue	0.03%	0.002%
Compliance Cost Ratio[a]	15.20	-
Rubber Products		
Number of Establishments	2,849	3,434
Average Employees	6.8	108.7
Average Cost	$ 725	$ 1,410
Cost per Employee	$ 107	$ 13
Cost as a % of Revenue	0.04%	0.010%
Compliance Cost Ratio[a]	8.22	-
Stone, Clay, Glass & Cement		
Number of Establishments	8,464	3,826
Average Employees	6.6	95.6
Average Cost	$ 800	$ 1,407
Cost per Employee	$ 121	$ 15
Cost as a % of Revenue	0.06%	0.010%

Compliance Cost Ratio[a]	8.23	-

EXHIBIT E-2 (continued)

PERMIT-REQUIRED CONFINED SPACES STANDARD

ANNUAL COMPLIANCE COSTS, BY SIZE OF ESTABLISHMENT

Industry/Cost	Small Establishments (1 - 19 Employees)	Large Establishments (20 or More Employees)
Fabricated Metal Products		
Number of Establishments	4,852	3,589
Average Employees	7.3	97.1
Average Cost	$ 604	$ 2,942
Cost per Employee	$ 83	$ 30
Cost as a % of Revenue	0.05%	0.030%
Compliance Cost Ratio[a]	2.73	-
Electric/Electronic Equipment		
Number of Establishments	3,115	3,498
Average Employees	6.3	243.9
Average Cost	$ 1,902	$ 2,126
Cost per Employee	$ 302	$ 9
Cost as a % of Revenue	0.10%	0.007%
Compliance Cost Ratio[a]	34.63	-
Miscellaneous Manufacturing		
Number of Establishments	336	550
Average Employees	5.4	86.3
Average Cost	$ 1,017	$ 1,556
Cost per Employee	$ 188	$ 18
Cost as a % of Revenue	0.17%	0.011%
Compliance Cost Ratio[a]	10.44	-
Motor Freight Transport		
Number of Establishments	10,937	3,646
Average Employees	6.0	63.7
Average Cost	$ 839	$ 1,038
Cost per Employee	$ 140	$ 16
Cost as a % of Revenue	0.12%	0.011%
Compliance Cost Ratio[a]	8.58	-
Private Utilities		
Number of Establishments	2,898	2,137
Average Employees	5.6	138.8
Average Cost	$ 1,769	$ 3,407

Industry/Cost	Small Establishments (1 - 19 Employees)	Large Establishments (20 or More Employees)
Cost per Employee	$ 316	$ 25
Cost as a % of Revenue	0.09%	0.006%
Compliance Cost Ratio[a]	12.87	-

EXHIBIT E-2 (continued)

PERMIT-REQUIRED CONFINED SPACES STANDARD

ANNUAL COMPLIANCE COSTS, BY SIZE OF ESTABLISHMENT

Industry/Cost	Small Establishments (1 - 19 Employees)	Large Establishments (20 or More Employees)
Wholesale Trade/Nondurable		
Number of Establishments	33,360	3,553
Average Employees	5.4	55.5
Average Cost	$ 407	$ 627
Cost per Employee	$ 75	$ 11
Cost as a % of Revenue	0.01%	0.001%
Compliance Cost Ratio[a]	6.66	-
Hotels and Other Lodging		
Number of Establishments	2,995	2,105
Average Employees	4.2	102.8
Average Cost	$ 126	$ 213
Cost per Employee	$ 30	$ 2
Cost as a % of Revenue	0.03%	0.003%
Compliance Cost Ratio[a]	14.50	-
Total / Weighted Average		
Number of Establishments	91,262	36,269
Average Employees	5.5	108.5
Average Cost	$ 636	$ 1,465
Cost per Employee	$ 116	$ 13
Cost as a % of Revenue	N.A.	N.A.
Compliance Cost Ratio[a]	8.59	-

[a] Ratio of cost per employee for small establishments to cost per employee for large establishments.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

F. OSHA STANDARD FOR PERSONAL PROTECTION EQUIPMENT FOR GENERAL INDUSTRY

1. Objective and Summary of the Regulation

The final rule for personal protection equipment (PPE) was a revision of the general industry safety standards for PPE. The standards being revised included those containing general requirements for PPE and specific standards for design and use of eye, face, head, foot, and hand PPE. OSHA determined that many of the existing PPE standards were outdated, since they reflected knowledge and practices regarding PPE as they existed in the early 1970s. Additionally, the original requirements did not provide for adequate employee training.

Workers involved in a wide range of occupations are exposed to significant risk of death or injury from being struck by objects in the workplace. A significant portion of all work-related injuries and fatalities involve workers being struck in the eyes, head, and face. OSHA estimated that as many as 2,500 eye injuries occurred in the workplace every day, and OSHA believes that employers and employees need guidance regarding the selection of protective equipment to limit these injuries.

The original PPE standard required that "personal protective equipment of safe design and construction be provided and maintained by employers in order to protect employees from workplace hazards." It also required that, when employees provide their own equipment, the employers "assure its adequacy." Both of these requirements remained in the new standard.

The new revisions required that employers assess workplace hazards, communicate any risks to the employees, and select PPE based on the assessment. They also required employee training in the usage and limitations of PPE. Finally, the revisions reduced many specific design requirements for PPE, so as to increase the options for equipment advancements and improvement. The revisions did increase the eye protection standards, however, requiring side eye protection as well as front protection. OSHA believed that these hazard assessment, training, and design revisions to the PPE standards would prevent 712,000 lost workdays and four fatalities per year.

2. Estimated Costs of Compliance With the Regulation

OSHA identified the individual cost elements of the revised PPE standard. The basic requirement that workers be provided with PPE where necessary by reason of the hazard (1910.132(a)) was common to both the existing standard and the standard. Four other requirements were new:

- o Selection of PPE based upon an assessment of the hazards likely to be encountered (1910.132(d));

- o Cleaning and disinfection of PPE before re-issuing (1910.132(f));

- o Training of employees in the proper use of their PPE (1910.132(g)); and

- o Side eye protection, as well as front protection, from flying objects (1910.132(l)).

OSHA divided costs of these actions into:

- o Equipment costs, including:
  - Purchase of PPE,
  - Equipment and supplies necessary to maintain and sterilize PPE; and

- o Labor costs, including:
  - Hazard assessment,
  - Employee training, and
  - Maintaining and cleaning PPE.

OSHA estimated unit costs of all equipment and the loaded wage costs of the types of labor involved. Annualized equipment costs were also estimated, depending on the useful life of the equipment. Based on these unit costs, OSHA estimated the unit compliance cost of each provision, including (where appropriate) different costs for the initial year and subsequent years. Exhibit F-1 summarizes these unit costs.

For eight principal industry sectors, OSHA estimated the number of at-risk employees and the percent of these employees who should wear each type of PPE (see Exhibit F-2). OSHA also estimated, by industry sector and establishment size class, at-risk employees and percentages of establishments that were not already in compliance with the new size class. These estimates provided the basis for estimation of compliance costs per establishment.

3. Effects of the Regulation on Small Establishments

Although the total costs annual of the PPE standard are relatively small, most of the activities are subject to economies of scale that result in a disproportionate burden on small businesses. This cost differential is reflected in Exhibit F-1.

- o For hazard assessment, the estimated effort increases, but not proportionally, with establishment size. Despite the mitigating effects of a flexible performance standard, OSHA estimated that this activity would require:
  - One hour for an establishment with fewer than 10 employees,
  - Four hours for an establishment with 10 to 99 employees,
  - Ten hours for an establishment with 100 to 499 employees, and
  - Fourty hours for an establishment with 500 or more employees.

- o For cleaning and disinfecting reissued PPE, OSHA estimated costs for two processes -- one suitable for low volumes (10 items per year) and the other suitable for high volumes (500 items per year). The low-volume process has a unit cost that is 2.77 times as high as the high-volume process.

- Employee training involves a trainer and employees. One trainer is required per session, but the number of employees can vary. In OSHA's estimates:
  - Initial training sessions involve 20 employees at a cost per employee of $3.19, but
  - Recurring training sessions (of the same length) involve five employees and have a cost per employee of $3.97 -- 24 percent higher.

  To the extent that a small establishment has fewer employees to train than the optimum class size, training costs will be correspondingly higher.

EXHIBIT F-1

UNIT COMPLIANCE COSTS FOR THE PPE STANDARD

Provision	**Cost Basis**	**Unit Cost**
Hazard Assessment		
Very Small Establishment[a]	Establishment	$ 20.80
Small Establishment[a]	Establishment	$ 83.20
Medium Establishment[a]	Establishment	$208.00
Large Establishment[a]	Establishment	$832.00
Cleaning/Disinfecting Reissued PPE		
Manual Wash/Rinse[b]	Item	$ 1.55
Disinfecting Cabinet[b]	Item	$ 0.56
Employee Training		
First-Year Costs	Session[c]	$ 63.70
Annual Recurring Costs	Session[c]	$ 19.83
Side Shield Protection	Unit	$ 0.75

---

[a] Establishment sizes are as follows:
Very Small: Fewer than 10 employees
Small: 10 to 99 employees
Medium: 100 to 499 employees
Large: 500 or more employees

[b] Alternative methods of disinfecting reissued PPEs are appropriate for different scales of operation, as follows:
Manual Wash/Rinse assumes 10 items per year.
Disinfecting Cabinet assumes 500 items per year.

[c] Different training is assumed to have sessions of different sizes:
First-year training involves one trainer and 20 employees.

Annual recurring training involves one trainer and 5 employees.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

EXHIBIT F-2

IMPACTS OF PPE STANDARD BY INDUSTRY SECTOR

Industry Sector	Establishments	At-Risk Employment	Annualized Compliance Cost ($ 000s)	Compliance Cost per Estab.
Landscape/Horticultural Services, Forestry, and Fisheries	34,700	390,800	$ 2,550	$ 15.51
Oil & Gas Extraction	25,000	242,500	$ 1,930	$ 76.90
Manufacturing	357,900	12,415,900	$ 52,740	$151.26
Transportation, Communication & Utilities	203,300	2,667,100	$ 9,890	$ 66.58
Wholesale Trade	438,100	1,692,600	$ 10,420	$ 24.08
Retail Trade	1,406,800	2,012,200	$ 5,980	$ 4.28
Finance, Insurance & Real Estate	487,800	321,400	$ 1,340	$ 2.07
Services	1,711,800	2,247,800	$ 8,680	$ 4.41
TOTAL	4,665,400	21,990,300	$ 93,580	$ 20.06

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

Exhibit F-3 shows cost per establishment and cost per employee for different industry sectors. For small businesses, costs per employee are estimated to be:

- o $5.20 to $5.40 in the agriculture and extractive sectors;
- o $3.75 in the manufacturing and transportation sectors;
- o $2.55 in wholesale trade; and
- o $ .20 to $ .40 in the retail trade, services, and finance sectors.

While these costs are quite modest, they are nevertheless disproportionately high. Compared with the largest establishment size class (for which data are available), costs per employee for small establishments are:

- o 1.2 to 1.4 times as high in the finance and services sectors;
- o 2.25 to 2.4 times as high in the wholsale and retail trade sectors;
- o 1.65 to 1.7 times as high in the manufacturing and extractive sectors;
- o 2.9 times as high in the transportation sector; and
- o 4 times as high in the agricultural sector.

4. Conclusion

Compliance costs for small businesses are disproportionately high, although only moderately so. The cost differential is attributable to the relatively fixed cost of hazard assessment and higher unit costs of a low-volume cleaning and disinfecting process. Training costs are probably also subject to economies of scale, although this is not adequately considered in OSHA's analysis.

EXHIBIT F-3
COMPLIANCE COSTS OF THE PPE STANDARD BY ESTABLISHMENT SIZE

	Size Class (Number of Employees			
Industry Sector	**< 10**	**10 to 99**	**100 to 499**	**≥ 500**
Landscape/Horticultural Services,				

Forestry, and Fisheries				
Cost per Establishment	$ 11.81	$ 33.09	$181.54	$3,336.69
Cost per Employee[a]	$ 5.20	$ 1.47	$ 1.31	N.A.
Cost Ratio[b]	3.97[c]	1.22[c]	-[c]	-
Oil & Gas Extraction				
Cost per Establishment	$ 15.03	$114.50	$726.09	$3,070.74
Cost per Employee[a]	$ 5.39	$ 4.21	$ 3.82	$ 3.26
Cost Ratio[b]	1.65	1.29	1.17	-

EXHIBIT F-3

COMPLIANCE COSTS OF THE PPE STANDARD BY ESTABLISHMENT SIZE (continued)

	Size Class (Number of Employees			
Industry Sector	**< 10**	**10 to 99**	**100 to 499**	**≥ 500**
Manufacturing				
Cost per Establishment	$ 13.27	$ 97.47	$550.95	$2,767.23
Cost per Employee[a]	$ 3.72	$ 3.04	$ 2.70	$ 2.19
Cost Ratio[b]	1.70	1.39	1.23	-
Transportation, Communication and Utilities				
Cost per Establishment	$ 11.59	$ 84.04	$550.34	$1,793.12
Cost per Employee[a]	$ 3.74	$ 2.94	$ 2.88	$ 1.28
Cost Ratio[b]	2.92	2.30	2.25	-
Wholesale Trade				
Cost per Establishment	$ 8.80	$ 46.01	$246.82	$ 992.93
Cost per Employee[a]	$ 2.54	$ 1.87	$ 1.37	$ 1.12
Cost Ratio[b]	2.27	1.67	1.22	-
Retail Trade				
Cost per Establishment	$ 1.37	$ 9.12	$ 57.12	$ 136.10
Cost per Employee[a]	$ 0.38	$ 0.36	$ 0.35	$ 0.16
Cost Ratio[b]	2.38	2.25	2.19	-
Finance, Insurance & Real Estate				
Cost per Establishment	$ 0.63	$ 4.28	$ 27.08	N.A.
Cost per Employee[a]	$ 0.22	$ 0.17	$ 0.14	N.A.
Cost Ratio[b]	1.57[c]	1.21[c]	-[c]	-
Services				
Cost per Establishment	$ 1.20	$ 8.86	$ 60.69	N.A.
Cost per Employee[a]	$ 0.39	$ 0.35	$ 0.32	N.A.
Cost Ratio[b]	1.22[c]	1.09[c]	-[c]	-

[a] Based on employment data from Department of Commerce, County Business Patterns, 1989.

[b] Ratio of cost per employee for very small firms to cost per employee for large establishments.

[c] Calculated relative to establishments with 100 to 499 employees, since data for establishments with 500 or more employees are not available.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

G. OSHA STANDARD FOR PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS

1. Objective and Summary of the Regulation

This standard contains requirements for the management of hazards associated with processes using highly hazardous chemicals. It established procedures for process safety management (PSM) designed to protect employees by preventing or minimizing the consequences of chemical accidents. Releases of toxic, reactive, or flammable liquids and gases in chemical processes have been reported for many years. Compliance with the standard is expected to protect employees, the public, and the environment.

For the eight year period 1983-1990, OSHA estimated that the PSM standard would prevent an average of 330 fatalities and 1,918 injuries/illnesses annually. The standard requires employers to develop a written plan of action detailing toxicity information, permissible exposure limits, reactivity data, corrosivity data, thermal and chemical stability, and hazardous effects of mixing different materials. It also requires training of employees in proper safety techniques and changing of processes to reduce exposure and the potential for accidents. Hazard analyses and quantitative risk evaluations are to be used to evaluate alternative methods for reducing risk in process design and plant operations.

The standard was expected to produce financial benefits for industry, as well as reducing risk of hazardous accidents. These benefits stem from efficiency and productivity improvements, reduced worker turnover, reduced costs of lost production, and reduced property damage.

2. Estimated Costs of Compliance With the Regulation

OSHA estimated average annual compliance costs for two time frames: The first five years of the standard and the second five years (or subsequent years) of the standard. Estimated average annual costs were $888.7 million for the first five years and $405.8 million thereafter. These costs, and their constituent elements, are shown in Exhibit G-1.

OSHA estimated the costs by calculating the number of affected processes, and estimating the necessary capital expenditures and labor costs to bring those processes into compliance for model plants. The second five years include all ongoing costs (with averages, rather than amortization, used for any cost that is incurred less often than yearly). The first five years include all of these ongoing costs plus initial (or start-up) costs -- both capital investment and one-time labor effort -- spread over five years. These initial costs consist of process safety information, process hazard analysis (although subsequent years also have process hazard analysis costs of about one eighth of the initial level), and incident investigation (although subsequent years also have incident investigation costs of about one third of the initial level). A majority of compliance costs in all years fall into one of two categories:

EXHIBIT G-1:

ANNUALIZED COMPLIANCE COSTS OF THE PSM STANDARD, BY PROVISION
($ Millions)

Provision	Years 1 - 5	Years 6 - 10
(c) Employee Participation	$ 0.3	$ 0.3
(d) Process Safety Information		
(d)(2) Process Technology	$ 12.2	$ 0.0
(d)(3) Process Equipment	$ 17.7	$ 0.0
Subtotal for (d)	$ 29.9	$ 0.0
(e) Process Hazard Analysis		
Labor	$105.7	$ 54.8
Capital	$365.1	$ 3.7
Subtotal for (e)	$470.8	$ 58.5
(g) Training		
(g)(1) Initial Training	$ 10.9	$ 10.9
(g)(2) Refresher Training	$ 19.1	$ 19.1
(g)(3) Training Documentation	$ 6.6	$ 6.6
Subtotal for (g)	$ 36.6	$ 36.6
(h) Contractors	$ 6.0	$ 6.0
(i) Pre-Startup Safety Review	$ 5.5	$ 5.5
(j) Mechanical Integrity		
(j)(3) Training	$ 5.4	$ 5.4
(j)(4) Inspection and Testing	$ 9.5	$ 9.5
(j)(5) Quality Assurance	$ 33.4	$ 33.4
Subtotal for (j)	$ 48.3	$ 48.3
(k) Hot Work Permit	$ 3.8	$ 3.8
(l) Management of Change	$179.1	$179.1
(m) Incident Investigation	$ 60.9	$ 20.1
(n) Energy Planning and Response	$ 3.2	$ 3.2
(o) Compliance Safety Audit	$ 15.7	$ 15.7
TOTAL	$888.7	$405.8

SOURCE: Office of Regulatory Analysis, based on Kearney/Centaur. Portions of the regulation not listed here did not have associated regulatory costs.

- o Process hazard analysis, defined as "identifying, evaluating, and controlling the hazards involved in the process," accounts for:
  - $470.8 million (53.0 percent) of costs in the first five years, and
  - $58.5 million (14.4 percent) of costs in the subsequent years.

- o Management of change, an ongoing cost defined as "establishing and implementing written procedures to manage changes to process chemicals, technology, equipment, and procedures; and changes to facilities that affect a covered process," accounts for:
  - $179.1 million (20.2 percent) of costs in the first five years, and
  - $179.1 million (44.1 percent) of costs in the subsequent years.

Other major compliance costs are associated with:

- o Incident investigation ($60.9 million in the first five years and $20.1 million in subsequent years);

- o Mechanical integrity ($48.3 million for all years); and

- o Training ($36.6 million in all years).

Exhibit G-2 shows the industries that OSHA estimated would incur compliance costs. Costs shown in Exhibit G-2 do not reflect the financial benefit to employeers of improved safety, because OSHA's estimates are based on the same percentage reductions for all establishments.

3. Effects of the Regulation on Small Establishments

The methodology documented in the RIA does not provide sufficient detail to analyze economies of scale directly. It is clear, however, that there is considerable potential for economies of scale in compliance. Most of the costly compliance activities appear to be on an establishment-wide basis. This is particularly true of the process hazard evaluation, process safety information, management of change, and pre-startup safety review. These activities appear to be largely fixed with respect to the size of the establishment or to involve machinery and processes that are inherently subject to economies of scale. Training is also subject to some economies of scale, particularly since one sixth of training costs are for documentation. For these reasons, disproportionately large cost impacts on small businesses are likely.

Exhibit G-2 is based on the regulatory flexibility analysis, as opposed to the cost chapter of the RIA, from which Exhibit G-1 was taken. These two chapters are not comparable. The regulatory flexibility analysis uses one set of costs, rather than different average costs for the first five years and the second five years, for example, and it is not at all clear how these two sets of costs are related. Since OSHA estimated costs for a model small establishment with 10 employees, Exhibit G-2 shows two ratios of cost per employee for small establishments to cost per employee for large establishments -- one ratio for the actual average number of employees in small establishments with 1 to 19 employees, and one ratio for 10 employees.

By any measure, Exhibit G-2 shows that PSM standard compliance costs for small establishments are disproportionately high:

EXHIBIT G-2:

ANNUALIZED COMPLIANCE COSTS OF THE PSM STANDARD BY SIZE OF ESTABLISHMENT

	Establishment Size	
Costs	**Small[a]**	**Large**
NATURAL GAS LIQUIDS (SIC 1321)		
Cost per Affected Establishment[b]	$18,721	$18,584
Cost as Percent of Revenue[c]	0.137%	0.023%
Cost per Employee[d]	$ 2,177	$ 407
Cost Ratio[e]	6.66	-
Cost Ratio Based on Cost Assumption[f]	4.60	-
FOOD AND KINDRED PRODUCTS (SIC 20)		
Cost per Affected Establishment[b]	$31,242	$59,567
Cost as Percent of Revenue[c]	0.114%	0.024%
Cost per Employee[d]	$ 4,711	$ 411
Cost Ratio[e]	11.45	-
Cost Ratio Based on Cost Assumption[f]	7.60	-
TEXTILE MILL PRODUCTS (SIC 22)		
Cost per Affected Establishment[b]	$36,333	$19,298
Cost as Percent of Revenue[c]	0.032%	0.072%
Cost per Employee[d]	$ 5,423	$ 145
Cost Ratio[e]	37.37	-
Cost Ratio Based on Cost Assumption[f]	25.06	-
LUMBER, WOOD PRODUCTS (SIC 24)		
Cost per Affected Establishment[b]	$24,574	$23,585
Cost as Percent of Revenue[c]	0.133%	0.033%
Cost per Employee[d]	$ 4,403	$ 311
Cost Ratio[e]	14.16	-
Cost Ratio Based on Cost Assumption[f]	7.90	-
PAPER AND ALLIED PRODUCTS (SIC 26)		
Cost per Affected Establishment[b]	$18,818	$23,770
Cost as Percent of Revenue[c]	0.045%	0.021%
Cost per Employee[d]	$ 2,320	$ 166
Cost Ratio[e]	13.98	-
Cost Ratio Based on Cost Assumption[f]	11.34	-

INDUSTRIAL INORGANIC CHEMICALS (SIC 281)		
Cost per Affected Establishment[a]	$13,119	$24,279
Cost as Percent of Revenue[b]	0.073%	0.021%
Cost per Employee[c]	$ 1,764	$ 144
Cost Ratio[d]	13.67	-
Cost Ratio Based on Cost Assumption[f]	9.11	-

EXHIBIT G-2: (continued)

ANNUALIZED COMPLIANCE COSTS OF THE PSM STANDARD BY SIZE OF ESTABLISHMENT

Costs	**Establishment Size**	
	Small[a]	**Large**
PLASTICS, RESINS, RUBBER, CELLULOSICS (SIC 282)		
Cost per Affected Establishment[b]	$23,548	$35,135
Cost as Percent of Revenue[c]	0.318%	0.038%
Cost per Employee[d]	$ 3,373	$ 123
Cost Ratio[e]	27.38	-
Cost Ratio Based on Cost Assumption[f]	19.15	-
DRUGS (SIC 238)		
Cost per Affected Establishment[b]	$20,870	$49,123
Cost as Percent of Revenue[c]	0.316%	0.014%
Cost per Employee[d]	$ 5,898	$ 189
Cost Ratio[e]	31.16	-
Cost Ratio Based on Cost Assumption[f]	11.04	-
DETERGENTS, PERFUMES, COSMETICS (SIC 284)		
Cost per Affected Establishment[b]	$17,344	$50,736
Cost as Percent of Revenue[c]	0.572%	0.042%
Cost per Employee[d]	$ 2,799	$ 361
Cost Ratio[e]	7.75	-
Cost Ratio Based on Cost Assumption[f]	4.80	-
PAINTS, VARNISHES, LACQUERS, ENAMELS (SIC 285)		
Cost per Affected Establishment[b]	$24,837	$84,964
Cost as Percent of Revenue[c]	2.032%	0.261%
Cost per Employee[d]	$ 3,220	$ 1,095
Cost Ratio[e]	2.94	-
Cost Ratio Based on Cost Assumption[f]	2.27	-
INDUSTRIAL ORGANIC CHEMICALS (SIC 286)		
Cost per Affected Establishment[b]	$22,231	$45,578
Cost as Percent of Revenue[c]	0.330%	0.053%
Cost per Employee[d]	$ 3,070	$ 212

Cost Ratio[e]	14.45	_
Cost Ratio Based on Cost Assumption[f]	10.49	-
AGRICULTURAL CHEMICALS (SIC 287)		
Cost per Affected Establishment[b]	$13,591	$46,739
Cost as Percent of Revenue[c]	0.240%	0.056%
Cost per Employee[b]	$ 1,936	$ 416
Cost Ratio[e]	4.65	-
Cost Ratio Based on Cost Assumption[f]	3.27	-

EXHIBIT G-2: (continued)

ANNUALIZED COMPLIANCE COSTS OF THE PSM STANDARD BY SIZE OF ESTABLISHMENT

Costs	Establishment Size	
	Small[a]	Large
MISCELLANEOUS CHEMICAL PRODUCTS (SIC 289)		
Cost per Affected Establishment[b]	$22,453	$68,491
Cost as Percent of Revenue[c]	0.918%	0.161%
Cost per Employee[d]	$ 3,081	$ 874
Cost Ratio[e]	3.53	-
Cost Ratio Based on Cost Assumption[f]	2.57	-
PETROLEUM REFINING (SIC 291)		
Cost per Affected Establishment[b]	$25,527	$46,531
Cost as Percent of Revenue[c]	0.058%	0.005%
Cost per Employee[d]	$ 2,848	$ 139
Cost Ratio[e]	20.52	-
Cost Ratio Based on Cost Assumption[f]	18.37	-
ASPHALT PAVING/ROOFING MATERIALS (SIC 295)		
Cost per Affected Establishment[b]	$20,964	$86,184
Cost as Percent of Revenue[c]	1.052%	0.434%
Cost per Employee[d]	$ 3,579	$ 1,297
Cost Ratio[e]	2.76	-
Cost Ratio Based on Cost Assumption[f]	1.62	-
MISC. PETROLEUM AND COAL PRODUCTS (SIC 299)		
Cost per Affected Establishment[b]	$25,082	$37,838
Cost as Percent of Revenue[c]	0.087%	0.032%
Cost per Employee[d]	$ 3,301	$ 643
Cost Ratio[e]	5.14	-
Cost Ratio Based on Cost Assumption[f]	3.90	-
FABRICATED RUBBER PRODUCTS, NEC (SIC 3069)		
Cost per Affected Establishment[b]	$26,321	$60,448

Cost as Percent of Revenue[c]	0.180%	0.247%
Cost per Employee[d]	$ 3,639	$ 547
Cost Ratio[e]	6.65	-
Cost Ratio Based on Cost Assumption[f]	4.81	-
MISCELLANEOUS PLASTICS PRODUCTS (SIC 3079)		
Cost per Affected Establishment[b]	$22,984	$40,076
Cost as Percent of Revenue[c]	0.088%	0.065%
Cost per Employee[d]	$ 3,220	$ 407
Cost Ratio[e]	7.91	-
Cost Ratio Based on Cost Assumption[f]	5.65	-

EXHIBIT G-2: (continued)

ANNUALIZED COMPLIANCE COSTS OF THE PSM STANDARD BY SIZE OF ESTABLISHMENT

	Establishment Size	
Costs	**Small[a]**	**Large**
STONE, CLAY, GLASS, AND CONCRETE (SIC 32)		
Cost per Affected Establishment[b]	$13,197	$32,667
Cost as Percent of Revenue[c]	0.134%	0.047%
Cost per Employee[d]	$ 1,931	$ 365
Cost Ratio[e]	5.29	-
Cost Ratio Based on Cost Assumption[f]	3.62	-
PRIMARY METALS INDUSTRIES (SIC 33)		
Cost per Affected Establishment[b]	$23,108	$40,863
Cost as Percent of Revenue[c]	0.024%	0.013%
Cost per Employee[d]	$ 3,181	$ 216
Cost Ratio[e]	14.74	-
Cost Ratio Based on Cost Assumption[f]	10.70	-
FABRICATED METAL (SIC 34)		
Cost per Affected Establishment[b]	$19,597	$71,380
Cost as Percent of Revenue[c]	0.131%	0.046%
Cost per Employee[d]	$ 2,752	$ 748
Cost Ratio[e]	3.68	-
Cost Ratio Based on Cost Assumption[f]	2.62	-
ELECTRONIC EQUIPMENT, EXCEPT COMPUTERS (SIC 36)		
Cost per Affected Establishment[b]	$24,328	$87,050
Cost as Percent of Revenue[c]	0.207%	0.047%
Cost per Employee[d]	$ 3,909	$ 435
Cost Ratio[e]	8.98	-
Cost Ratio Based on Cost Assumption[f]	5.59	-

CHEMICAL AND ALLIED PRODUCTS (SIC 5161)
WHOLESALE TRADE

Cost per Affected Establishment[b]	$14,971	$103,788
Cost as Percent of Revenue[c]	0.174%	0.021%
Cost per Employee[d]	$ 2,778	$ 2,004
Cost Ratio[e]	1.39	-
Cost Ratio Based on Cost Assumption[f]	0.75	-

EXHIBIT G-2: (continued)

ANNUALIZED COMPLIANCE COSTS OF THE PSM STANDARD
BY SIZE OF ESTABLISHMENT

Costs	Establishment Size	
	Small[a]	Large
FARM SUPPLIES, WHOLESALE TRADE (SIC 5191)		
Cost per Affected Establishment[b]	$15,150	$146,377
Cost as Percent of Revenue[c]	0.101%	0.037%
Cost per Employee[d]	$ 2,783	$ 3,939
Cost Ratio[e]	0.71	-
Cost Ratio Based on Cost Assumption[f]	0.38	-

---

[a] Fewer than 20 employees.

[b] Number of large establishments is reported in Chapter IV. Annualized cost for large establishments computed by subtracting annualized cost for small establishments from annualized cost for all establishments.

[c] Revenues for large establishments computed by subtracting revenues for small establishments from revenues for all establishments.

[d] Based on industry employment data in U.S. Department of Commerce, County Business Patterns, 1984.

[e] Ratio of cost per employee for small establishments to cost per employee for large establishments.

[f] In estimating costs, OSHA assumed that a small establishment has 10 employees. The same assumption is made for this computation.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, except as otherwise noted.

- o Total compliance cost per establishment for large establishments is rarely more than three times the cost per establishment for small establishments, and is sometimes less than twice as high.

- o As a percentage of revenue, compliance costs are usually at least three to five times as high for small establishments as for large establishments and (particularly in Chemicals, SIC 28) are often ten times as high.

- o Even using the results for 10 employees in a small establishment, costs per employee for small establishments in the industries shown in Exhibit G-2 are:
  - Less than costs per employee for large establishments only in two wholesale trade industries,
  - Less than three times the costs per employee for large establishments in only four other industries,
  - Three to six times the costs per employee for large establishments in eight industries,
  - Seven to ten times the costs per employee for large establishments in three industries,
  - Ten to twenty times the costs per employee for large establishments in six industries, and
  - Over twenty times the costs per employee for large establishments in one industry.

- o Based on the actual numbers of employees, the cost ratios (cost per employee in small establishment over cost per employee in large establishments) are about half again as high.

Impacts on small businesses are not only disproportionate, they are significant. In six of the eight different industries for which profit information is available, the compliance costs as a percent of profits, are five times larger at small establishments than for all establishments. These ratios would be even greater if they compared small establishments to large establishments instead of small to all. OSHA concluded that "the data indicate that some small firms may have difficulty complying with the proposed regulation."

4. Conclusion

The standard for process safety management of highly hazardous chemicals has disproportionately high costs for small businesses for a number of reasons. It includes activities -- hazard analysis and development of safety information -- that are esentially fixed costs. Most of the other activities -- training, management of change, mechanical integrity activities, etc. -- are also subject to varying degrees of economies of scale. Although the degree of disproportion in costs not consistent for different industries, the multiple factors involved make this standard one of the most disproportionately burdensome rules for small businesses of all the OSHA regulations included in this study.

H. OSHA FINAL REVISIONS TO THE ASBESTOS STANDARD

1. Objective and Summary of the Regulation

This final revision to the asbestos standard applied to general industry, construction, and shipyards. OSHA set an 8-hour time-weighted average permissible exposure limit of 0.1 f/cc. OSHA also revised a number of ancillary requirements that had been remanded by the Court.

Asbestos is a carcinogen that has been linked to lung cancer and mesothelioma (a cancer of the lining of the chest or abdomen) and suspected in cancer at other sites. Asbestos is also associated with asbestosis, a disabling lung condition with high treatment costs. OSHA projected that the final revisions to the asbestos standard would prevent 43.6 cancer deaths per year among directly exposed workers and additional cancer deaths among indirectly exposed workers and building occupants. OSHA estimated a reduction of 14 disabling cases of asbestosis per year.

2. Estimated Costs of Compliance With the Regulation

General Industry. OSHA initially identified potential exposures to asbestos and determined the compliance measures that would be required, if they were not already in place. OSHA then estimated unit costs of each compliance measure. Exhibit H-1 shows the compliance measures, together with the unit of measurement upon which each of the unit costs is based.

OSHA identified the industry/process groups for which controls would be needed. For each industry/process group, OSHA estimated the number of plants, number of processes, number of work stations, and number of workers exposed needing additional controls, as well as the average worker-days and worker-hours per year needing additional controls. Based on the unit costs and these estimates of required controls, OSHA then estimated the total compliance costs for each industry/process group.

Exhibit H-2 shows annual incremental control costs by industry/process group for general industry. Total estimated annual incremental costs were $14.8 million. Three quarters of these costs ($11.2 million) were for engineering controls in auto repair.

Construction. OSHA began by identifying construction activities involving exposure to asbestos. As with general industry, OSHA next assessed the compliance measures that would be required for each activity, if they were not already in place, and unit costs of compliance. OSHA then estimated the numbers of activities to be brought into compliance and multiplied them by the unit costs to obtain total cost estimates.

Exhibit H-3 shows estimated annual incremental compliance costs by construction activity. Total annual compliance costs for construction were estimated to be $346.5 million. Just over 60 percent ($213.5 million) of these costs are for routine maintenance, and another 30 percent are for custodial work. Less than 10 percent of the estimated costs result from new construction, abatement, demolition, and remodeling and renovation combined.

EXHIBIT H-1:

COMPLIANCE MEASURES FOR ASBESTOS STANDARD AND UNIT OF MEASUREMENT

Compliance Measure	Unit of Measurement
Engineering Controls	Process
Written Compliance Program	
Annual Update	Process
Regulation of Areas With Exposure Above the Permissable Exposure Limit	
Barricade Tape/Wall Signs	Process
Respirator with HEPA Filter	
Respirator/Accessories	Worker
Fit Testing	Worker
Filters	Worker-Day
Cleaning	Worker-Day
Disposable Protective Clothing and Gloves	Worker-Day
Change Rooms and Lockers	Worker & Worker-Day
Shower Rooms	Worker & Worker-Day
Lunch Areas	Worker

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

EXHIBIT H-2

ESTIMATED ANNUAL INCREMENTAL COSTS OF COMPLIANCE WITH OSHA'S REVISED GENERAL INDUSTRY ASBESTOS STANDARD

	Friction Materials	**Gaskets/ Packings**	**Coatings/ Sealants**	**Plastics**	**Auto Repair**	**TOTAL**
Engineering Controls	$ 0	$ 0	$ 0	$ 0	$11,165,431	$11,165,431
Annual Update of Written Compliance Program	$ 1,298	$ 350	$ 974	$ 13	$ 0	$ 2,635
Install Regulated Areas	$ 712	$ 184	$ 565	$ 5	$ 0	$ 1,465
Half Mask Cartridge Respirator With HEPA Filter	$826,124	$ 72,979	$468,818	$ 1,168	$ 0	$1,369,090
Disposable Protective Clothing/ Cloves	$676,611	$ 59,771	$383,971	$ 956	$ 0	$1,121,309
Change Rooms/ Lockers	$229,722	$ 30,011	$192,789	$ 480	$ 0	$ 563,002
Shower Rooms	$252,090	$ 22,269	$143,059	$ 356	$ 0	$ 417,775
Lunch Areas	$111,397	$ 11,086	$ 24,006	$ 149	$ 0	$ 146,639
Total Annual Incremental Control Costs	$2,207,954	$196,651	$1,214,182	$ 3,128	$11,165,431	$14,787,345

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

EXHIBIT H-3

ESTIMATED ANNUAL INCREMENTAL COSTS OF COMPLIANCE WITH OSHA'S REVISED ASBESTOS CONSTRUCTION STANDARD

Construction Activity	Annual Cost
NEW CONSTRUCTION	
A/C Pipe Installation	$ 578,189
A/C Sheet Installation	$ 233,602
ABATEMENT AND DEMOLITION	
Removal	$ 1,089,688
Encapsulation	$ 77,611
Demolition	$ 1,095,692
REMODELING AND RENOVATION	
Drywall Renovation	$ 4,697,904
Remove Roofing Felts & Coatings	$ 436,077
Remove Flooring Products	$ 13,183,683
ROUTINE MAINTENANCE IN PUBLIC, COMMERCIAL, AND RESIDENTIAL BUILDINGS	
Repair Ceiling Tiles	$ 9,136,115
Repair HVAC/lighting	$ 15,612,401
Other Work/Drop Ceiling	$ 3,937,675
Repair Boiler	$ 16,711,380
Repair Plumbing	$ 21,730,412
Repair Roofing	$ 8,392,722
Repair Drywall	$ 23,276,376
Repair Flooring	$ 45,094,590
ROUTINE MAINTENANCE IN INDUSTRIAL FACILITIES	
Remove Gaskets	$ 12,603,466
Repair Boilers	$ 15,441,483
Repair Pipe	$ 5,804,357
Miscellaneous Maintenance	$ 27,065,151
Telecommunications Maintenance	$ 8,701,317
CUSTODIAL WORK	
Public, Commercial, and Residential Buildings	$104,338,415
Industrial Facilities	$ 7,279,509

ALL ACTIVITIES	$346,517,816

____

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

Shipyards. While shipyards fall under manufacturing, the asbestos exposures resemble those of construction. OSHA identified two processes -- wet and dry -- for removal of asbestos, repair, and installation where significant exposure to asbestos could take place. As with the other types of activities, OSHA assessed the measures required to control exposure, unit costs of these measures, and the number of activities where the measures were required. Total incremental compliance costs were low because OSHA believed that use of the controls in shipyards was already near the 100-percent level. OSHA then adjusted incremental costs downward, because about 60 percent of the estimated costs were associated with training required by the EPA Model Accreditation Plan regulation, which was legislatively mandated.

Total net annual estimated incremental compliance costs for shipyards were as follows:

- For wet removal/repair/installation, total estimated compliance cost was:
  - $187,790, less EPA-related training costs of:
  - $110,255, leaving a net OSHA cost of:
  - $77,535.

- For dry removal/repair/installation, total estimated compliance cost was:
  - $41,316, less EPA-related training costs of:
  - $26,270, leaving a net OSHA cost of:
  - $15,046.

- The combined net estimated OSHA compliance cost was $92,581.

3. Effects of the Regulation on Small Establishments

Several factors affect the potential for disproportionate cost impacts on small businesses. The major cost items for manufacturing (respiratory protection and protective clothing and gloves) are generally proportional to the number of workers or the number of worker days. Conversely, costs that are process wide (updating the compliance program and controlling access to regulated areas) are quite small. For the most part, the potential for economies of scale is rather modest. Auto repair, which requires engineering controls, is an exception, although here the large total cost is spread over hundreds of thousands of establishments.

The other factor that is likely to affect disproportionate cost impacts is the extent to which small businesses encounter asbestos in their activities. This factor can work in either direction. To the extent that small businesses perform no activities with asbestos exposure, their costs will be zero. If they only occasionally encounter asbestos, however, they will have fewer worker-days over which to spread certain costs, and this will impose disproportionately high costs on them. These factors appear to play out in different ways for different sectors.

Manufacturing. Exhibit H-4 shows costs for large and small establishments in primary manufacturing. Small businesses incur substantially higher compliance costs, relative to measures of size, than do large businesses:

- o Relative to revenue, costs of small establishments are about three times as high as costs of large establishments.
- o Measured per employee, costs of small establishments are five or six times as high as costs of large establishments.

In other manufacturing industries, small businesses did not have exposure to asbestos. OSHA determined that no small plants in the friction materials or plastics industries manufacture products containing asbestos.

Brake and Clutch Repair. Exhibit H-4 also shows costs for large and small establishments performing brake and clutch repair. Here OSHA has assumed the same cost per establishment regardless of size. This seems improbable, since small establishments would probably equip only one bay to perform brake and clutch repairs, while large establishments would probably equip several bays. Thus the finding of costs per employee for small establishments that are four to nine times the costs for large establishments is problematic. It seems likely that OSHA simply did not bother to achieve accuracy since the costs were far too small to be significant.

Ship Repair. Cost impacts for shipbuilding and repair establishments are even more problematic. OSHA has again assumed constant costs for all sizes of establishment. This produces a disproportionately large impact, relative to revenue, on small shipyards -- twice the level of large shipyards. Costs per employee, however, simply do not make sense. OSHA made no reference to the level of employment in a "small" shipyard -- not even indirectly through a variable such as cost per employee. This leaves no choice but use of another data source (County Business Patterns). The disparity between small and large shipyards measured in employment and in revenue in the two sources is far too great for plausibility.

Elsewhere in the RIA, where exposures were discussed, OSHA made the point that the potential for exposure to asbestos was confined chiefly to very large shipyards. It appears that OSHA's regulatory flexibility analysis probably used a "small" establishment of more than 20 employees. At any rate, it is more reasonable to assume that no small shipyards have asbestos exposure than to use the results found in Exhibit H-4. We will do so.

Construction. Exhibit H-5 shows impacts on construction industries, by size of establishment. The results on the proportionality of costs are mixed:

- o Industries related primarily to new construction or reconstruction (heavy construction, plastering & drywall, flooring, and electrical work) have disproportionately low costs per employee for small establishments.

- Industries where maintenance activities involve widespread potential exposures to asbestos (building operators) or where repairs with exposure to asbestos insulation are likely (special trades, demolition, roofing, and plumbing) have disproportionately high costs per employee for small establishments, although in some industries the disproportion is quite modest.

In appears that in some construction work (particularly new construction), asbestos can be avoided. Here there is scope for specialization, with large businesses undertaking most of the work involving asbestos. Where asbestos is commonplace, however, all businesses must protect their workers at least occasionally, and these appear to be the industries in which small businesses incur disproportionately high costs.

EXHIBIT H-4

ESTIMATED ECONOMIC IMPACTS IN GENERAL INDUSTRY RESULTING FROM OSHA'S REVISED GENERAL INDUSTRY ASBESTOS STANDARD, BY SIZE OF PLANT

Sector/Industry	Small Establishments[a]	Large Establishments[a]
PRIMARY MANUFACTURING[b]		
Gaskets and Packings (SIC 3053)		
Incremental Cost per Plant[c]	$ 11,722	$ 31,697
Annual Sales per Plant[c]	$1,035,835	$8,882,245
Mean Employment per Plant[d]	8.28	100.48
Cost as a Percent of Sales	1.1 %	0.4 %
Cost per Employee	$ 1,416	$ 285
Cost Ratio[e]	4.93	-
Coatings and Sealants (SIC 2952)		
Incremental Cost per Plant[c]	$ 10,275	$ 21,733
Annual Sales per Plant[c]	$1,674,208	$7,954,089
Mean Employment per Plant[d]	7.07	95.61
Cost as a Percent of Sales	0.6 %	0.2 %
Cost per Employee	$ 1,453	$ 227
Cost Ratio[e]	6.40	-
BRAKE AND CLUTCH REPAIR		
New and Used Car Dealers (SIC 551)		
Incremental Cost per Plant	$ 34	$ 34
Annual Sales per Plant[c]	$2,589,089	$13,900,134
Mean Employment per Plant[d]	8.98	53.69
Cost as a Percent of Sales	< 0.01 %	< 0.01 %
Cost per Employee	$ 4	$ 1
Cost Ratio[e]	4	-
Gasoline Service Stations (SIC 554)		
Incremental Cost per Plant	$ 34	$ 34
Annual Sales per Plant[c]	$ 669,395	$9,419,097
Mean Employment per Plant[d]	5.70	35.60
Cost as a Percent of Sales	0.01 %	< 0.01 %
Cost per Employee	$ 6	$ 6
Cost Ratio[e]	6	-
Automotive Repair Shops (SIC 753)		
Incremental Cost per Plant	$ 34	$ 34
Annual Sales per Plant[c]	$ 197,139	$1,876,483
Mean Employment per Plant[d]	3.63	32.51
Cost as a Percent of Sales	0.02 %	< 0.01 %

Cost per Employee	$ 9	$ 1
Cost Ratio[e]	9	-

EXHIBIT H-4 (continued)

ESTIMATED ECONOMIC IMPACTS IN GENERAL INDUSTRY RESULTING FROM OSHA'S REVISED GENERAL INDUSTRY ASBESTOS STANDARD, BY SIZE OF PLANT

Sector/Industry	Small Establishments[a]	Large Establishments[a]
SHIP REPAIR		
Shipbuilding and Repair (SIC 3731)		
Incremental Cost per Plant	$ 12,728	$ 12,728
Annual Sales per Plant[c]	$12,751,431	$27,991,468
Mean Employment per Plant[d]	6.19	405.50
Cost as a Percent of Sales	0.10 %	0.04 %
Cost per Employee	$ 2,056	$ 31
Cost Ratio[e]	66.3	-

---

[a] Small establishments have 1-19 employees; large establishments have 20 or more employees.

[b] Friction materials (SIC 3292) and Plastics (SIC 3069) are not included because OSHA estimated that no small plants in these industries manufacture products containing asbestos.

[c] Annual costs and sales for large establishments are computed computing total cost and sales for small establishments and all establishments (cost or sales per plant times number of plants); subtracting small-establishment costs and sales from all-establishments costs and sales, and dividing the result by the number of large establishments. The source for the number of establishments was: U.S. Department of Commerce, County Business Patterns, 1993.

[d] U.S. Department of Commerce, County Business Patterns, 1993.

[e] Ratio of compliance cost per employee for small establishments to compliance cost per employee for large establishments.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, except as otherwise noted.

EXHIBIT H-5

ESTIMATED ECONOMIC IMPACTS RESULTING FROM OSHA'S REVISED CONSTRUCTION ASBESTOS STANDARD, BY SIZE OF PLANT

Industry	Small Establishments[a]	Large Establishments[a]
Heavy Construction, exc. Highways (SIC 1623)		
Incremental Cost per Establishment[b]	$ 667	$13,117
Cost as a Percent of Sales[b]	0.09 %	0.28 %
Cost per Employee[c]	$ 134	$ 153
Cost Ratio[d]	0.88	-
Plumbing, Heating, Air Cond. (SIC 1711)		
Incremental Cost per Establishment[b]	$ 723	$ 2,121
Cost as a Percent of Sales[b]	0.23 %	0.05 %
Cost per Employee[c]	$ 169	$ 43
Cost Ratio[d]	3.93	-
Electrical Work (SIC 1711)		
Incremental Cost per Establishment[b]	$ 656	$10,082
Cost as a Percent of Sales[b]	0.23 %	0.18 %
Cost per Employee[c]	$ 153	$ 202
Cost Ratio[d]	0.76	-
Plastering, Drywall, Insulation (SIC 1742)		
Incremental Cost per Establishment[b]	$ 271	$ 3,618
Cost as a Percent of Sales[b]	0.09 %	0.08 %
Cost per Employee[c]	$ 60	$ 70
Cost Ratio[d]	0.86	-
Floor Laying, Floor Work, NEC (SIC 1752)		
Incremental Cost per Establishment[b]	$ 699	$38,069
Cost as a Percent of Sales[b]	0.28 %	0.92 %
Cost per Employee[c]	$ 216	$ 1,030
Cost Ratio[d]	0.21	-
Roofing, Siding, Sheet Metal (SIC 1761)		
Incremental Cost per Establishment[b]	$ 181	$ 1,722
Cost as a Percent of Sales[b]	0.07 %	0.09 %
Cost per Employee[c]	$ 44	$ 41

Cost Ratio[d]	1.07	-
Wrecking & Demolition Work (SIC 1795)		
Incremental Cost per Establishment[b]	$ 316	$ 2,907
Cost as a Percent of Sales[b]	0.10 %	0.10 %
Cost per Employee[c]	$ 66	$ 63
Cost Ratio[d]	1.05	-

EXHIBIT H-5 (continued)

ESTIMATED ECONOMIC IMPACTS RESULTING FROM OSHA'S REVISED CONSTRUCTION ASBESTOS STANDARD, BY SIZE OF PLANT

Industry	Small Establishments[a]	Large Establishments[a]
Special Trade Contractors, NEC (SIC 1799)		
Incremental Cost per Establishment[b]	$ 427	$ 3,621
Cost as a Percent of Sales[b]	0.17 %	0.15 %
Cost per Employee[c]	$ 104	$ 76
Cost Ratio[d]	1.37	-
Operators, Nonres. Buildings (SIC 6512)		
Incremental Cost per Establishment[b]	$ 128	$ 938
Cost as a Percent of Sales[b]	0.03 %	0.03 %
Cost per Employee[c]	$ 42	$ 18
Cost Ratio[d]	2.33	-
Operators, Apartment Buildings (SIC 6513)		
Incremental Cost per Establishment[b]	$ 163	$ 1,881
Cost as a Percent of Sales[b]	0.07 %	0.04 %
Cost per Employee[c]	$ 53	$ 35
Cost Ratio[d]	1.51	-

---

[a] Small establishments have 1-19 employees; large establishments have 20 or more employees.

[b] Annual costs and sales for large establishments are computed computing total cost and sales for small establishments and all establishments (cost or sales per plant times number of plants); subtracting small-establishment costs and sales from all-establishments costs and sales, and dividing the result by the number of large

establishments. The source for the number of establishments was: U.S. Department of Commerce, County Business Patterns, 1993.

[c] U.S. Department of Commerce, County Business Patterns, 1993.

[d] Ratio of compliance cost per employee for small establishments to compliance cost per employee for large establishments.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, except as otherwise noted.

4. Conclusion

The asbestos standard produces quite a range of results with respect to relative burdens on small businesses. Several factors appear to be at work. Some industries incur fixed costs (e.g., compliance programs) or investment costs for equipment that has economies of scale. This is particularly true of the automotive repair industry and may well be true of the plumbing, heating, and air conditioning industry, where asbestos is very likely to be found. Many of the costs, however, are largely proportional to the number of workers protected, which may account for construction industry costs generally being proportional to establishment size. Where asbestos is not generally encountered (again, most construction trades), specialization in (or avoidance of) asbestos work would also seem to limit disproportionate impacts on small businesses.

I. OSHA STANDARD FOR OCCUPATIONAL EXPOSURE TO CADMIUM

1. Objective and Summary of the Regulation

OSHA determined that employees exposed to cadmium face a significant risk to their health from lung cancer and serious kidney damage at the current permissible exposure limits and that passing a new standard would substantially reduce that risk. The new standard established a single 8-hour time weighted average permissible exposure limit (TWA PEL) of 5 micrograms of cadmium per cubic meter of air for all cadmium compounds, including dust and fumes. Employers are required to comply with this limit primarily by means of engineering and work practice controls. For a small number of industries, OSHA established a separate engineering control air limit (SECAL) of 25 micrograms per cubic meter as the lowest feasible limit that can be achieved by engineering and work practice controls. Like the PEL for other industries, the SECAL, where applicable, must be achieved by engineering and work practice controls, except to the extent that the employer can demonstrate that such controls are not feasible.

The SECAL applies to construction worksites which differ from other workplaces in that: (1) The construction industry is characterized by non-fixed worksites; and (2) Employees in the construction industry often do not remain in construction or in the employ of the same employer for a long period of time, in contrast to employees in fixed site manufacturing facilities.

The standard requires engineering controls to be implemented to the extent feasible and allows the supplemental use of respirators for achieving the PEL. In almost all industries the application of appropriate engineering controls, such as local exhaust ventilation systems, and work practices can keep cadmium exposures below the PEL for most employees most of the time. Overall, OSHA estimated that 40,000 of 524,000 exposed employees might require respiratory protection after the implementation of feasible engineering controls.

2. Estimated Costs of Compliance With the Regulation

Compliance costs estimates covered both engineering controls and non-engineering controls. The engineering controls include the following:

- o Local exhaust ventilation (LEV) is the principal engineering control for reducing cadmium exposures. OSHA estimated that one ventilated work station would be required for every 20 workers. Operation and maintenance costs would be proportional to the number of work stations ventilated.

- o Enclosed and automated cement transfer mechanisms were expected to be required in cadmium smelters. OSHA estimated the unit price of such a mechanism to be $36,043.

Non-engineering compliance costs arise as a result of the following activities:

- o A fugitive emissions detection program is also required. OSHA estimated that this detection program would require 10 extra person-hours per week from the dry solids operator and from the solution operator.

- o Respirator protection: Each employee exposed above the PEL is required to wear a respirator, which must be fit tested by a technician.

- o Exposure monitoring is required at periodic time intervals.

- o Medical surveillance: Exposed employees must be offered an annual physical exam by an in-house doctor or outside clinic.

- o Hygiene and clothing: Exposed employees must be provided with coveralls and laundering service, and plants are required to have changing rooms, locker areas, and shower facilities.

- o Housekeeping: Cadmium dust must be vacuumed as it accumulates. This will require a HEPA-filtered industrial vacuum.

- o Recordkeeping: Employers must establish, and update annually, a written plan of compliance outlining their means for reducing workplace exposure. Employers must also maintain records of medical testing and exposure monitoring of exposed employees.

- Information and training: Employees must receive annual training on the hazards of cadmium exposure.

- Signs and labels indicating the need for caution must be posted in areas of potential cadmium exposure.

OSHA estimated that 65,244 establishments would be affected by the regulation. Total compliance costs were estimated to be $187 million. Of this total:

- Engineering costs account for 44 percent ($82 million);

- Hygiene and clothing costs account for 30 percent ($56 million); and

- All other costs account for $51 million (26 percent).

Exhibit I-1 shows the costs by provision of the standard and by industry.

EXHIBIT I-1:

SUMMARY OF COMPLIANCE COSTS OF CADMIUM EXPOSURE STANDARDS BY INDUSTRY AND PROVISION ($ 1,000s)

Industry	Number of Affected Establishments	Engineering Controls	Respirators	Exposure Monitoring	Medical Surveillance	Hygiene/ Clothing	Information Training & Record-Keeping	Total Annual Costs	Costs as a Percent of Revenues
Batteries	6	$ 180	$ 180	$ 16	$ 386	$ 495	$ 8	$ 1,946	1.1%
Zinc/Cadmium	5	$ 728	$ 150	$ 17	$ 383	$ 459	$ 5	$ 1,742	0.7%
Pigments	4	$ 312	$ 12	$ 10	$ 35	$ 104	$ 1	$ 474	1.6%
Formulators	700	$ 4,620	$ 525	$ 914	$ 1,277	$ 0	$ 35	$ 7,371	0.8%
Stabilizers	5	$ 825	$ 12	$ 11	$ 36	$ 50	$ 1	$ 935	1.0%
Lead	4	$ 112	$ 60	$ 3	$ 106	$ 0	$ 2	$ 283	0.2%
Plating	400	$ 189	$ 6	$ 166	$ 102	$ 294	$ 30	$ 787	0.4%
Utilities	4,000	$ 0	$ 0	$1,600	$ 600	$ 0	$ 188	$ 2,388	0.0%
Iron/Steel	120	$ 0	$ 300	$ 288	$ 1,000	$ 0	$ 50	$ 1,638	0.0%
SUBTOTAL	5,244	$ 7,647	$ 1,245	$3,025	$ 3,907	$1,402	$ 319	$17,545	0.0%
Other General Industry	50,000	$74,820	$11,855	$2,754	$13,512	$50,937	$5,737	$159,615	0.1%
Construction	10,000	$ 0	$ 350	$2,870	$ 2,380	$4,203	$ 700	$10,503	2.1%
TOTAL	**65,244**	**$82,467**	**$13,450**	**$8,649**	**$19,799**	**$56,542**	**$6,756**	**$187,663**	**0.1%**

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

3. Effects of the Regulation on Small Establishments

Exhibit I-2 summarizes the results of the Regulatory Flexibility Analysis. OSHA estimated that the standard would affect 45,580 small establishments (fewer than 20 employees) and 19,664 large establishments (20 or more employees). OSHA estimated that average annual compliance costs would average $601 for small establishments and $8,153 for large establishments. This is equivalent to an average annual cost per employee of $375 for small establishments, $355 for large establishments, and $358 for all establishments. The small business compliance cost ratio is 1.06.

Non-engineering Costs. For a variety of reasons, most non-engineering costs appear not to have disproportionate impacts on small businesses, and those that do have relatively small impacts:

- o Hygiene facilities were estimated to have no cost, since all plants surveyed already had changing rooms, locker areas, and shower facilities.

- o A number of non-engineering costs appear to be entirely proportional to employees. These include:
  - Respirators,
  - Medical surveillance, and
  - Work clothing.

- o Several non-engineering costs appear to be largely proportional to employees but contain an element of fixed cost that represents preparation or specialized skill. These include:
  - Fit testing of respirators by a technician,
  - Information and training, and
  - Recordkeeping related to medical surveillance.

- o Several non-engineering costs appear to be roughly proportional to output, space, or work stations, but may be subject to economies of scale in very small plants that do not use their capacity as fully as larger firms. These include:
  - Housekeeping activities, and
  - Signs and labels.

- o Some non-engineering costs are entirely fixed, at least over a quite substantial range of plant size, and thus appear to be subject to substantial economies of scale. These include:
  - Exposure monitoring and related recordkeeping, and
  - A written compliance plan.

Thus most of the non-engineering costs appear reasonably proportional to employment and/or output. Hygiene and clothing, for example, account for 30 percent of all compliance costs. Conversely, the activities that have the greatest potential for disproportionate impacts are relatively small. Exposure monitoring, recordkeeping, and information and training combined account for 8 percent of all compliance costs. For many non-engineering costs, at least, the cost ratio of 1.06 may be reasonable.

EXHIBIT I-2:

COMPLIANCE COSTS OF CADMIUM EXPOSURE STANDARDS, BY ESTABLISHMENT EMPLOYMENT SIZE

	Establishment Size		
	1 - 19	**20 & Over**	**All**
Number of Establishments	45,580	19,664	65,244
Number of Employees	73,000	452,000	525,000
Annual Compliance Cost ($ 1,000s)	$27,410	$160,323	$187,733
Average Annual Compliance Cost per Establishment	$ 601	$ 8,153	$ 2,877
Average Annual Compliance Cost per Employee	$ 375	$ 355	$ 358

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

Engineering Costs. Engineering costs are subject to economies of scale. Exhibit I-3 shows costs per establishment and per employee of the major types of engineering controls. For the enclosed, automated cement transfer mechanism, for example, OSHA made the assumption that every cadmium smelter would need one, at an estimated unit cost of $36,043. Thus the cost per employee is inversely proportional to the number of employees.

The HEPA-filter vacuum was similar, except that OSHA was not sure how many establishments already were using a HEPA-filtered vacuum. OSHA assumed that every establishment would need one, and that those without one would have to acquire one at a cost of $1,500. Again the cost per employee is inversely proportional to the number of employees.

Local exhaust ventilation (LEV) systems are more complex because they can be designed with various capacities. OSHA estimated costs for systems with a small hood and small baghouse (3,500 cubic feet/minute), a medium hood and medium baghouse (6,000 cfm), and a large hood and large baghouse (10,000 cfm), as well as other configurations. The costs for these three systems are $41,916, $58,018, and $91,934, respectively. OSHA also indicated that one system would serve 20 employees. In estimating the relative equipment costs, therefore, we will assume that a 20-employee establishment uses the large LEV system, and a small establishment uses the small LEV system. Economies of scale are evident in the fact that OSHA's estimated cost per cfm is 30 percent higher for the small unit than for the large unit. Thus (assuming needed capacity in cfm is proportional to employees) a seven-employee establishment would have costs per employee 30 percent higher than a 20 employee establishment. The typical small establishment, however, does not have seven employees (according to Exhibit I-2) but about two. Thus the cost per employee of LEV is 4.5 times as for the small establishment as for the large establishment.

The problem with estimates of equipment costs -- as well as the summarized data in Exhibit I-2 -- is that cadmium exposure occurs in very diverse industries. Many of these industries will not need this expensive equipment. An enclosed, automated cement transfer mechanism, for example, is apparently needed only in cadmium smelters, and cadmium, pigments, and stabilizers are the only industries specifically mentioned with reference to major equipment in the RIA. Furthermore, Exhibit I-1 shows that engineering control costs per establishment average $6,600 for Formulators; $1,500 for Other General Industry; under $500 for Plating; and nil for Utilities, Iron and Steel, and Construction. Only Batteries, Zinc/Cadmium, Pigments, Stabilizers, and Lead have estimated costs per establishment that could include equipment costs of $40,000 and up. Yet these industries have only four to six affected establishments each. Where so few establishments are impacted, it is not at all clear that any of them is small. Thus, with the exception of HEPA-filtered vacuums, equipment costs do not appear to be a substantial cause of disproportionate impacts on small business. The extent to which the cost of HEPA-filtered vacuums is incremental is not clear.

4. Conclusion

The cadmium standard has overall impacts on small businesses that are disproportionately large. Overall, small businesses have a cost per employee that is five times as large as that of large establishments. This result is quite variable from industry to industry, however, and in some industries the impacts are roughly proportional to establishment size. Engineering costs that are subject to economies of scale appear to be the principal explanation for the instances of disproportionately large small-business impacts. Some non-engineering costs -- particularly paperwork -- appear also to have considerable economies of scale, although many costs -- particularly those related to PPE and medical surveillance -- appear to have minimal or only modest economies of scale. Nevertheless, where exposure to cadmium is significant and routine, the costs for protecting workers in small establishments are quite substantial.

EXHIBIT I-3:

EQUIPMENT COSTS OF CADMIUM EXPOSURE STANDARDS, BY ESTABLISHMENT EMPLOYMENT SIZE

	Establishment Size	
Equipment/Cost	**1 - 19**	**20 & Over**
Enclosed/Automated Cement Transfer Mechanism		
Unit Cost	$ 36,043	$ 36,043
Cost per Employee[a]	$ 18,022	$ 1,802
Compliance Cost Ratio[b]	10.0	-
HEPA-Filtered Vacuum		
Unit Cost	$ 1,500	$ 1,500
Cost per Employee[a]	$ 750	$ 75
Compliance Cost Ratio[b]	10.0	-
Local Exhaust Ventilation		
Unit Cost	$ 41,916	$ 91,934
Cost per Employee[a]	$ 20,958	$ 4,597
Compliance Cost Ratio[b]	4.56	-

[a] Based on 2 employees for a small establishment (see Exhibit I-3) and 20 employees for a large establishment.

[b] Ratio of cost per employee for small establishments to cost per employee for large establishments.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

J. OSHA STANDARD FOR LEAD EXPOSURE IN CONSTRUCTION

1. Objective and Summary of the Regulation

This standard extends existing lead exposure controls by adding employee protection requirements for construction workers exposed to lead. The standard reduces the permitted level of exposure to lead for construction workers from 200 micrograms per cubic meter of air as an eight hour time weighted average (TWA) to an 8 hour TWA of 50 micrograms per cubic meter. The standard also includes requirements concerning exposure assessment, methods of compliance, respiratory protection, protective clothing and equipment, hygiene facilities, medical surveillance, employee training, signs, and recordkeeping. The standard established an action level of an 8-hour TWA of 30 micrograms per cubic meter. In instances where exposure levels are below 30 micrograms per cubic meter, the employer is not obligated to comply with most of the requirements.

The construction industry had originally been exempted from the 50 micrograms per cubic meter permissible exposure limit (PEL) because of insufficient information in the record to resolve issues raised about the applicability of the standard to conditions in the industry. This standard amends existing regulations to bring the PEL for construction to the same level as in other fields. Approaches for controlling exposure to airborne lead associated with construction include:

- o Engineering controls and work practices to prevent the generation of airborne lead from the activities and building materials being handled, including the use of HEPA vacuums and the use of wetting agents for sweeping;

- o Ventilated hand tools and building enclosures to remove airborne lead before exposure occurs; and (if necessary)

- o Respiratory protection and protective cloting to isolate the employees from their environment and monitoring to assess the efficacy of controls.

2. Estimated Costs of Compliance With the Regulation

The construction industry is characterized by high worker mobility. It is highly cyclical, and there is considerable shifting among job sites and employers. Thus OSHA assessed compliance costs for the lead standard on both a per-worker and a per-establishment basis.

OSHA estimated that compliance with the lead standard in construction would cost nearly half a billion dollars ($489.4 million) annually. In estimating costs, OSHA first identified 25 types of construction projects that involved lead exposure. OSHA broke each project down into activities that entail exposure to lead; assessed the controls necessary for each type of job; estimated the costs; estimated the costs of measures required to protect the crews doing each job; estimated the number of projects of each type, the total number of crews that would be exposed, and the number of establishments involved; and built up total cost estimates for each type of project from these estimates. Exhibit J-1 shows the project types, number of each type of projects, the number of exposed workers on each type of project, and total compliance cost for each type of project.

EXHIBIT J-1:
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS AND WORKER EXPOSURE BY PROJECT TYPE

Project	Annual Compliance Cost ($ Thousands)	Number of Projects Per Year	Number of Exposed Workers
Highway/Railroad Bridge Repainting	$ 56,905	3,721	18,419
Highway/Railroad Bridge Rehabilitation	$110,484	2,157	29,958
Water Tank Repainting	$ 16,065	1,994	5,113
Petroleum Tank Repainting	$ 19,771	3,491	4,364
Underground Storage Tank Demolition	$ 701	648	288
Housing Lead Abatement (Public)	$ 4,928	900	2,893
Housing Lead Abatement (Private)	$ 443	62,300	9,345
In-Place Management (Public)	$ 11	3,150	188
In-Place Management (Private)	$ 1,511	631,000	35,056
Demolition, Commercial/Industrial	$ 16,608	1,240	7,440
Indoor Ind. Facility Maint./Renovation	$ 1,591	280	2,113
Outdoor Ind. Facility Maint./Renovation	$ 10,579	1,584	2,981
Cast Iron Soil Pipe Lead Joint	$ 557	9,438	15,337
Mfg./Maint./Repair of Ind. Process Equip.	$ 2,826	982	409
Industrial Vacuuming	$ 793	784	392
Stained Glass Window Removal	$ 2,395	2,500	208
Installation of Radiation Shielding	$ 2	100	40
Commercial Remodeling/Renovation	$118,482	546,000	546,798
Residential Remodeling/Renovation	$ 85,839	2,698,000	178,544
Babbitting while Recabling Elevators	$ 285	5,400	4,500
Electrical Cable Splicing	$ 182	100,000	5,000

Reinsulation of Existing Mineral Wool	$ 21,180	22,000	18,333
Repair/Removal of Leaded Water Lines	$ 4,264	197,000	41,042
Electric Tower Maintenance	$ 12,966	880	7,333
Installation of Lead-Coated Roofing	$ 20	40	576
ALL PROJECT TYPES COMBINED	$ 489,417	4,295,589	936,670

SOURCE: U.S. Department of Labor, Office of Regulatory Analysis

OSHA identified the following types of control measures that would impose incremental costs for at least one of the project types:

- o Project supervision;
- o Exposure monitoring;
- o HEPA vacuuming;
- o Local exhaust ventilation;
- o A written compliance program;
- o Warning signs;
- o Worker training;
- o Respiratory protection;
- o Protective work clothing;
- o Change areas;
- o Decontamination facilities;
- o Eating facilities;
- o Biological monitoring; and

- o Recordkeeping.[37]

OSHA selected a set of measures to control lead exposure for each project type and activity. OSHA reviewed 22 construction industries identified as involving lead exposure, matched them with each type of project, and estimated the types of projects and the specific construction activities that would expose workers in each industry to lead. OSHA calculated unit costs of each control measure. The "unit" was the establishment, project, crew, worker, project-day, crew-day, or worker-day. OSHA then estimated the annual number of projects, crews, workers, project-days, crew-days, and worker-days and extrapolated to the aggregate total costs for each type of project. Finally, OSHA assigned costs to each industry.

EXHIBIT J-2:
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	Small Establishments (< 20 Employees)	Large Establishments (≥ 20 Employees)
Residential Housing - Single Family		
Number of Establishments	88,170	2,208
Compliance Cost per Establishment[a]	$ 1,417	$ 15,498
Compliance Cost per Exposed Worker[b]	$ 435	$ 435
Compliance Cost per Employee[c]	$ 400	$ 409
Compliance Cost as Percent of Net Sales[d]	0.56 %	0.60 %
Compliance Cost Ratio[e]	0.98	-
Residential Housing - Multi Family		
Number of Establishments	7,233	910
Compliance Cost per Establishment[a]	$ 919	$ 10,118
Compliance Cost per Exposed Worker[b]	$ 481	$ 481
Compliance Cost per Employee[c]	$ 196	$ 193
Compliance Cost as Percent of Net Sales[d]	0.26 %	0.25 %
Compliance Cost Ratio[e]	1.02	-

---

[37] OSHA also identified other measures that were required but did not impose an incremental cost. These measures included:

- o Determination of the presence of lead;
- o Mechanical ventilation with HEPA filtration;
- o Wetting agents;
- o Enclosure/containment systems;
- o Hand washing facilities;
- o Medical surveillance;
- o Medical removal protection benefits; and
- o Labeling of lead contaminated clothing and equipment.

Operative Building Contractors		
Number of Establishments	19,280	1,486
Compliance Cost per Establishment[a]	$ 818	$ 12,398
Compliance Cost per Exposed Worker[b]	$ 409	$ 409
Compliance Cost per Employee[c]	$ 201	$ 203
Compliance Cost as Percent of Net Sales[d]	0.12 %	0.13 %
Compliance Cost Ratio[e]	0.99	-
Industrial Buildings and Warehouses		
Number of Establishments	5,511	1,503
Compliance Cost per Establishment[a]	$ 1,349	$ 15,704
Compliance Cost per Exposed Worker[b]	$ 245	$ 245
Compliance Cost per Employee[c]	$ 217	$ 217
Compliance Cost as Percent of Net Sales[d]	0.27 %	0.28 %
Compliance Cost Ratio[e]	1.00	-
Other Nonresidential Buildings		
Number of Establishments	25,713	5,624
Compliance Cost per Establishment[a]	$ 1,481	$ 15,283
Compliance Cost per Exposed Worker[b]	$ 217	$ 217
Compliance Cost per Employee[c]	$ 253	$ 254
Compliance Cost as Percent of Net Sales[d]	0.34 %	0.30 %
Compliance Cost Ratio[e]	1.00	-

EXHIBIT J-2: (continued)
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	**Small Establishments (< 20 Employees)**	**Large Establishments (≥ 20 Employees)**
Highway and Street Construction Contractors		
Number of Establishments	7,734	3,252
Compliance Cost per Establishment[a]	$14,438	$161,870
Compliance Cost per Exposed Worker[b]	$ 3,418	$ 3,418
Compliance Cost per Employee[c]	$ 2,563	$ 2,560
Compliance Cost as Percent of Net Sales[d]	2.54 %	2.23 %
Compliance Cost Ratio[e]	1.00	-
Bridge and Tunnel Highway Contractors		
Number of Establishments	629	530
Compliance Cost per Establishment[a]	$15,012	$152,955
Compliance Cost per Exposed Worker[b]	$ 3,653	$ 3,653
Compliance Cost per Employee[c]	$ 1,908	$ 1,905
Compliance Cost as Percent of Net Sales[d]	2.23 %	2.15 %
Compliance Cost Ratio[e]	1.00	-
Plumbing Contractors		
Number of Establishments	63,154	6,412
Compliance Cost per Establishment[a]	$ 59	$ 623
Compliance Cost per Exposed Worker[b]	$ 86	$ 86
Compliance Cost per Employee[c]	$ 12	$ 12

Compliance Cost as Percent of Net Sales[d]	0.19 %	0.02 %
Compliance Cost Ratio[e]	1.00	-
Painting Contractors		
Number of Establishments	28,390	1,477
Compliance Cost per Establishment[a]	$ 5,800	$ 62,561
Compliance Cost per Exposed Worker[b]	$ 856	$ 856
Compliance Cost per Employee[c]	$ 1,514	$ 1,510
Compliance Cost as Percent of Net Sales[d]	3.77 %	3.00 %
Compliance Cost Ratio[e]	1.00	-
Electrical Work Contractors		
Number of Establishments	44,380	5,054
Compliance Cost per Establishment[a]	$ 1,118	$ 13,609
Compliance Cost per Exposed Worker[b]	$ 315	$ 315
Compliance Cost per Employee[c]	$ 231	$ 234
Compliance Cost as Percent of Net Sales[d]	0.39 %	0.31 %
Compliance Cost Ratio[e]	0.99	-

EXHIBIT J-2: (continued)
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	Small Establishments (< 20 Employees)	Large Establishments (≥ 20 Employees)
Plastering Contractors		
Number of Establishments	14,660	3,149
Compliance Cost per Establishment[a]	$ 1,069	$ 10,819
Compliance Cost per Exposed Worker[b]	$ 317	$ 317
Compliance Cost per Employee[c]	$ 198	$ 195
Compliance Cost as Percent of Net Sales[d]	0.34 %	0.32 %
Compliance Cost Ratio[e]	1.02	-
Carpentry Work Contractors		
Number of Establishments	32,580	3,429
Compliance Cost per Establishment[a]	$ 2,127	$ 12,397
Compliance Cost per Exposed Worker[b]	$ 254	$ 254
Compliance Cost per Employee[c]	$ 590	$ 583
Compliance Cost as Percent of Net Sales[d]	1.16 %	1.04 %
Compliance Cost Ratio[e]	1.01	-
Floor Laying Contractors		
Number of Establishments	7,752	422
Compliance Cost per Establishment[a]	$ 1,743	$ 21,441
Compliance Cost per Exposed Worker[b]	$ 282	$ 282
Compliance Cost per Employee[c]	$ 1,043	$ 286
Compliance Cost as Percent of Net Sales[d]	0.69 %	0.64 %
Compliance Cost Ratio[e]	3.65	-
Roofing Contractors		
Number of Establishments	22,870	2,803
Compliance Cost per Establishment[a]	$ 1,725	$ 14,044
Compliance Cost per Exposed Worker[b]	$ 252	$ 252
Compliance Cost per Employee[c]	$ 343	$ 339
Compliance Cost as Percent of Net Sales[d]	0.09 %	0.93 %
Compliance Cost Ratio[e]	1.01	-
Structural Steel Erection Contractors		
Number of Establishments	3,205	812
Compliance Cost per Establishment[a]	$58,285	$120,603
Compliance Cost per Exposed Worker[b]	$ 3,656	$ 3,627
Compliance Cost per Employee[c]	$ 8,726	$ 2,229
Compliance Cost as Percent of Net Sales[d]	14.24 %	3.06 %
Compliance Cost Ratio[e]	3.91	-

EXHIBIT J-2: (continued)
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	Small Establishments (< 20 Employees)	Large Establishments (≥ 20 Employees)
Wrecking and Demolition		
Number of Establishments	1,088	152
Compliance Cost per Establishment[a]	$11,615	$122,228
Compliance Cost per Exposed Worker[b]	$ 2,239	$ 2,239
Compliance Cost per Employee[c]	$ 2,205	$ 2,218
Compliance Cost as Percent of Net Sales[d]	3.65 %	3.73 %
Compliance Cost Ratio[e]	0.99	-
Installation/Erection of Building Equipment		
Number of Establishments	3,021	756
Compliance Cost per Establishment[a]	$ 44	$ 459
Compliance Cost per Exposed Worker[b]	$ 63	$ 63
Compliance Cost per Employee[c]	$ 8	$ 8
Compliance Cost as Percent of Net Sales[d]	0.01 %	$ 0.01 %
Compliance Cost Ratio[e]	1.00	-
Miscellaneous Trade Contractors, NEC		
Number of Establishments	21,533	1,665
Compliance Cost per Establishment[a]	$ 1,634	$ 15,358
Compliance Cost per Exposed Worker[b]	$ 519	$ 519
Compliance Cost per Employee[c]	$ 344	$ 346
Compliance Cost as Percent of Net Sales[d]	0.63 %	0.60 %
Compliance Cost Ratio[e]	1.00	-
Glass Products Manufacturers		
Number of Establishments	979	0
Compliance Cost per Establishment	$22,992	N.A.
Compliance Cost per Exposed Worker[b]	$11,496	N.A.
Compliance Cost per Employee[c]	$ 5,410	N.A.
Compliance Cost as Percent of Net Sales[d]	1.97 %	N.A.
Compliance Cost Ratio[e]	N.A.	-
Electric Utilities		
Number of Establishments	0	2,733
Compliance Cost per Establishment[a]	N.A.	$ 218
Compliance Cost per Exposed Worker[b]	N.A.	$ 2
Compliance Cost per Employee[c]	N.A.	$ 2
Compliance Cost as Percent of Net Sales[d]	N.A.	0.00 %
Compliance Cost Ratio[e]	N.A.	-

EXHIBIT J-2: (continued)
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	Small Establishments (< 20 Employees)	Large Establishments (≥ 20 Employees)
Operators of Apartment Buildings		
Number of Establishments	89,139	3,871
Compliance Cost per Establishment[a]	$ 111	$ 1,577
Compliance Cost per Exposed Worker[b]	$ 43	$ 43
Compliance Cost per Employee[c]	$ 36	$ 28
Compliance Cost as Percent of Net Sales[d]	0.06 %	0.01 %
Compliance Cost Ratio[e]	1.28	-
Operators of Other Buildings		
Number of Establishments	89,139	3,871
Compliance Cost per Establishment[a]	$ 127	$ 1,208
Compliance Cost per Exposed Worker[b]	$ 43	$ 43
Compliance Cost per Employee[c]	$ 41	$ 22
Compliance Cost as Percent of Net Sales[d]	1.10 %	1.20 %
Compliance Cost Ratio[e]	1.86	-

---

[a] OSHA published cost per establishment only for small establishments and all establishments. Cost per large establishment was computed by subtracting costs associated with small establishments from total costs and dividing by the number of large establishments.

[b] Results published by OSHA.

[c] Computed from OSHA data by dividing total estimated cost for each industry size class by the number of employees in that size class.

[d] Computed from OSHA data by dividing cost per establishment by Net Value of Construction Work/Sales per Establishment.

[e] Ratio of cost per employee for small establishments to cost per employee for large establishments.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, except as otherwise noted.

3. Effects of the Regulation on Small Establishments

Exhibit J-2 shows OSHA's estimates of cost per establishment and per exposed worker for small establishments in each industry, as well as similar results for large establishments computed from OSHA data. Exhibit J-2 also shows estimates of cost per employee and as a percent of net sales for both small and large establishments, which were computed from OSHA data. These results suggest mostly proportionate impacts on small establishments. This finding warrants some examination.

a. OSHA Estimation Procedures and Their Implications

OSHA developed its total cost estimates for each industry by aggregating unit costs that are generally based on projects, crews, workers, or some measure of labor input per project. A few costs were estimated per establishment, but where multiple crews were expected to be fielded simultaneously, the cost estimates assumed that each crew would have to have the appropriate equipment (e.g., HEPA-filtered vacuums). OSHA then allocated costs associated with each construction activity of each project to large and small establishments in an industry in proportion to the number of exposed workers in large and small establishments in that industry. This allocation is approximately (although not precisely) equivalent to assuming that costs are proportional to employees.

The appropriateness of these assumptions can be assessed in part by examining the characteristics of the crews involved. The issue is whether, at the crew level, a small establishment is likely to encounter diseconomies of small scale in complying the regulation. Exhibit J-3 shows the number of establishments in each affected industry, the mean employment of small establishments (fewer than 20 employees), and OSHA's estimates of mean crew size and numbers of crews for each construction activity involving lead. Exhibit J-3 shows that:

- o In most industries, the mean small establishment has substantially more employees than the mean crew size.[38] Thus the mean small establishment need not incur disproportionate per-employee costs to equip a crew merely because the crew is smaller than average.

- o In all construction activities, the number of crews is smaller than the number of establishments (in all industries) performing the activity. This suggests that there

[38] The exceptions are:

- o Small highway and street construction contractors (for bridge rehabilitation);
- o Small floor laying contractors (for all activities);
- o Small roofing contractors (for installation of tern roofing);
- o Small wrecking and demolition contractors (for commercial/industrial demolition); and
- o Small Miscellaneous trade contractors, NEC (for industrial process equipment).

is a degree of specialization in work on construction projects involving the hazard of lead exposure; not all contractors do this work. While this means that OSHA has understated the impact per affected establishment, specialization tends to support the assumption of similar cost per worker:

EXHIBIT J-3:

CHARACTERISTICS OF CREWS EXPOSED TO LEAD IN CONSTRUCTION

	Number of Establishments			**Crews**	
Industry	**Small**	**Large**	**Mean Employment of Small Establishments**[a]	**Mean Size**	**Number**
Residential Housing, Single Family	88,170	2,208	3.5		
Private In-Place Management				2	17,528
Res. Remodeling/Renovation				2	89,272
Residential Housing, Multi Family	7,233	910	4.7		
Res. Remodeling/Renovation				2	89,272
Operative Building Contractors	19,280	1,486	4.1		
Private In-Place Management				2	17,528
Res. Remodeling/Renovation				2	89,272
Industrial Buildings and Warehouses	5,511	1,503	6.2		
Petroleum Tank Repainting				3	1,455
Ind. Fac. Maint./Renovation				3	1,703
Com. Remodeling/Renovation				3	182,798
Other Nonresidential Buildings	25,713	5,624	5.9		
Com. Remodeling/Renovation				3	182,798
Highway and Street Construction Contractors	7,734	3,252	5.6		
Bridge Repainting				4	6,140
Bridge Rehabilitation				6	5,992
Bridge and Tunnel	629	530	7.9		

Industry	Number of Establishments: Small	Large	Mean Employment of Small Establishments[a]	Crews: Mean Size	Number
Highway Contractors					
Bridge Repainting				4	6,140
Bridge Rehabilitation				6	5,992
Plumbing Contractors	63,154	6,412	4.7		
Pipe Lead Joints				3	5,112
Lead Water Lines				1	41,042

EXHIBIT J-3: (continued)

CHARACTERISTICS OF CREWS EXPOSED TO LEAD IN CONSTRUCTION

Industry	Number of Establishments		Mean Employment of Small Establishments[a]	Crews	
	Small	Large		Mean Size	Number
Painting Contractors	28,390	1,477	3.8		
Bridge Repainting				4	6,140
Water Tank Repainting				3	1,704
Petroleum Tank Repainting				3	1,455
Public House Lead Abatement				3	964
Private House Lead Abatement				3	3,115
Public In-Place Management				2	94
Private In-Place Management				2	17,528
Ind. Fac. Maint./Renovation				3	1,703
Com. Remodeling/Renovation				3	182,796
Res. Remodeling/Renovation				2	89,282
Tower Maintenance				3	2,444
Electrical Work Contractors	44,380	5,054	4.8		
Ind. Fac. Maint./Renovation				3	1,703
Com. Remodeling/Renovation				3	182,796
Electrical Cable Splicing				3	1,667

Industry	Small	Large	Mean Employment of Small Establishments[a]	Crews Mean Size	Crews Number
Plastering Contractors	14,660	3,149	5.4		
Public In-Place Management				2	94
Private In-Place Management				2	17,528
Com. Remodeling/Renovation				3	182,796
Res. Remodeling/Renovation				2	89,282
Reinsulation Over Mineral Wool				2	9,169
Carpentry Work Contractors	32,580	3,429	3.6		
Com. Remodeling/Renovation				3	182,796
Res. Remodeling/Renovation				2	89,282
Floor Laying Contractors	7,752	422	1.7		
Com. Remodeling/Renovation				3	182,796
Res. Remodeling/Renovation				2	89,282
Roofing Contractors	22,870	2,803	5.0		
Com. Remodeling/Renovation				3	182,796
Res. Remodeling/Renovation				2	89,282
Install Tern Roofing				7	576

EXHIBIT J-3: (continued)

CHARACTERISTICS OF CREWS EXPOSED TO LEAD IN CONSTRUCTION

	Number of Establishments			Crews	
Industry	**Small**	**Large**	**Mean Employment of Small Establishments[a]**	**Mean Size**	**Number**
Structural Steel Erection Contractors	3,205	812	6.7		
Bridge Rehabilitation				6	5,992
Ind. Fac. Maint./Renovation				3	1,703
Wrecking and Demolition	1,088	512	5.3		
UST Demolition				2	144
Com./Ind. Demolition				6	1,240

Installation/Erection of Building Equipment	3,021	756	5.7			
Babitting/Recabling Elevators				2		2,250
Misc. Trade Contractors NEC	21,533	1,666	4.7			
UST Demolition				2		144
Public House Lead Abatement				3		964
Private House Lead Abatement				3		3,115
Public In-Place Management				2		94
Private In-Place Management				2		17,528
Ind. Fac. Maint./Renovation				3		1,703
Industrial Process Equipment				5		82
Industrial Vacuuming				3		131
Install Radiation Shielding				2		20
Com. Remodeling/Renovation					3	182,798
Res. Remodeling/Renovation				2		89,272
Reinsulation Over Mineral Wool				2		9,167
Glass Products Manufacturers	979	0	4.3			
Stained Glass Window Removal				2		104
Operators of Apartment Buildings & Other Buildings	89,139	3,871	3.1			
Private In-Place Management				2		17,528

[a] Computed as the total number of employees divided by OSHA's estimate of the total number of crews for each industry.

SOURCE: U.S. Department of Labor, OSHA, Office of Regulatory Analysis.

- The possibility of specialization enlarges the safety margin in assuming that small establishments doing lead work have similar sized crews as large establishments doing the same work.
- Specialization also suggests that disproportionate impacts on small establishments will be somewhat self-limiting, because these establishments always have options that do not involve lead exposure.
- If only some small establishments specialize in lead-related work (rather than all small establishments in an industry), it becomes much more likely that small establishments will be able to find enough work for their crews to spread costs over a substantial number of projects.

This interpretation of crew size is given additional credence by the three industries in which compliance cost per employee for small establishments most substantially exceeds that of large establishments:

- o Small floor laying contractors have fewer mean employees (1.7) than the mean crew sizes for the work performed (2 or 3).

- o Small wrecking and demolition contractors have fewer mean employees (5.6) than the mean crew size for the principal work performed (6).

- o Small structural steel erection contractors have almost as few mean employees (6.7) as the mean crew size for bridge rehabilitation (6), and there are fewer establishments in bridge and tunnel highway contractors and structural steel erection contractors combined than the number of bridge rehabilitation crews.

b. Potential for Scale Economies in Compliance Activities

Exhibit J-4 summarizes factors that OSHA found affected each compliance cost. Costs that vary per worker or per crew, or with exposure levels or blood levels, do not have significant potential for economies of scale at the establishment level. If crews of small contractors work as often as crews of large contractors, variation of costs with the number of worker days or project days will not create economies of scale. Economies of scale, however, exist in the following compliance activities:

- o Crews of up to five workers, which are large relative to the mean number of employees for small establishments in most industries, can get by with one HEPA vacuum, and larger HEPA vacuums can serve multiple purposes. Scale economies may add 50 percent to the cost per employee of small contractors.

- o The fixed cost of preparing a worker training course is estimated to be approximately equal to the time costs of training a worker for initial training and about one third more than the time costs of training a worker for refresher training. Training costs per employee will be about one quarter higher for an establishment that trains three workers (one crews) than an establishment that trains nine workers (about three crews).

- o Change areas and decontamination facilities are typically provided in trailers that can accommodate 10 to 15 workers. A small contractor that provides these facilities for three workers (one crew) will bear per-employee costs four times as high as a contractor that can use such facilities to capacity. In practice, double costs for small establishmens appears to be a more reasonable average.

EXHIBIT J-4:

PRINCIPAL FACTORS AFFECTING INDIVIDUAL COMPLIANCE ACTIVITY COSTS

Compliance Activity	Key Factors	Additional Information

Project Supervision	Project Day Crew	No scale economies if crews have steady work.
Exposure monitoring	Start of Job Activity x Worker Exposure	Several activities on one project may be monitored by one IH. Maximum of 3 workers/activity allows scale economies for large projects.
Local Exhaust Ventilation	Crew	Portable system
HEPA Vacuuming	Crew/Workers	One unit for up to 5 workers. Two or three units for more.
Compliance Plan	Project	Conditions vary at each site.
Warning Signs	Project	Vary with size of project.
Worker Training	Course Worker	Development cost of course must be incurred only once.
Respiratory Protection	Worker Worker Day	No scale economies of crews have steady work.
Protective Clothing	Worker Worker Day	No scale economies if crews have steady work or reusable clothing is used.
Change Areas and Decontamination Facilities	Project Site	Trailers can accommodate 10 - 15 workers.
Eating Facilities	Crew	Minimum: Benches seating three.
Biological Monitoring	Worker Assignment Exposure Blood Levels	
Recordkeeping	Worker	Involves keeping biological and medical records and notifying workers of problems.

These three cost elements account for a substantial fraction of overall compliance costs. HEPA vacuuming is only 1.22 percent of total compliance costs, and worker training is only 2.36 percent of total costs, but change areas and decontamination facilities account for 27.07 percent of compliance costs. Multiplying the individual increases in small contractor's cost per employee by these fractions of total cost and summing the results produces an overall increase in small contractor costs due to economies of scale of 28.27 percent.

c. Start-Up Costs

OSHA's analysis deals almost entirely with annual incremental recurring costs for the standard. OSHA estimated first-year start-up costs to be $300 million, which is about $79 million per year, if amortized over five years -- or about 16 percent of the estimated annual recurring costs of $490 million. OSHA noted that this start-up cost was associated with worker training, biological monitoring, medical examinations, and medical removal protection benefits. Of these items, only worker training has economies of scale, and OSHA's estimate for fixed costs of initial training was considerably lower for initial training than for refresher training. If the cost base is enlarged by one sixth, the small-contractor cost disadvantage falls to approximately 25 percent.

d. Revised Comparative Costs

Exhibit J-5 shows revised estimates of compliance costs. These are based on costs shown in Exhibit J-2, but with small establishment cost per employee increased by 25 percent.

4. Conclusion

The standard for lead exposure in construction is difficult to interpret in a definitive way. OSHA's analysis appears to be biased toward constant returns to scale, and the compliance cost ratios are almost too constant across construction industries. A review of actual compliance activities, however, suggests that most of the costs are proportional to the number of workers, worker-days, or crews. Thus a finding of costs for small businesses that are not greatly disproportionately high seems plausible. In this regard, it is somewhat striking that the two construction industries where per-employee costs are four or five times as high for small businesses as for large ones -- floor laying and structural steel -- are also the industries where average employment size for small establishments is very substantially below the efficient crew size assumed in the analysis.

EXHIBIT J-5: LEAD EXPOSURE IN CONSTRUCTION
REVISED COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	Small Establishments (< 20 Employees)	Large Establishments (≥ 20 Employees)
Residential Housing - Single Family		
Compliance Cost per Employee[a]	$ 500	$ 409
Compliance Cost Ratio[b]	1.22	-
Residential Housing - Multi Family		
Compliance Cost per Employee[a]	$ 245	$ 193
Compliance Cost Ratio[b]	1.27	-
Operative Building Contractors		
Compliance Cost per Employee[a]	$ 251	$ 203
Compliance Cost Ratio[b]	1.24	-
Industrial Buildings and Warehouses		
Compliance Cost per Employee[a]	$ 271	$ 217
Compliance Cost Ratio[b]	1.25	-
Other Nonresidential Buildings		
Compliance Cost per Employee[a]	$ 316	$ 254
Compliance Cost Ratio[b]	1.24	-
Highway and Street Construction Contractors		
Compliance Cost per Employee[a]	$ 3,204	$ 2,560
Compliance Cost Ratio[b]	1.25	-
Bridge and Tunnel Highway Contractors		
Compliance Cost per Employee[a]	$ 2,385	$ 1,905
Compliance Cost Ratio[b]	1.25	-
Plumbing Contractors		
Compliance Cost per Employee[c]	$ 15	$ 12
Compliance Cost Ratio[b]	1.25	-
Painting Contractors		
Compliance Cost per Employee[a]	$ 1,893	$ 1,510
Compliance Cost Ratio[b]	1.25	-
Electrical Work Contractors		
Compliance Cost per Employee[a]	$ 289	$ 234
Compliance Cost Ratio[b]	1.24	-
Plastering Contractors		
Compliance Cost per Employee[a]	$ 248	$ 195
Compliance Cost Ratio[b]	1.27	-

EXHIBIT J-5: (continued)
LEAD EXPOSURE IN CONSTRUCTION
COMPLIANCE COSTS BY INDUSTRY AND ESTABLISHMENT SIZE

Industry	Small Establishments (< 20 Employees)	Large Establishments (≥ 20 Employees)
Carpentry Work Contractors		
Compliance Cost per Employee[a]	$ 738	$ 583
Compliance Cost Ratio[b]	1.27	-
Floor Laying Contractors		
Compliance Cost per Employee[a]	$ 1,304	$ 286
Compliance Cost Ratio[b]	4.56	-
Roofing Contractors		
Compliance Cost per Employee[a]	$ 429	$ 339
Compliance Cost Ratio[b]	1.26	-
Structural Steel Erection Contractors		
Compliance Cost per Employee[a]	$10,907	$ 2,229
Compliance Cost Ratio[b]	4.89	-
Wrecking and Demolition		
Compliance Cost per Employee[a]	$ 2,756	$ 2,218
Compliance Cost Ratio[b]	1.24	-
Installation/Erection of Building Equipment		
Compliance Cost per Employee[a]	$ 10	$ 8
Compliance Cost Ratio[b]	1.25	-
Miscellaneous Trade Contractors, NEC		
Compliance Cost per Employee[a]	$ 430	$ 346
Compliance Cost Ratio[b]	1.24	-
Operators of Apartment Buildings		
Compliance Cost per Employee[a]	$ 45	$ 28
Compliance Cost Ratio[b]	1.61	-
Operators of Other Buildings		
Compliance Cost per Employee[a]	$ 51	$ 22
Compliance Cost Ratio[b]	2.33	-

[a] Adjusted from Exhibit J-2; multiplied by 1.25.

[b] Ratio of cost per employee for small establishments to cost per employee for large establishments.

K. EPA ACID RAIN IMPLEMENTING REGULATIONS

1. Objective and Summary of the Regulation

Acid rain has been linked to damage to ecosystems, construction and cultural materials, and public health, and precursor gaseous pollutants have been linked to local ozone buildup, suspended particulate matter, and reduced visibility. Two of the three pollutants generally considered to be most heavily involved in the formation of acid rain, SO_2 and NO_X, arise almost entirely from power plants and motor vehicles. To address these issues, Title IV of the Clean Air Act (CAA) Amendments of 1990 set three major goals:

- o A reduction of SO_2 emissions of 10 million tons per year below 1980 levels by the year 2000;
- o A nationwide cap on SO_2 emissions beginning in the year 2000; and
- o A two million ton reduction in NO_X emissions.

These reductions are to be achieved in two phases. Phase I, effective in 1995, applies to the largest, highest-emitting power plants. Phase II applies more stringent requirements to virtually all fossil fuel (coal-burning, oil-fired, and gas-fired) power plants.

Title IV represents a significant departure from the more traditional "command and control" approach to environmental regulation. The Acid Rain Program includes a system of allowance allocations. Each generating unit is allocated transferable emissions "allowances," which allow one ton of SO_2 emission. Units may buy, sell, auction, or bank the allowances. Thus SO_2 emission reduction will be done by units that can accomplish it most economically, and these units can then sell their allowances. Units with more difficulty reducing SO_2 emissions can purchase allowances on the market.

The acid rain "implementating regulations" RIA directly covers the related costs of four classes of regulations:

- o The SO_2 allowance system (tracking and trading regulations),
- o SO_2 monitoring regulations;
- o Permits; and
- o Auctions, direct sales, and independent power producer (IPP) written guarantee regulations.

The RIA first estimated the cost of the regulations as if they had been promulgated without the "implementing regulations." It then estimated the incremental costs (and savings) attributable to the implementing regulations themselves. Thus the RIA produced two estimates of regulatory impacts: Without and with the implementing regulations.

2. Estimated Costs of Compliance With the Regulation

EPA's analysis focused on electric utility industry units, which produce most of the emissions involved in power generation. The affected existing utility-owned units included the following:

- o Phase I regulations affected:
    - One Federal/public power entity operating one unit with 9 gigawatt (GW) capacity,
    - Five cooperative systems operating 15 units with 4 GW capacity,
    - Fifty-two investor-owned systems operating 216 units with 75 GW capacity, and
    - Three municipal systems operating 4 units with 1 GW capacity.

- o Phase II regulations affect:
    - Thirteen Federal/public power entities operating 116 unit with 32 GW capacity,
    - Twenty-seven cooperative systems operating 89 units with 23 GW capacity,
    - One hundred thirty-two investor-owned systems operating 1,157 units with 392 GW capacity, and
    - Sixty-seven municipal systems operating 183 units with 24 GW capacity.

Exhibit K-1 shows the aggregate annualized costs of the "core" acid rain regulations and the implementing regulations. These estimates indicate that:

- o Annualized costs of acid rain regulations without implementing regulations are \$1.6 billion to \$2.5 billion.

- o The implementing regulations:
    - Have direct costs of:
        - . \$15 million to \$30.2 million for the allowance system, and
        - . \$4.9 million for permits, but
    - Produce savings of:
        - . \$700 million to \$1.0 billion in direct compliance costs, and
        - . \$8.5 million in monitoring costs.

- o Net annualized costs of the acid rain regulations are \$894 million to \$1.5 billion.

3. Effects of the Regulation on Small Establishments

For purposes of regulatory flexibility analysis, EPA adopted the SBA definition of "small" electric utility -- one that generates a total of less than 4 billion kwh per year. Not all small utilities are affected by the acid rain regulations. The regulations do not apply to units that do not use fossil fuels; and existing simple gas turbines and existing units smaller than 25 MW capacity are exempt. EPA identified 105 small utilities affected by the regulation, just under half of the 241 utilities affected by Phase II. Small utilities accounted for about 5 percent of total electricity generated in 1988. Small utilities have characteristics that are distinct from those of large utilities:

EXHIBIT K-1

ANNUALIZED COSTS AND COST SAVINGS OF ACID RAIN REGULATIONS[a]

Cost	Costs of SO_2 Reductions Without Implementation Regulations	Costs of Implementation Regulations	Costs of SO_2 Reductions With Implementation Regulations
Cost of SO_2 Reductions	$1,400 to $2,300	- $700 to - $1,000	$ 700 to $1,300
Implementation			
Allowance System			
Transactions Tracking	$ 0	$14.8 to $29.5	$14.8 to $29.5
Conservation & Renewable Energy	$ 0	$ 0.1	$ 0.1
Auction, Sale & IPP Guarantee	$ 0	$ 0.1 to $ 0.6	$ 0.1 to $ 0.6
Monitoring	$ 182.6	- $ 8.5	$ 174.1
Permits	$ 0	$ 4.9	$ 4.9
SUBTOTAL	$ 182.6	$11.5 to $26.6	$194.0 to $209.2
TOTAL COSTS (SAVINGS)	$1,583 to $2,483	- $689 to - $973	$ 894 to $1,509

[a] Annualized costs for 1993 to 2010 are computed using the total costs and a discount rate of 3 percent per year. Total costs are present values of costs incurred in each year (with capital costs annualized at 7 percent per year) discounted to 1992 at 3 percent per year. Ranges cover EPA Low Scenario and High Scenario.

SOURCE: Regulatory Impact Analysis of the Final Acid Rain Implementation Regulations.

- o Small utilities are far more likely to be owned by municipalities (63 of 105, or 60 percent) than are large utilities (5 of 132, or 4 percent), and these small municipal utilities are likely to be operated by small municipalities (38 of 63, or 60 percent).

- o Small utilities usually operate only one unit; large utilities typically operate multiple units. Small utilities tend to rely exclusively on oil/gas or coal, and very small utilities tend to rely on oil or gas, while large utilities tend to use different fuels at different units.

- o It is generally more expensive per kilowatt-hour (kwh) of electricity for small utilities to reach a given emissions target than for large utilities to reach the same target. Several factors contribute to this:
  - Small utilities require more fuel per kwh produced, and this makes fuel switching more expensive.
  - Small utilities incur higher capital costs per kwh because of economies of scale in equipment.
  - Small utilities tend to be older (leaving less time to amortize control equipment) and to have less space (making equipment design more difficult) than large utilities.

The cost disadvantages of small utilities were offset to some extent in the allowance allocation mechanism. Units with less than 250 MW capacity were granted full allowances equivalent to baseline emissions, while larger units were expected to reduce emissions. Moreover, most units with less than 250 MW capacity (about the median of small utilities) received additional allowances, either because they had emissions rates of less than 1.2 lb/mmBtu, or because (while they failed to meet this level) they had less than 75 MW capacity.

EPA estimated small utility costs by developing six model small units. These units varied by size (over 250 MW and less than 250 MW) and by fuel (coal, oil, and gas). A number of specific assumptions went into the cost estimates.[39] Exhibit K-2 shows the results of this analysis. In general:

- o Unit costs are highest for coal units and smallest for gas units.

- o Unit costs are higher for the small units with over 250 MW capacity than for the units with under 250 MW capacity. This result is due to the more favorable allocation of allowances to the smaller units.

---

[39] These included assumptions on:
- Compliance strategy without and with the implementing regulations (see footnotes to Exhibit K-2),
- Transaction costs -- four times as high for small utilities as for the industry as a whole, and
- Monitoring -- the choice of a CEMS option.

- Units of all fuel types with under 250 MW capacity have compliance costs that are 1.0 to 1.4 percent of sales. Of units with over 250 MW capacity, coal and oil units have much higher unit costs -- about 7 percent of sales -- while gas-fired unit has much lower costs -- under 0.1 percent of sales.

EXHIBIT K-2: COST OF THE ACID RAIN PROGRAM FOR SMALL MODEL UNITS ($1,000s)

Unit Fuel Unit Size, Cost Element	Costs of SO_2 Reductions Without Implementation Regulations	Costs of Implementation Regulations	Costs of SO_2 Reductions With Implementation Regulations
COAL			
Over 250 MW[a]			
SO_2 Reductions	$23,516	- $16,220	$ 7,296
Transactions	$ 0	$ 1,946	$ 1,946
Monitoring	$ 55	$ 55	$ 109
Permits	$ 0	$ 3	$ 3
TOTAL	$23,571	- $14,216	$ 9,355
PERCENT OF SALES[b]	18.7%	- 11.3%	7.42%
Under 250 MW[c]			
SO_2 Reductions	$ 0	$ 0	$ 0
Transactions	$ 0	$ 0	$ 0
Monitoring	$ 55	$ 55	$ 109
Permits	$ 0	$ 3	$ 3
TOTAL	$ 55	$ 58	$ 113
PERCENT OF SALES[b]	0.652%	0.690%	1.34%
OIL			
Over 250 MW[d]			
SO_2 Reductions	$ 2,655	- $ 810	$ 1,845
Transactions	$ 0	$ 97	$ 97
Monitoring	$ 55	$ 70	$ 125
Permits	$ 0	$ 3	$ 3
TOTAL	$ 2,710	- $ 639	$ 2,070
PERCENT OF SALES[b]	8.60%	- 2.03%	6.57%
Under 250 MW[e]			
SO_2 Reductions	$ 0	- $ 62	- $ 62
Transactions	$ 0	$ 7	$ 7
Monitoring	$ 55	$ 70	$ 125
Permits	$ 0	$ 3	$ 3
TOTAL	$ 55	$ 19	$ 74

PERCENT OF SALES[b]	0.701%	0.242%	0.943%

EXHIBIT K-2: COST OF THE ACID RAIN PROGRAM FOR SMALL MODEL UNITS (continued)

Unit Fuel Unit Size, Cost Element	Costs of SO_2 Reductions Without Implementation Regulations	Costs of Implementation Regulations	Costs of SO_2 Reductions With Implementation Regulations
GAS			
Over 250 MW[f]			
SO_2 Reductions	$ 0	- $ 66	- $ 66
Transactions	$ 0	$ 8	$ 8
Monitoring	$ 55	$ 49	$ 104
Permits	$ 0	$ 3	$ 3
TOTAL	$ 55	- $ 6	$ 49
PERCENT OF SALES[b]	0.068%	- 0.008%	0.06%
Under 250 MW[f]			
SO_2 Reductions	$ 0	- $ 7	- $ 7
Transactions	$ 0	$ 1	$ 1
Monitoring	$ 55	$ 49	$ 104
Permits	$ 0	$ 3	$ 3
TOTAL	$ 55	$ 47	$ 101
PERCENT OF SALES[b]	0.675%	0.577%	1.25%

[a] Cost based on the assumption that unit installs scrubbers in the absence of implementing regulations but switches to low-sulphur coal and buys allowances with implementing regulations.

[b] Based on the assumption of 6 cents per kwh.

[c] Cost based on the assumption that unit makes no response because of just adequate allowances.

[d] Cost based on the assumption that unit switches to gas in the absence of implementing regulations but buys allowances with implementing regulations.

[e] Cost based on the assumption that unit makes no response in the absence of implementing regulations and sells allowances with implementing regulations.

[f] Cost based on the assumption that unit makes no response in the absence of implementing regulations but may sell allowances with implementing regulations.

SOURCE: Regulatory Impact Analysis of the Final Acid Rain Implementation Regulations. Failure of numbers to sum to totals, due to rounding, is in the original.

- o The implementing regulations benefitted all three units with capacity over 250 MW, and the cost savings for the larger coal and oil units were quite substantial. Units with less than 250 MW capacity (which incurred relatively low costs without the implementing regulations) actually incurred increased costs due to these regulations.

Several factors complicate the comparison of costs of small utilities and large utilities:

- o EPA estimated aggregate (and thus large-utility) costs with a linear programming model, rather than with model plants used for small utilities;

- o The aggregate estimates are presented with a "high" and "low" scenario, rather than a single cost estimate; and

- o The treatment of fuel type is not as explicit in the treatment of aggregate costs as it is in the small-utility analysis.

Nevertheless, the RIA does include national aggregate results per kwh, which are included in Exhibit K-3. This comparison indicates that:

- o Small coal and oil utilities with over 250 MW capacity have unit costs that are several times the national average for all utilities. Even after the implementing regulations, these small units have costs six or seven times the national average.

- o The implementing regulations (which allow trading) provide the small coal and oil units with capacity over 250 MW greater cost savings per kwh than large utilities receive. These savings do not significantly reduce the disproportionate cost on small coal units, however, and the disproportionate cost on small oil units actually increases.

- o Other small units generally have disproportionately <u>smaller</u> costs than large utilities, principally because of the favorable allocation of allowances. Since they do not benefit much from trading allowances, they incur additional costs absolutely and lose ground relatively as a result of the implementing regulations. Except for coal units with under 250 MW capacity, however, all of these smaller small units continue to have unit costs that are equal to or lower than the larger units.

In a sense, the small units with over 250 MW capacity represent a worst case. EPA selected this model size as slightly over the median size for small units. Compared with large utilities, these units are so small that they face significant disadvantages due to economies of scale and other factors noted above. On the other hand, as EPA noted, this size unit is marginally too large to receive any significant number of additional allowances, which cushion the impacts for yet smaller units. Among other things, this case represents an interesting illustration of the proposition that a mechanism designed generally to reduce costs and improve efficiency of achieving a regulatory goal --

allocations of tradable emission rights -- can also be used in a manner (i.e., targeted allocation) to enhance regulatory flexibility.

EXHIBIT K-3: COST OF THE ACID RAIN PROGRAM, BY UNIT SIZE

Unit Fuel Unit Size, Cost Element	Costs of SO_2 Reductions Without Implementation Regulations	Costs of Implementation Regulations	Costs of SO_2 Reductions With Implementation Regulations
NATIONAL AGGREGATE[a]			
Cost as a Percent of Sales[b]			
SO_2 Reductions	2.313 %	- 1.335 %	0.978 %
Transactions	0.000 %	0.015 %	0.015 %
Monitoring	0.093 %	0.008 %	0.102 %
Permits	0.000 %	0.002 %	0.002 %
TOTAL	2.407 %	- 1.310 %	1.097 %
COST RATIOS[c] **FOR MODEL SMALL UNITS**			
Coal: Over 250 MW	7.77	8.63	6.76[d]
Under 250 MW	0.27	- 0.53	1.22[d]
Oil: Over 250 MW	3.57	1.55	5.99[d]
Under 250 MW	0.29	- 0.18	0.86[d]
Gas: Over 250 MW	0.028	0.006	0.05[d]
Under 250 MW	1.00	- 1.00	1.00[d]

[a] Estimated by dividing total cost by total generation.

[b] Based on the assumption of 6 cents per kwh.

[c] Ratio of compliance costs as a percent of sales for small utilitites to compliance costs as a percent of sales for large utilities.

[d] Cost ratios for SO_2 reductions (without implementing regulations) and for implementing regulations themselves have different denominators. Thus they do not sum to the cost ratio for SO_2 with implementing regulations.

SOURCE: Regulatory Impact Analysis of the Final Acid Rain Implementation Regulations. Failure of numbers to sum to totals, due to rounding, is in the original.

4. Conclusion

The acid rain implementing regulations impose costs per-employee on small coal-fired and oil-fired utilities that are six or seven times as large as per-employee costs of large utilities. This disparity is due in large part to technical economies of scale in generating equipment and fuel efficiency, as well as generally greater age of smaller utilities. These economies of scale are not found in gas-fired utilities. EPA's small-utility exemption from SO_2 requirements, which applies only to utilities with less than 250 MW, essentially neutralized the diseconomies of small size leaving the per-employee cost more or less (depending on fuel type) equal to that of larger utilities.

L. EPA PHASEOUT OF OZONE DEPLETING CHEMICALS

1. Objective and Summary of the Regulation

In this action, EPA promulgated stratospheric ozone protection regulations required under Section 604 of the Clean Air Act (CAA). The rule is also pursuant to the United States' obligation under the Montreal Protocol for ozone depleting substances. In the primary components of the rule, EPA:

- Apportioned baseline allowances to companies that produce ozone depleting substances to produce or import them;
- Allocated decreasing amounts of those allowances to the companies according to a phaseout schedule;
- Applied an 18-month cap (from July 1, 1991 to December 31, 1992) on production and consumption, as required under the Montreal Protocol; and
- Permitted the transfer of allowances.

Benefits associated with the reduction of ozone depleting substances stem from reduced cancer risks. By allowing the transfer of permits, the rule intended to accomplish the reduction in the most economically efficient manner.

2. Estimated Costs of Compliance With the Regulation

The RIA examined costs for phaseout of chlorofluorocarbons (CFCs) and halons, methyl chloroform (MCF), and carbon tetrachloride. The three classes of control options for CFCs (and the other substances) considered were:

- Switching from CFC-using products to other products that are entirely different;

- Switching from CFC-based products to other similar products that use other chemicals; and

- Switching from CFC-based to non-CFC-based processes.

The RIA analyzed the following applications:

- o CFC/halon applications, including:
  - Mobile air conditioners,
  - Refrigeration,
  - Flexible PU foam, both molded and slabstock,
  - Rigid insulating foams,
  - Solvents,
  - Sterilants,
  - Aerosols,
  - Total flooding systems (H-1301), and
  - Portable fire extinguishers (H-1211); and

- o MCF applications, including:
  - Conveyorized vapor degreasing,
  - Open-top vapor degreasing,
  - Cold cleaning,
  - Aerosols,
  - Adhesives,
  - Coatings and inks, and
  - Miscellaneous applications.

The analysis identified specific control options for each of these applications; estimated penetration rates of each; and assessed the timing of changes with respect to whether the phaseout deadlines could be met. Costs were estimated as aggregate costs or unit costs for the application, process, and/or control option, without specific reference to establishments. Thus the cost chapter of the RIA did not produce costs that could be related to employment, financial characteristics, or other metric of a firm or establishment. The RIA was structured to support a comparison of benefits and costs; it lacked the standard chapter on economic impacts.

3. Effects of the Regulation on Small Establishments

Costs were estimated in appendices to the RIA. The regulatory flexibility analysis, which bears a strong resemblance to other cost estimates, was also an appendix. The RFA focused on one aspect of economic impacts -- compliance costs as a percent of revenues. The RFA began with a triage process to determine which applications posed the greatest potential impact. This was largely a matter of assessing the percent of manufacturing cost represented by the ozone depleter. This test was supplemented by reference to the elasticity of demand; it was noted, for example, that the market for fire extinguishers could absorb substantial price increases without a significant loss of sales. The foam industry (SIC 3086), where CFCs are common, and the aerosol can industry (SIC 2842), where MCF is common, were identified as having the highest potential for impacts and were selected for further analysis.

CFCs/Foam. EPA identified 18 sectors within the foam industry, which were aggregated into five groups. Exhibit L-1 shows the values of shipments and CFC cost shares in these sectors. In a majority of these sectors, CFCs account for over 10 percent of the value of shipments. Exhibit L-2 generally reflects the analytical approach.

For each type of control option, EPA estimated market penetration percentages. EPA then estimated unit incremental capital costs, reformulation and **EXHIBIT L-1: FOAM INDUSTRY OVERVIEW, BY SECTOR**

Industry Sector	Value of Shipments ($Millions)	CFC Costs as a Percent of Shipment Value
Flexible Foam		
Slabstock	$ 968[a]	1.7%
Molded	$ 504[a]	0.9%
Rigid Packaging Foam		
Extruded Polystyrene Sheet	$ 312	3.3%
Polypropylene	$ 25	15.4%
Rigid Polyurethane Foam	$ 120	4.2%
Polyethylene	$ 38	17.4%
Rigid Insulation Foam (Poured)		
Building Construction	$ 31	15.6%
Industrial Construction	$ 5	15.6%
Refrigeration	$ 87	15.6%
Refrigerated Transport	$ 32	15.6%
Rigid Insulation Foam (Boardstock)		
Rigid PU Bunstock (Building)	$ 31	12.5%
Rigid PU Bunstock (Industrial)	$ 6	4.2%
Rigid PU Laminated Boardstock	$ 420	4.3%
Extruded Polystyrene Boardstock	$ 200	2.4%
Phenolic Foam	$ 42	5.8%
Rigid Insulating Foam (Sprayed)		
Building Construction	$ 98	11.5%
Industrial Construction	$ 37	11.5%
Transportation Insulation	$ 16	11.5%
TOTAL FOR FOAM INDUSTRY	$ 2,972	3.9%

[a] Production costs, excluding labor, rather than value of shipments.

SOURCE: Regulatory Impact Analysis: Compliance with Section 604 of the Clean Air Act for the Phaseout of Ozone Depleting Chemicals, Appendix G.

EXHIBIT L-2: COMPLIANCE COSTS FOR FLEXIBLE FOAM (SLABSTOCK)

	Alternative Foams -- Built-Up Cushioning	**Natural/ Synthetic Fiberfill**	**Engineered Plastic Cushioning**	**Water-Blown Foams/Polyol Technology**	**HCFC - 123/141b**
Type of Control Option	Product Subs.	Product Subs.	Product Subs.	Chem./Proc. Subs.	Chemical Subs.
Percent of Market Captured	20%[a]	20%[a]	20%[a]	10%	70%
Capital Costs per MTF	$154	$110	$440	[b]	$ 10[c] $100[d]
Capital Equipment Life (Years)	10	10	20	N.A.	20
Reformulation/Testing Costs per MTF	0	0	0	$44	$11
Incremental Operating Costs per MTF	0	0	0	0	$220
Incremental Chemical or Product Substitution Costs per MTF	$2,000	$ 200	$2,200	$ 75	0
Total Annualized Compliance Costs per MTF	$2,021	$ 215	$2,238	$ 75	$222[c] $230[d]
Compliance Costs as Percent of Baseline Cost[e]	91.9%	9.8%	101.7%	3.4%	10.1%[c] 10.4%[d]

[a] These substitutes collectively capture 20 percent of the market.

[b] Amortized capital costs are included in the increased chemical cost.

[c] Large plant, with output of 5,000 MTF/year.

[d] Small plant with output of 500 MTF/year.

[e] Based on a nominal raw material cost of $2,200/MTF. Labor cost is not included.

SOURCE: Regulatory Impact Analysis: Compliance with Section 604 of the Clean Air Act for the Phaseout of Ozone Depleting Chemicals, Appendix G.

testing costs, operating costs, and chemical or product substitution costs; annualized the costs; and compared them to unit raw material costs of the CFC.

As a regulatory flexibility analysis, this process leaves a great deal to be desired. For four out of five flexible foam control options -- and for all control options assessed for all other foams -- EPA estimated unit costs of a process without regard to scale of production. Thus (with no real attempt at justification) EPA assumed away any disproportionate costs for small entities. Only for water-blown foams/polyol technology (the dominant control option for flexible foam) did EPA use two different sizes of model plant. For these two model plants, the unit capital costs differed by an order of magnitude. It is certainly implausible that unit capital costs do not vary with plant size for other control options, nor is it clear which unit chemical or product substitution costs should be constant.

MCF/Aerosol. Exhibit L-3 shows the results for MCF in aerosol cans. Here the control option assumed was aerosol reformulation without MCF. A model plant approach was used, with different types of equipment as well as different size. The analysis assumed constant unit manufacturing costs for both model plants (although some qualms were expressed about this assumption) and thus implicitly assumed that changes in unit manufacturing costs would also be the same for both plants. In this analysis, differential compliance costs were limited to one-time reformulation costs, including both research & development and marketing.

Although differential costs for phaseout of CFCs in flexible foam and MCF in aerosol cans were probably understated, it is possible to produce summary results, at least with respect to revenue. Cost ratios in terms of revenue (i.e., the ratio of compliance costs as a percent of revenue for a small plant to compliance costs as a percent of revenue for a large plant) were:

- 1.03 for flexible foam; and
- 1.39 for MCF aerosol.

Any attempt to estimate cost ratios in terms of employment (i.e., the ratio of cost per employee for a small plant to the cost per employee for a large plant) is problematic, since the RIA provides no data on employment or employment size class for the model plants. Using revenue or physical output as a basis for estimating employment would just replicate the cost ratios based on revenue. The principal alternative is to make the rather heroic assumption that the model small plants[40] and model large plants[41] have the

[40] Fewer than 20 employees. The mean number of employees in this size establishment is 9.19 in SIC 3068 and 6.24 for SIC 2842 (1987 Census of Manufactures).

mean number of employees in SIC 3086 and SIC 2842, respectively. If this assumption is made, on an annualized basis:

---

[41] 20 or more employees. The mean number of employees in this size establishment is 98.81 in SIC 3068 and 81.69 in SIC 2842 (1987 Census of Manufactures).

EXHIBIT L-3
METHYL CHLOROFORM AEROSOL COMPLIANCE COST DATA FOR MODEL PLANTS

	Large Plant[a]	Small Plant[b]
Annual Production (cans)	16,800,000	4,800,000
Product Manufacturing Cost per Can[c]	$ 0.648	$ 0.648
Chemical Cost per Can	$ 0.270	$ 0.270
One-Time Reformulation Costs		
R&D	$120,000	$ 48,000
Marketing	$ 80,000	$ 32,000
Total	$200,000	$ 80,000
Annualized Reformulation Costs[d]		
Per Plant	$ 47,479	$ 18,992
Per Can	$ 0.0028	$ 0.0040
Reformulation Costs as a Percent of Product Manufacturing Cost	0.44%	0.61%

[a] One rotary line, 140 cans/minute.

[b] One single-index line, 40 cans/minute.

[c] Includes costs of chemical ingredients, packaging (i.e., can, valve, covercup, etc.), labor, and overhead. Manufacturing costs per unit for the large plant are likely to be lower due to volume discounts on raw materials and lower fixed costs per unit of output. Due to lack of data, however, manufacturing costs are assumed to be the same for large and small plants.

[d] Annualized at a 6% discount rate over 5 years.

SOURCE: Regulatory Impact Analysis: Compliance with Section 604 of the Clean Air Act for the Phaseout of Ozone Depleting Chemicals, Appendix G.

- o For SIC 3086 (flexible foam),
  - Compliance costs per employee for a small plant are $12,511,
  - Compliance costs per employee for a large plant are $11,234, and
  - The cost ratio (with respect to employment) is 1.11.

- o For SIC 2842 (MCF aerosol),
  - Compliance costs per employee for a small plant are $3,045,
  - Compliance costs per employee for a large plant are $581, and
  - The cost ratio (with respect to employment) is 5.24.

4. Conclusion

The analysis showed that compliance costs of small businesses were disproportionately high, but only by a relatively small amount. Costs as a percent of revenue are no more than 40 percent higher for small businesses than for large establishments, although this result appears partly due to simplifying assumptions in the analysis. The disparity in costs is due entirely to economies of scale in research and development, product reformulation, and marketing; actual manufacturing costs are assumed to be proportional to output.

M. EPA FUELS AND FUEL ADDITIVES REGISTRATION REGULATIONS

1. Objective and Summary of the Regulation

Section 211(c) of the Clean Air Act (CAA) authorizes EPA to control or prohibit any fuel or fuel additive whose emission products contribute to air pollution which may reasonably be anticipated to endanger the public health or welfare. The registration of fuels and fuel additives (F/FAs) is authorized under Sections 211(b)(2) and 211(e) of the CAA to provide EPA with information that will guide Section 211 regulatory actions.

The registration regulations focus on identification and evaluation of potential adverse health effects associated with F/FA emissions (including both evaporative and combustion emissions). The regulation requires emission characterization, literature search, other data search, and biological testing. The regulation allows existing test data to be submitted in lieu of conducting new duplicative tests.

2. Estimated Costs of Compliance With the Regulation

The registration requirements for F/FAs are organized into three tiers:

- o Tier 1 requires F/FA manufacturers to:
  - Perform a literature search on the health and welfare effects of F/FA emissions,
  - Characterize the emissions, and
  - Provide qualitative exposure information.

- o Tier 2 requires:
  - Biological testing for the examination of subchronic systemic and organ toxicity, and
  - Assessment of specific health effects endpoints.

- o Tier 3 requires other additional tests (when necessary, as determined by review of Tier 1 and Tier 2 data).

The regulation includes a grouping system that allows manufacturers of similar F/FA products to share the costs of compliance. The system includes six fuel families, defined as F/FAs that contain (respectively) more than 50 percent gasoline, diesel, methanol, ethanol, methane, and propane. Within each of these fuel families are three F/FA categories:

- o "Baseline" categories include F/FAs that resemble the base fuel of the fuel family and conform with quantitative limits for particular constituents.

- o "Non-baseline" categories include F/FAs that contain only the chemical elements allowed in the baseline category, but that contain some of the constituents in excess of the allowable limits.

- o "Atypical" categories generally contain chemical elements in addition to those allowed in the baseline categories.

As shown in Exhibit M-1, EPA estimated that 638 manufacturers produce 1,420 fuels products, and 458 manufacturers produce 2,778 fuel additives products, including 20 manufacturers that produce both fuels and fuel additives products. About 15 percent of fuels and 10 percent of fuel additives are "atypical." EPA's estimates of total cost of the registration program were:

- o Tier 1 and Tier 2 costs of $66 million over the first three years (or $22 million per year for three years); and

- o Tier 3 costs of $10 million[42] per year thereafter.

3. Effects of the Regulation on Small Establishments

EPA had concerns about the potential for impacts on small manufacturers of F/FAs. EPA recognized that costs of testing could be large and that small firms were less likely to be members of trade associations or otherwise networked in ways that would allow cost-sharing of testing. EPA had several issues to address in developing regulatory flexibility alternatives. These included defining small F/FA manufacturers and addressing special problems posed by atypical F/FAs.

---

42 Based on an estimate of $1 million per product or group, with 10 products or groups tested annually.

EPA chose to define small manufacturers in terms of value of sales. EPA selected $50 million in sales as the cut-off. In fact, EPA found, most F/FA manufacturers that had less than $50 million in sales also had less than $10 million in

EXHIBIT M-1: MANUFACTURERS OF FUELS AND FUEL ADDITIVES

Manufacturers and Products	Fuels	Fuel Additives
Number of Manufacturers		
Small[a]	465	295
Large[b]	173	163
Total	638[c]	458[c]
Number of Products	1,420	2,778
Manufacturers With Only One F/FA Product		
Number	254	207
Percent	40%	45%
Number of Products per Manufacturer		
Average	2	6
Maximum	16	179
Atypical Products		
Number of Products	220	286
Percent of Products	15%	10%
Number of Manufacturers	83	122

[a] Less than $50 million in sales.

[b] $50 million or more in sales.

[c] Includes 20 manufacturers that manufacture both fuels and fuel additives.

SOURCE: Small Business Impact Analysis of the Fuel and Fuel Additive Registration Program.

sales. EPA considered an "SBA" definition of $3.5 million in sales, but found that this cut-off matched the change in level of impacts less well than $50 million.[43]

Atypical F/FAs posed a practical difficulty. Baseline and non-baseline F/FAs are relatively common. By definition, they share the same set of constituents within each family, although in different proportions. Thus EPA could anticipate that test results for these constituents would be available from large manufacturers of F/FAs in each fuel family. Atypical F/FAs, however, are individually less common and are likely to have constituents that are not found in baseline and non-baseline F/FAs. Thus EPA could not necessarily expect to have test results on the constituents of an atypical F/FA, and this limited EPA's scope for regulatory flexibility alternatives. The constraint on regulatory flexibility was more severe for manufacturers of fuel additives; EPA found that nearly 60 percent of manufacturers of atypical fuel additives (72 of 122) were small. By contrast, EPA found that just over 25 percent of manufacturers of atypical fuels (22 of 83) were small.

To address the distinct features of atypical F/FAs, EPA settled on the following exemptions for small F/FA manufacturers:

- EPA exempted all F/FA manufacturers with less than $50 million in sales from Tier 1 and Tier 2 requirements when registering baseline and non-baseline F/FAs.[44]

- EPA exempted all F/FA manufacturers with less than $10 million in sales from Tier 2 requirements when registering atypical F/FAs.

Exhibit M-2 shows compliance costs for small and large F/FA manufacturers. Because micro data for these manufacturers were available, EPA was able to take median, quartile, minimum, and maximum values for different variables. Although it is not documented, it appears likely that the value of each variable was median, quartile, minimum, or maximum with respect to all manufacturers. Thus the "median" manufacturer (as well as quartile, minimum and maximum manufacturers) may be a composite of median variables. For this reason, the minimum and maximum values are

---

[43] Curiously, EPA selected a sales based definition, although all manufacturing industries listed have SBA definitions in terms of number of employees. EPA made calculations of impacts using both definitions of "small" (i.e., $50 million and $3.5 million). The test does not appear to have been an unbiased one, however, since the impacts included regulatory flexibility provisions based on the $50 million definition. Thus the failure of a $3.5 million cut-off to distinguish different levels of impacts on larger and smaller firms appears substantially due to the fact that both firms smaller than $3.5 million in sales and much larger firms all enjoyed the same regulatory flexibility provisions in the analysis.

[44] Registration reporting requirements (already in force) include providing compositional data on the F/FA.

particularly suspect. Cost data for the first and third quartiles were not directly available. Thus the median is the most useful observation.

Small fuel manufacturers have (at the median) costs per employee and costs as a percent of sales that are just over half of the costs of large fuel manufacturers.

EXHIBIT M-2: COMPLIANCE COSTS, BY SIZE OF FIRM

	Minimum	Quartile	Median	Quartile	Maximum	Average
FUEL MANUFACTURERS						
Small Firms						
Employees	0	8	22	51	29,437	154
Sales (1,000s)	$ 49	$ 3,000	$ 9,000	$22,000	$49,666	$14,708
Compliance Costs						
Per Manufacturer	$ 400	N.A.	$ 500	N.A.	$657,900	N.A.
Per Employee	N.D.	N.A.	$ 22.7	N.A.	$ 22.3	N.A.
Cost Ratio[a]	N.D.	N.A.	0.55	N.A.	0.65	N.A.
Percent of Sales	0.000268%	0.000775%	0.001773%	0.006667%	84.34615%	N.A.
Cost Ratio[a]	268	1.11	0.57	1.04	297.5	N.A.
Large Firms						
Employees	0	215	445	3,025	67,300	4,315
Sales (1,000,000s)	$ 50	$ 86	$ 269	$ 1,776	$62,359	$ 2,653
Compliance Costs						
Per Manufacturer	$ 400	N.A.	$18,316	N.A.	$2,292,257	N.A.
Per Employee	N.D.	N.A.	$ 41.2	N.A.	$ 34.1	N.A.
Percent of Sales	0.000001%	0.000679%	0.003136%	0.006388%	0.283498%	N.A.
FUEL ADDITIVE MANUFACTURERS						
Small Firms						
Employees	0	7	18	45	1,300	50
Sales (1,000s)	$ 49	$ 2,300	$ 8,995	$27,257	$5,500,000	$64,794
Compliance Costs						
Per Manufacturer	$ 400	N.A.	$ 500	N.A.	$1,304,618	N.A.
Per Employee	N.D.	N.A.	$ 27.8	N.A.	$ 1,004	N.A.
Cost Ratio[a]	N.D.	N.A.	1.17	N.A.	16.04	N.A.
Percent of Sales	0.000272%	0.001572%	0.012209%	0.128205%	129.5151%	N.A.
Cost Ratio[a]	272	17.7	31.8	38.3	500	N.A.
Large Firms						
Employees	0	80	203	1,000	67,300	3,098
Sales (1,000,000s)	$ 0.2	$ 19	$ 49	$ 452	$62,359	$ 1,710
Compliance Costs						
Per Manufacturer	$ 400	N.A.	$ 4,804	N.A.	$4,214,056	N.A.
Per Employee	N.D.	N.A.	$ 23.7	N.A.	$ 62.6	N.A.
Percent of Sales	0.000001%	0.000089%	0.000384%	0.003347%	0.258927%	N.A.

[a] Ratio of cost per employee (or cost as a percent of revenue) for small firm to cost per employee (or cost as a percent of revenue) for large firm.

SOURCE: Small Business Impact Analysis of the Fuel and Fuel Additive Registration Program.

This reflects the savings of the regulatory flexibility provisions. By the time the third quartile is reached, cost as a percent of sales is higher for small manufacturers than for large ones, which may reflect the increasing incidence of atypical fuels.

Small fuel additive manufacturers consistently have higher unit costs than large fuel additive manufacturers. For the median fuel additive manufacturer, the difference in terms of cost per employee (a cost ratio of 1.17) is relatively small. Cost as a percent of sales, however, is 18 times as high for the first quartile small manufacturers, and 32 to 38 times as high for median and third quartile small manufacturers, as for large manufacturers. These higher unit costs are consistent with the relatively high incidence of small manufacturers of atypical fuel additives.

4. Conclusion

Impacts on small business of the registration requirements for fuels and fuel additives are subject to two opposite forces. Registration and related costs are fixed costs (at least within each fuel family, category, and tier), which tend to make impacts on small businesses disproportionately large. Exemptions for small businesses, however, largely offsets (or more than offsets) the diseconomies of small scale. Baseline FFAs have a higher exemption threshold and more extensive exemptions than atypical FFAs. Since fuels tend to be baseline and fuel additives tend to be atypical, it is not surprising that the exemption benefits small fuel manufacturers (who actually bear disproportionately small costs) more than small fuel additive manufactures.

N. EPA REGULATORY CONTROLS IN THE DRY CLEANING INDUSTRY

1. Objective and Summary of the Regulation

The Clean Air Act Amendments of 1990 required EPA to promulgate National Emission Standards for Hazardous Air Pollutants (NESHAP). Perchloroethylene (PCE) is such a hazardous air pollutant, and in this regulation, EPA set a standard to control PCE air emissions from dry cleaning facilities.[45] EPA identified two industry sectors that would be affected: Commercial dry cleaners (SIC 7216) and industrial dry cleaners (SIC 7218). A third sector, coin-operated facilities (SIC 7215), was largely exempted.

[45] The Clean Air Act Amendments of 1990 also required EPA to promulgate regulatory controls for 1,1,1-Trichloroethane (1,1,1-TCE). EPA determined that all dry cleaning plants that use 1,1,1-TCA were already in compliance with the proposed regulatory alternatives, however, and so 1,1,1-TCE was not considered in the RIA.

EPA considered several regulatory alternatives. All of them involved a combination of engineering controls and reporting to EPA. Depending on the type of machine technology, the engineering controls include vent controls and/or room enclosure.

2. Estimated Costs of Compliance With the Regulation

EPA estimated compliance costs using a model plant approach. The population of dry cleaning plants was stratified by:

- o Industry sector, including:
  - Commercial dry cleaners, and
  - Industrial dry cleaners (who often rent out the worker clothing that they also dry clean);

- o Machine technology, including:
  - Dry-to-dry technology, and
  - Transfer technology;

- o Capacity of machines (in kg/load);

- o Size of facility, measured in receipts, including:
  - Under $75,000,
  - $75,000 to $100,000, and
  - Over $100,000; and

- o Existing (baseline) vent controls, including:
  - No vent controls,
  - Refrigerated condenser vent controls, and
  - Carbon adsorber vent controls.

As shown in Exhibit N-1, regulatory requirements depend on the size of the establishment, the machine technology, and the existence of baseline vent controls. Cost estimation was further complicated by the fact that new dry cleaning equipment comes with vent controls as standard equipment. Thus (for facilities not already in compliance) relevant factors in estimation of compliance costs included the age and remaining useful life of equipment (which EPA projected to be no more than 15 years) and the possibility of replacing equipment rather than retrofitting old equipment.

Exhibit N-2 shows estimated annualized cost of compliance for different combinations of industry, machine technology, machine size, and baseline vent controls. Several factors influence the costs across variables:

- o As a matter of regulatory flexibility, EPA exempted dry cleaning facilities with receipts of less than $75,000 from engineering controls.

- o Transfer technology requires room enclosures, which (other things being equal) makes compliance more expensive than for dry-to-dry technology. As a matter of regulatory flexibility, however, EPA exempted transfer facilities with receipts of less than $100,000 from room enclosure requirements.

- EPA assumed that there were no affected industrial dry cleaners with receipts less than $100,000.[46]

EXHIBIT N-1: REQUIREMENTS OF THE FINAL STANDARDS

Industry Sector, Establishment Size, Machine Technology, and Baseline Vent Control	Recordkeeping	Refrigerated Condenser	Room Enclosure
Commercial Dry Cleaning			
Under $75K Annual Receipts			
Dry-to-Dry			
No Vent Control	X		
Vent Control	X		
Transfer			
No Vent Control	X		
Vent Control	X		
$75K-$100K Annual Receipts			
Dry-to-Dry			
No Vent Control	X	X	
Vent Control	X		
Transfer			
No Vent Control	X	X	
Vent Control	X		
Over $100K Annual Receipts			
Dry-to-Dry			
No Vent Control	X	X	
Vent Control	X		
Transfer			
No Vent Control	X	X	X
Vent Control	X		
Industrial Dry Cleaning			
Over $100K Annual Receipts[a]			
Dry-to-Dry			
No Vent Control	X	X	
Vent Control	X		
Transfer			
No Vent Control	X	X	X
Vent Control	X		

[46] In fact, 7 percent of industrial dry cleaners have receipts less than $100,000, but this was not important to the analysis.

[a] All industrial dry cleaners are estimated to have receipts over $100,000.

SOURCE: Regulatory Impact Analysis: Regulatory Controls in the Dry Cleaning Industry.

- o EPA assumed that there were no affected industrial dry cleaners with receipts less than $100,000.[47]

- o The large scale of operations of industrial dry cleaners makes it possible and economic to recover substantial amounts of PCE with the engineering controls. The saving from recycled PCE makes it possible for poorly controlled facilities to make a positive return on complying with the regulation.

Costs in Exhibit N-2 do not change monotonically, which seems to reflect the use of multiple model plants in cost estimation, but several patterns are discernible:

- o Costs generally rise with the capacity of the machinery, although the smallest machines are substantially the most expensive (relative to capacity) to control. Since large machines probably generate more revenue (although they do not necessarily require more labor), cost as a percent of revenue is probably overstated for large machinery.

- o Even without room enclosure, controls for transfer machinery are more costly than controls for dry-to-dry machinery of the same capacity.

- o Carbon adsorbers (the principal means of retrofitting) are somewhat more expensive for vent control than refrigerated condensers (the principal control on new machines).

3. Effects of the Regulation on Small Establishments

In developing the PCE standard for the dry cleaning industry, EPA paid a great deal of attention to the impacts on small businesses. This was certainly appropriate, since the alternatives being considered were projected to cause as many as one quarter of small dry cleaners to fail. The key issue was defining a small dry cleaning establishment. Most commercial dry cleaners are small by any definition; 93 percent have fewer than 20 employees, and the median employment is six. Coin-operated dry cleaning firms are generally much smaller. Since dry cleaning is a service industry and the definition was driven by financial analysis, however, EPA defined size in terms of receipts. EPA settled on receipts thresholds of $75,000 for vent controls and $100,000 for room enclosure (needed for the transfer process only). These thresholds exempted

[47] In fact, 7 percent of industrial dry cleaners have receipts less than $100,000, but this was not important to the analysis.

about one quarter of commercial dry cleaners -- and all coin-operated dry cleaners[48] -- from all but reporting requirements.

Industrial dry cleaning facilities are much larger than commercial dry cleaning facilities. Only 44 percent of industrial dry cleaners have fewer than 20 employees. The mean receipts of industrial dry cleaners with more than $100,000 in receipts (93 percent of industrial dry cleaners) is $2,105,650, compared with $285,100 for commercial dry cleaners with more than $100,000 in receipts (57 percent of all commercial dry cleaners). Moreover, as is shown in Exhibit N-2, impacts on

---

[48] This exemption was the reason that, in the final RIA, EPA considered coin-operated dry cleaners not to be impacted by the standard.

EXHIBIT N-2: ANNUALIZED COMPLIANCE COST PER FACILITY

Industry Sector, Machine Technology, Machine Capacity, and Baseline Vent Controls	Annual Receipts per Facility		
	Under $75K	$75K-$100K	Over $100K
COMMERCIAL DRY CLEANING			
Dry-to-Dry			
6.8 (kg/load)			
No Baseline Vent Controls	$ 345	$ 4,874	$ 7,765
RC[a] Baseline Vent Controls	$ 345	$ 666	$ 1,300
CA[b] Baseline Vent Controls	$ 345	$ 824	$ 1,628
8.2 (kg/load)			
No Baseline Vent Controls	$ 345	$ 4,897	$ 5,835
C[a] Baseline Vent Controls	$ 345	$ 666	$ 983
CA[b] Baseline Vent Controls	$ 345	$ 824	$ 1,226
11.3 (kg/load)			
No Baseline Vent Controls	$ 345	$ 2,442	$ 5,648
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 983
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 1,243
13.6 (kg/load)			
No Baseline Vent Controls	$ 345	$ 2,429	$ 3,792
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 666
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 836
15.9 (kg/load)			
No Baseline Vent Controls	$ 345	$ 2,445	$ 3,813
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 666
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 836
20.4 (kg/load)			
No Baseline Vent Controls	$ 345	$ 2,571	$ 4,045
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 666
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 836
22.7 (kg/load)			
No Baseline Vent Controls	$ 345	$ 2,582	$ 4,066
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 666
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 836
27.2 (kg/load)			
No Baseline Vent Controls	$ 345	$ 2,603	$ 2,063
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 349
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 428
45.4 (kg/load)			
No Baseline Vent Controls	$ 345	$ 3,520	$ 2,971
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 349
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 428

EXHIBIT N-2: ANNUALIZED COMPLIANCE COST PER FACILITY (continued)

Industry Sector, Machine Technology, Machine Capacity, and Baseline Vent Controls	Annual Receipts per Facility		
	Under $75K	$75K-$100K	Over $100K
COMMERCIAL DRY CLEANING (continued)			
Transfer			
15.9 (kg/load)			
No Baseline Vent Controls	$ 345	$ 3,189	$ 8,019
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 666
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 836
27.2 (kg/load)			
No Baseline Vent Controls	$ 345	$ 3,253	$ 8,454
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 666
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 836
45.4 (kg/load)			
No Baseline Vent Controls	$ 345	$ 4,214	$ 6,735
RC[a] Baseline Vent Controls	$ 345	$ 349	$ 349
CA[b] Baseline Vent Controls	$ 345	$ 428	$ 428
INDUSTRIAL DRY CLEANING			
Dry-to-Dry			
63.5 (kg/load)			
No Baseline Vent Controls	-	-	$ 2,673
RC[a] Baseline Vent Controls	-	-	$ 358
CA[b] Baseline Vent Controls	-	-	$ 437
113.4 (kg/load)			
No Baseline Vent Controls	-	-	$ 3,003[c]
RC[a] Baseline Vent Controls	-	-	$ 358
CA[b] Baseline Vent Controls	-	-	$ 437
Transfer			
113.4 (kg/load)			
No Baseline Vent Controls	-	-	$ 8,544[c]
RC[a] Baseline Vent Controls	-	-	$ 5,785[c]
CA[b] Baseline Vent Controls	-	-	$ 5,706[c]

[a] Refrigerated condenser.

[b] Carbon adsorber.

[c] Positive benefit due to the recapture of PCE.

SOURCE: Regulatory Impact Analysis: Regulatory Controls in the Dry Cleaning Industry.

industrial dry cleaners are smaller than those on commercial dry cleaners, and are actually negative in some cases. Because of these differences, the remainder of the analysis focuses only on commercial dry cleaning (SIC 7216).

Exhibit N-3 shows annualized costs per employee, annualized costs as a percent of receipts, and employment-based cost ratios,[49] by size of facility. Data provided in the RIA indicate that all dry cleaning firms with less than $100,000 in receipts have only one facility, so that the standard assumption of one-establishment small firms is confirmed in this instance. Exhibit N-3 shows costs by size class of facility, machine technology, baseline vent controls, and machine capacity. Exhibit N-3 shows several patterns with respect to facility size:

- Most of the costs are due to vent controls and/or room enclosure; reporting costs are relatively minor. Thus EPA's exemption of small dry cleaning establishments from equipment control costs made a large difference in impacts on small businesses. For facilities where the baseline is no controls, the cost ratio for firms with under $75,000 in receipts is:
  - About 0.25 for machines with transfer technology,
  - About 0.25 to 0.50 for dry-to-dry machines up to 23 kg/load capacity, and
  - Still under 1.00 for larger dry-to-dry machines.

- For facilities using transfer technology, compliance costs for facilities with over $100,000 in receipts are 50 percent to 150 percent higher than compliance costs for facilities with $75,000 to $100,000 with the same capacity machinery. Thus EPA's exemption of dry cleaning establishments with $75,000 to $100,000 in receipts from room enclosure requirements also made a substantial difference in impacts on small businesses.

- Where the baseline includes vent controls, reporting costs -- although fairly small -- nevertheless fall disproportionately on small establishments. For both types of vent controls, cost ratios for dry cleaners with under $75,000 and $75,000 to $100,000 in receipts are:
  - Between 1.00 and about 2.00 for facilities with small machines (11.3 kg/load and under),

---

[49] Ratio of cost per employee for small size classes to cost per employee for the largest size class. Cost ratios based on percentages of receipts are extremely similar and thus are not reported.

- Between 1.5 and 3.0 for facilities with medium-sized machines (13.6 to 22.7 kg/load dry-to-dry machines and 15.9 to 27.2 kg/load transfer machines), and
- Between 3.0 and 6.0 for facilities with the large machines (22.7 kg/load and above dry-to-dry machines and 45.5 kg/load transfer machines).

o The economies of scale in reporting costs that produce a disproportionate impact on small firms is also visible in a comparison between commercial dry cleaners with under $75,000 in receipts and commercial dry cleaners with $75,000 to $100,000 in receipts. Except for the smallest machines, unit reporting costs (and cost ratios) are 45 to 80 percent higher for the smallest dry cleaners than for the latter group.

EXHIBIT N-3: RELATIVE COSTS OF THE PCE RULE, BY ESTABLISHMENT SIZE

Machine Technology, Baseline Vent Controls, and Machine Capacity	Annual Receipts per Facility		
	Under $75K	$75K-$100K	Over $100K
DRY-TO-DRY			
No Controls			
6.8 (kg/load)			
Cost per Employee	$169.04	$1,331.69	$678.81
Cost as Percent of Revenue	0.781%	5.613%	2.724%
Cost Ratio[a]	0.249	1.96	-
8.2 (kg/load)			
Cost per Employee	$169.04	$1,337.98	$510.09
Cost as Percent of Revenue	0.781%	5.640%	2.047%
Cost Ratio[a]	0.331	2.62	-
11.3 (kg/load)			
Cost per Employee	$169.04	$ 667.21	$493.74
Cost as Percent of Revenue	0.781%	2.812%	1.981%
Cost Ratio[a]	0.342	1.35	-
13.6 (kg/load)			
Cost per Employee	$169.04	$ 663.66	$331.49
Cost as Percent of Revenue	0.781%	2.797%	1.330%
Cost Ratio[a]	0.510	2.00	-
15.9 (kg/load)			
Cost per Employee	$169.04	$ 668.03	$333.33
Cost as Percent of Revenue	0.781%	2.816%	1.337%
Cost Ratio[a]	0.507	2.00	-
20.4 (kg/load)			
Cost per Employee	$169.04	$ 702.46	$353.61
Cost as Percent of Revenue	0.781%	2.961%	1.419%
Cost Ratio[a]	0.478	1.99	-
22.7 (kg/load)			

Cost per Employee	$169.04	$ 705.46	$355.44
Cost as Percent of Revenue	0.781%	2.974%	1.426%
Cost Ratio[a]	0.476	1.98	-
27.2 (kg/load)			
Cost per Employee	$169.04	$ 711.20	$180.35
Cost as Percent of Revenue	0.781%	2.998%	0.724%
Cost Ratio[a]	0.937	3.94	-
45.4 (kg/load)			
Cost per Employee	$169.04	$ 961.75	$259.72
Cost as Percent of Revenue	0.781%	4.054%	1.042%
Cost Ratio[a]	0.651	3.70	-

EXHIBIT N-3: RELATIVE COSTS OF THE PCE RULE, BY ESTABLISHMENT SIZE

(continued)

Machine Technology, Baseline Vent Controls, and Machine Capacity	**Annual Receipts per Facility**		
	Under $75K	**$75K-$100K**	**Over $100K**
DRY-TO-DRY			
Refrigerated Condenser Controls			
6.8 (kg/load)			
Cost per Employee	$169.04	$ 181.97	$113.64
Cost as Percent of Revenue	0.781%	0.767%	0.456%
Cost Ratio[a]	1.49	1.60	-
8.2 (kg/load)			
Cost per Employee	$169.04	$ 181.97	$ 85.93
Cost as Percent of Revenue	0.781%	0.767%	0.345%
Cost Ratio[a]	1.97	2.12	-
11.3 (kg/load)			
Cost per Employee	$169.04	$ 95.36	$ 85.93
Cost as Percent of Revenue	0.781%	0.402%	0.345%
Cost Ratio[a]	1.97	1.11	-
13.6, 15.9, 20.4 & 22.7 (kg/load)			
Cost per Employee	$169.04	$ 95.36	$ 58.22
Cost as Percent of Revenue	0.781%	0.402%	0.234%
Cost Ratio[a]	2.90	1.64	-
27.2 & 45.4 (kg/load)			
Cost per Employee	$169.04	$ 95.36	$ 30.51
Cost as Percent of Revenue	0.781%	0.402%	0.122%
Cost Ratio[a]	5.54	3.13	-
Carbon Adsorber Controls			
6.8 (kg/load)			
Cost per Employee	$169.04	$ 225.14	$142.32
Cost as Percent of Revenue	0.781%	0.949%	0.571%
Cost Ratio[a]	1.19	1.58	-
8.2 (kg/load)			
Cost per Employee	$169.04	$ 225.14	$107.18
Cost as Percent of Revenue	0.781%	0.949%	0.429%
Cost Ratio[a]	1.58	2.10	-
11.3 (kg/load)			
Cost per Employee	$169.04	$ 116.94	$108.66
Cost as Percent of Revenue	0.781%	0.493%	0.436%
Cost Ratio[a]	1.56	1.08	-
13.6, 15.9, 20.4 & 22.7 (kg/load)			
Cost per Employee	$169.04	$ 116.94	$ 73.08
Cost as Percent of Revenue	0.781%	0.493%	0.293%
Cost Ratio[a]	2.31	1.60	-
27.2 & 45.4 (kg/load)			

Cost per Employee	$169.04	$ 116.94	$ 37.42
Cost as Percent of Revenue	0.781%	0.493%	0.234%
Cost Ratio[a]	4.52	3.13	-

EXHIBIT N-3: RELATIVE COSTS OF THE PCE RULE, BY ESTABLISHMENT SIZE

(continued)

Machine Technology, Baseline Vent Controls, and Machine Capacity	Annual Receipts per Facility		
	Under $75K	$75K-$100K	Over $100K
TRANSFER			
No Controls			
15.9 (kg/load)			
Cost per Employee	$169.04	$ 871.31	$701.01
Cost as Percent of Revenue	0.781%	3.673%	2.813%
Cost Ratio[a]	0.24	1.24	-
27.2 (kg/load)			
Cost per Employee	$169.04	$ 888.80	$739.04
Cost as Percent of Revenue	0.781%	3.746%	2.965%
Cost Ratio[a]	0.229	1.20	-
45.4 (kg/load)			
Cost per Employee	$169.04	$1,151.37	$588.77
Cost as Percent of Revenue	0.781%	4.853%	2.362%
Cost Ratio[a]	0.287	1.96	-
Refrigerated Condenser Controls			
15.9 & 27.2 (kg/load)			
Cost per Employee	$169.04	$ 95.36	$ 58.22
Cost as Percent of Revenue	0.781%	0.402%	0.234%
Cost Ratio[a]	2.90	1.64	-
45.4 (kg/load)			
Cost per Employee	$169.04	$ 95.36	$ 30.51
Cost as Percent of Revenue	0.781%	0.402%	0.122%
Cost Ratio[a]	5.54	3.13	-
Carbon Adsorber Controls			
15.9 & 27.2 (kg/load)			
Cost per Employee	$169.04	$ 116.94	$ 73.09
Cost as Percent of Revenue	0.781%	0.493%	0.293%
Cost Ratio[a]	2.31	1.59	-
45.4 (kg/load)			
Cost per Employee	$169.04	$ 116.94	$ 37.42
Cost as Percent of Revenue	0.781%	0.493%	0.150%
Cost Ratio[a]	4.52	3.13	-

[a] Ratio of cost per employee for small size classes to cost per employee for the largest size class.

NOTE: Computations are based on Exhibit N-2 and the following facility averages:

Size:	Under $75,000	75,000-$100,000	Over $100,000
Employees:	2.04	3.66	11.4
Receipts:	$44,200	$86,800	$285,100

4. Conclusion

The regulation of PCE in dry cleaning imposes both engineering costs and recordkeeping/reporting costs. Both reporting and engineering impose disproportionately large costs on small businesses. Per-employee reporting costs for small businesses are 1.6 times, and for very small businesses are 2.3 to 2.9 times, as large as per-employee reporting costs for larger dry cleaners. The disparity for vent controls is just under half as large. The regulations provide exemptions on installing controls for very small dry cleaners that have no controls. This exemption results in per-employee compliance costs for very small dry cleaners that are only one quarter to one half the per-employee costs for large dry cleaners.

O. EPA AIR EMISSION STANDARDS FOR HAZARDOUS WASTE FACILITIES

1. Objective and Summary of the Regulation

Section 3004(n) of the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA) requires EPA to set standards for monitoring and control of air emissions from hazardous waste treatment, storage, and disposal facilities (TSDFs). Organic emissions regulated by the standard contribute to tropospheric ozone formation, and TSDF organic emissions may also contain substances that are toxic or carcinogenic. Thus the standards have both environmental and human health objectives.

EPA decided to control organic emissions as a class, rather than on a constituent-by-constituent basis. Under the final rule, air emissions controls must be placed on all tanks, surface impoundments, and containers for hazardous waste. For purposes of the regulation, hazardous waste is defined as that having an average volatile organic concentration equal to or greater than 100 parts per million (ppm) at the point of waste origination. Controls typically consist of leakproof and air-tight containers and liners. If a waste has been treated to remove or destroy the organics, its storage containers are not subject to the air quality control standards.

2. Estimated Costs of Compliance With the Regulation

The analysis of costs in the RIA began with an identification of hazardous waste management processes, hazardous waste units and control options, and control strategies. Hazardous waste management processes comprise:

- o Storage processes, including:
  - Containers,
  - Tanks,

- Waste piles, and
- Surface impoundments;

- o Treatment processes, including:
  - Tank treatment, and
  - Surface impoundment treatment; and

- o Disposal processes, including:
  - Injection wells,
  - Landfills,
  - Land application, and
  - Surface impoundments.

Control options include:

- o Level 0 control (no control);

- o Level 1 control (suppression control that includes covers); and

- o Level 2 control (suppression control with additional control devices, such as carbon adsorbers).

The analysis also identified 19 different volatile organic concentration action levels, ranging from 0-10 ppmw to 100,000 ppmw or above. The analysis then applied selected control options to a set of regulated units that included:

- o Container storage;

- o Quiescent tanks;

- o Quiescent impoundments;

- o Aerated tanks and impoundments;

- o Fixation processes; and

- o Drum and truck loading.

These action levels, regulated units, and control options produced 2,718 distinct control strategies.

Based on operating cost data from a variety of sources, EPA estimated costs of each control strategy. EPA then used computer models to identify dominant control strategies, defined as control strategies that could produce greater emissions reductions at equal cost, or similar emissions reductions at less cost, than other control strategies. EPA identified about 100 dominant control strategies. Of these, EPA selected four dominant strategies and a fifth option for further analysis in the Draft RIA. Exhibit O-1 shows characteristics of the four dominant control options.

EPA noted that generators of hazardous waste are found in more than 100 four-digit SIC codes[50] and that more than 400 RCRA waste codes are involved.

---

[50] The principal industries involved include:
- o Mining,
- o Milling,
- o Manufacturing of chemicals and pharmaceuticals,

EXHIBIT O-1: SELECTED DOMINANT CONTROL STRATEGIES

	Option 1	Option 2	Option 3	Option 4
Action Level	>0 ppmw	≥500 ppmw	≥500 ppmw	≥1,500 ppmw
Control Level				
Container Storage	1	1	1	1
Quiescent Tanks	2	2	1	2
Quiescent Impoundments	2	2	1	2
Aerated Tanks	1	1	1	1
Fixation Process	1	1	1	1
Transfer/Handling	1	1	1	1
Control Cost ($Millions/Year)	$775.99	$750.20	$404.03	$197.39
Emission Reduction (10^3 MG/Year)	1,650.66	1,647.90	1,610.89	1,541.98
Incident Reduction (Cases/Year)	122.64	122.43	119.60	115.78

- Manufacturing of primary and fabricated metals,
- Manufacturing of cement,
- Manufacturing of electrical and nonelectrical machinery,
- Manufacturing of transportation equipment and instruments,
- Electric and gas utilities,
- Wholesale and retail sales,
- Research labs, hospitals, university research centers, and
- Government facilities.

SOURCE: "Hazardous Waste TSDF - Draft Regulatory Impact Analysis for Proposed RCRA Air Emission Standards," August 1989.

Wastes classified as hazardous must be treated, stored, or disposed of by a permitted TSDF. Generators have the option of obtaining a permit and treating, storing, and/or disposing of hazardous waste on site, or of hiring a commercial TSDF to manage the hazardous waste. EPA classified facilities into four categories, based on whether they were storage-only facilities or full TSDFs, and on whether the facilities were captive TSDFs (on-site facilities of a generator) or commercial TSDFs. EPA identified 2,336 facilities that performed some form of hazardous waste management services (in 1985). Of these, 2,002 were estimated to produce organic emissions. Of these 2,002 facilities:

- 1,098 were storage-only facilities;
- 70 were government facilities or service industry facilities, and
- 834 were TSDFs directly affected by the regulations,[51] of which
  - 698 were captive TSDFs, and
  - 136 were commercial TSDFs.

EPA grouped these 834 facilities into 20 generating sectors and one commercial sector for further analysis. Exhibit O-2 shows the Draft RIA estimates of compliance costs of each of the five options for these 21 sectors. Of these options, Option 1 (which has the lowest action level) is the most expensive.

In the Final RIA, EPA obtained new data on both baseline practices and costs. The control options considered were somewhat different as well, reflecting a wider range of action levels. The final rule included an action level of 500 ppmw (similar to control option 3). Recalculation of costs produced a far lower estimate of annualized costs: $90 million per year. The Final RIA is a very brief document that gives only critical new results, however, and it is insufficiently developed to support additional analysis.

3. Effects of the Regulation on Small Establishments

The analysis of small TSDFs in the Draft RIA[52] made a number of simplifying assumptions:

[51] EPA excluded storage-only facilities and government or service sector facilities from further economic impact analysis because they represented less than five percent of total waste volume and less than one percent of compliance costs.

[52] The Final RIA presents little new information. Only enough data are presented to confirm the findings of the Draft RIA, and these data are so fragmentary as to be useless for this analysis.

- o Captive TSDFs were eliminated from the analysis because of difficulties of determining the size of the hazardous waste generator.

- o A cutoff of $3.5 million in sales was used to define a "small" commercial TSDF. By this definition:
  - 101 commercial facilities were initially estimated to be large, and

EXHIBIT O-2
ANNUALIZED DRAFT RIA COMPLIANCE COSTS BY CONTROL OPTION
($Millions/Year)

Sector	Control Option 1	2	3	4	5
Mining	0.19	0.10	0.04	0.10	0.07
Grain and Textile Mill Products	0.97	0.97	0.10	0.97	0.97
Furniture, Paper Products, Printing	0.17	0.17	0.04	0.17	0.12
Industrial Chemicals, Inorganic & Organic	245.00	203.00	59.00	188.00	119.00
Plastics, Fibers	445.00	420.00	255.00	21.30	21.26
Biological, Pharmaceutical, Medical Chem.	1.76	1.54	0.72	1.54	1.54
Assorted Chemical Products	155.00	38.40	22.50	34.20	32.63
Paint & Allied Products, Petroleum & Coal	12.00	4.20	0.98	3.21	3.17
Rubber, Plastics	0.01	0.01	0.01	0.00	0.00
Cement Companies	0.21	0.16	0.04	0.01	0.01
Primary Metals	6.82	6.70	2.20	4.11	3.05
Metal Fabrication	1.67	0.85	0.34	0.77	0.12
Nonelectric Machinery	0.18	0.11	0.03	0.11	0.09
Electrical Machinery and Suppliers	2.41	2.38	0.32	2.25	2.23
Transportation Equipment	0.37	0.22	0.08	0.08	0.00
Instruments	0.17	0.17	0.03	0.17	0.16
Miscellaneous Manufacturing	0.13	0.13	0.00	0.13	0.06
Electric and Gas Utilities	0.22	0.21	0.12	0.21	0.00
Nondurable Goods: Wholesale Sales	0.02	0.01	0.01	0.01	0.01
Research Labs, Hospitals, Universities	0.00	0.00	0.00	0.00	0.00
Commercial Hazardous Waste Handlers	19.10	15.10	13.40	13.00	12.90
TOTALS	892.00	695.00	355.00	271.00	197.00

- 35 commercial facilities were initially estimated to be small, but of these:
  - 12 had gone out of business,
  - 7 were owned by large businesses, and
  - 6 did not return survey forms and could not be confirmed as small (although EPA assumed that they were).

- o Analysis of impacts on small businesses was based on Option 1, since it was the most costly option and would have the greatest impacts.

The regulatory flexibility analysis used the four standard EPA criteria.[53] Of these criteria, cost as a percent of sales is the most useful for this study. The Draft RIA found that compliance costs were:

- o 0.26 percent of sales for the 101 large commercial TSDFs; and

- o 0.28 percent of sales for the 16 small commercial TSDFs.

Thus, as a percent of sales, costs for small commercial TSDFs were 1.08 times the costs for large commercial TSDFs.

4. Conclusion

The analysis shows that costs for commercial TSDFs are largely proportional to the amount of waste treated. Simplifying assumptions related to costs are critical, however, so that it is not clear how meaningful this result is.

P. EPA FINANCIAL RESPONSIBILITY STANDARDS FOR OPERATORS OF UNDERGROUND PETROLEUM STORAGE TANKS

1. Objective and Summary of the Regulation

The 1984 Hazardous and Solid Waste Amendments to RCRA required regulation of petroleum storage tanks. The requirements included technical standards for prevention of leaks from underground petroleum storage tanks and corrective action for underground storage tanks (USTs) that leaked. The 1984 Amendments also required that petroleum UST operators demonstrate the financial ability to take corrective action and compensate third parties for damages caused by petroleum UST leaks. This regulation promulgates these UST financial responsibility standards.

The goal of the financial responsibility standard was to ensure that any corrective action and payment of damages would actually be carried out. The technical standards RIA showed that substantial numbers of UST owners would go out of business, particularly if leaking petroleum reaches ground water. The requirement for financial

---

[53] These criteria are:

- o Annualized compliance cost increases for small entities of greater than five percent of costs of production;
- o Compliance costs as a percent of sales for small entities that are at least 10 percent higher than compliance costs as a percent of sales for large entities;
- o Capital costs of compliance that represent a significant portion of capital available to small entities; and
- o The likelihood of closures of small entities as a result of regulatory requirements.

responsibility was intended to finance corrective action and damages despite such potential for business failures. The standards allowed a variety of mechanisms for demonstrating adequate financial capability, including:

- A financial test for self-insurance;
- Guarantees by a third party;
- Insurance;
- Risk retention group coverage;
- Indemnity contracts;
- Surety bonds;
- Letters of credit; and
- State funds or other state assurance.

The initial financial responsibility standards provided mechanisms that were not necessarily suitable for small local governments. A second rulemaking addressed the differences between local governments and private sector entities by providing additional mechanisms, which could be used with other mechanisms, to minimize administrative burdens on local governments. These mechanisms include:

- A bond rating test;
- A worksheet test incorporating several financial criteria;
- A guarantee from another government entity; and
- Maintenance of an emergency fund balance.

2. Estimated Costs of Compliance With the Regulation

EPA made the simplifying assumption that business UST owners would use one of three types of financial responsibility mechanisms:

- Firms that could pass the financial test would self-insure;
- Subsidiaries of firms that could pass the financial test would use guarantees by the parent company; and
- All other businesses would purchase insurance.

This assumption was based on the estimate that other mechanisms would generally be similarly or more expensive and/or rarely used.

Self-insurance and (by extension) financial guarantees by self-insured firms are quite inexpensive compared to other financial responsibility mechanisms. Some firms report financial data to a government agency. Eligible (i.e., large) firms also generally report financial data to Dun & Bradstreet, so that the information for the financial test is already accessibly documented. Reporting and recordkeeping costs are quite modest; EPA estimated them to be an hour ($15) per year. In addition, of course, a self-insuring firm would have to bear the costs of any corrective action.

Costs of insurance are quite complex because of the interrelationship between the financial responsibility standards and the technical standards.[54] The technical standards allowed a phase-in period of up to ten years, while the financial responsibility standards included a phase-in of just two years. As a practical matter, however, insurance companies are unlikely to insure UST owners that have not complied with the technical standards and that have not demonstrated that their USTs are not already leaking. Such requirements would accelerate tank replacement and other measures of compliance with the technical standards, and they would hasten the discovery of leaks, leading to earlier and thus (when discounted) more expensive corrective action. On the other hand, putting leak detection in place would detect leaks at an earlier stage, resulting in lower (undiscounted) corrective action costs.

Because of this complex interaction of the two standards, EPA performed an incremental analysis. EPA first estimated the impacts of the technical standard. Then EPA estimated the net incremental impacts of the financial responsibility standard -- including all of the effects of changing the effective timing of the technical requirements.

Exhibit P-1 shows the combined costs for the technical standard and financial responsibility standard and the incremental costs of the financial responsibility standard. EPA's estimate of costs of accelerated tank replacement, upgrading, and leak detection is almost as large as the estimated cost of insurance itself. Earlier detection, however, leads to substantial net reductions in estimated corrective action costs. The incremental cost of the financial responsibility standard is only about one percent of the total combined cost.

Exhibit P-1 shows aggregate costs. Actual insurance premiums vary with a number of factors, including the following:

- Premiums per firm increase with the number of UST facilities;
- Premiums per UST facility increase with the age of the tanks;
- Premiums per UST facility increase with the per-occurrence limit;
- Premiums per UST facility increase with the aggregate limit; and
- Premiums per UST facility increase with the number of USTs per facility.

---

[54] Availability of insurance is also a non-trivial matter, but it is a separate issue in many respects and will not be addressed fully here.

Exhibit P-2 shows EPA's estimates of premiums for the initial five-year period. Estimated premiums in Exhibit P-2 reflect the factors cited above:

EXHIBIT P-1

PRESENT VALUE OF TOTAL COSTS[a] OF UST TECHNICAL STANDARDS AND UST FINANCIAL RESPONSIBILITY STANDARDS

Standard	Combined Costs: Technical Standard and Financial Responsibility Standard		Incremental Costs of the Financial Responsibility	
Cost Component	Total ($Millions)	per UST (Dollars)	Total ($Millions)	per UST (Dollars)
Tank Replacement, Upgrading, and Leak Detection[b]	$38,384.2	$22,844	$ 1,549.6	$ 911
Corrective Action in Response to UST Releases[b]	$29,488.6	$17,346	- $ 2,484.6	- $1,461
Financial Responsibility Mechanisms[b,c]	$ 1,958.1	$ 1,152	$ 1,636.0	$ 962
TOTAL COSTS	$70,280.5	$41,342	$ 701.0	$ 412

[a] All costs are discounted at 3 percent over 30 years.

[b] Based on EPA's UST model, which probabilistically predicts releases, their severity, and the corrective action required.

[c] Derived from the premium module of EPA's affordability model. Computations include the following assumptions:

- o All firms that can pass the financial test will self-insure.
- o Subsidiaries of firms that self-insure will use parent company guarantees.
- o All other firms will purchase insurance.
- o Insurance costs of administration, etc. are equal to insurance payouts for corrective action (i.e., premiums are double the corrective action paid for), but insurance costs included above are just the administrative costs, since corrective

action costs were already considered in the correction category and would be double-counted if included in the cost of financial responsibility mechanisms.

SOURCE: Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks.

EXHIBIT P-2
ESTIMATED INITIAL[a] INSURANCE PREMIUMS PER UST FACILITY

Sector and Coverage Limits	Deductible ($)					
	5,000	10,000	25,000	50,000	100,000	250,000
Retail Motor Fuel Marketing Sector[b]						
$1,000,000 Aggregate Limit	$3,532	$2,986	$2,285	$1,608	$1,076	$ 508
$2,000,000 Aggregate Limit	$5,651	$4,778	$3,656	$2,573	$1,722	$ 813
Farm Sector[c]						
$1,000,000 Aggregate Limit	$1,275	$1,061	$ 788	$ 524	$ 316	$ 94
$2,000,000 Aggregate Limit	$2,040	$1,698	$1,261	$ 838	$ 506	$ 150
Local Government Sector[d]						
$1,000,000 Aggregate Limit	$1,673	$1,393	$1,034	$ 687	$ 415	$ 124
$2,000,000 Aggregate Limit	$2,677	$2,229	$1,654	$1,099	$ 664	$ 198
General Industry[e]						
$1,000,000 Aggregate Limit	$2,629	$2,189	$1,625	$1,080	$ 652	$ 195
$2,000,000 Aggregate Limit	$4,206	$3,502	$2,600	$1,728	$1,043	$ 312

[a] Estimates are for years 1-5. Insurance premiums in subsequent periods vary considerably over time and slightly among sectors. They are about:

- 24 percent to 25 percent of year 1-5 levels in years 6-10;
- 7 percent to 8 percent of year 1-5 levels in years 11-15;
- 8 percent to 9 percent of year 1-5 levels in years 16-20;
- 12 percent to 13 percent of year 1-5 levels in years 21-25; and
- 53 percent to 54 percent of year 1-5 levels in years 26-30.

[b] Based on a $1,000,000 per-occurrence limit. Retail motor fuel outlets have an average of 4.1 USTs per facility.

[c] Based on a $500,000 per-occurrence limit. Farms have an average of 1.6 USTs.

[d] Based on a $500,000 per-occurrence limit. Local governments have an average of 2.1 USTs.

[e] Table in source says Retail Motor Fuel Marketing Sector, but this appears to be in error since premiums are based on $500,000 per-occurrence limit. General industry averages 3.3 USTs per facility.

SOURCE: Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks.

- o Over time, average premiums will fall as old tanks are replaced and then rise as the new tanks age (see footnote a).

- o Premiums are higher in the retail motor fuel marketing sector (which has a $1,000,000 per-occurrence limit) than in the other sectors (which have $500,000 per-occurrence limits in most cases).

- o Premiums are consistently higher for a $2,000,000 aggregate limit than for a $1,000,000 aggregate limit.

- o Premiums reflect the average numbers of USTs per facility in each sector. They are:
  - Lowest for farms (1.6 USTs per farm),
  - Second lowest for local governments (2.1 USTs per facility),
  - Second highest for general industry (3.3 USTs per facility), and
  - Highest for retail motor fuel marketing (4.1 USTs per facility).

EPA's premium estimates also reflect underlying differences in requirements for coverage, which were related to the size and industry of the UST owner. The financial responsibility regulations require:

- o Insurance with per-occurrence limits of:
  - $1,000,000 for:
    - . Petroleum marketers and
    - . Petroleum non-marketers with more than 10,000 gallons per month, and
  - $500,000 for petroleum non-marketers with 10,000 gallons or less per month; and

- o Insurance with aggregate limits of:
  - $2,000,000 for owners of more than 100 USTs, and
  - $1,000,000 for owners of 100 or fewer USTs.

In a second rulemaking, EPA authorized additional financial responsibility mechanisms for local governments, in part because local governments and corporations have different accounting systems and the financial responsibility test was designed explicitly for corporate accounting.[55] EPA estimated that the costs (principally certification and reporting) of these mechanisms were:

---

[55] The financial self-insurance test requires meeting one of two sets of criteria:

o Either: Tangible net worth of at least $10 million,
Tangible net worth at least 10 times the aggregate coverage,
Either financial statements filed with the SEC or annual reports filed with Dun & Bradstreet with a 4A or 5A rating, and
Audited financial statements with no adverse opinion;

o Or: Tangible net worth of at least $10 million,
Tangible net worth at least 6 times aggregate coverage,
U.S. assets of at least 90% of total assets or 6 times aggregate coverage,

- $74.50 per government for the bond rating test;
- $104.22 per government for the worksheet test;
- $163.66 per government for the fund balance mechanism test; and
- $252.82 per government for a guarantee by another governmental entity.

A local government that could not meet the criteria for any of these mechanisms would have to obtain insurance or close its UST and purchase petroleum products from retail outlets.

3. Effects of the Regulation on Small Establishments

Retail Motor Fuel Marketing Industry. EPA used the SBA definition of small for retail motor fuel marketing, which is $4.6 million in sales. This figure needs to be put into perspective, since there are a number of measures of size. Exhibit P-3 shows the distribution of retail motor fuel marketing firms and outlets by size of assets and by number of outlets per firm. EPA estimated that, by this definition, in 1984 there were:

- 84,002 small business owners, including:
  - 80,304 open dealers (independent owners of one outlet),
  - 3,246 jobbers (outlet owners and wholesalers) with 6,591 outlets, and
  - 402 small convenience store chain owners with 1,604 outlets; as well as
- 43,131 small business lessees of 58,656 outlets owned by large firms.

Thus EPA estimated that 93.6 percent of retail motor fuel outlet owners were small businesses and that they operated 76.2 percent of retail motor fuel outlets.

Using information provided by the major pollution liability insurer of USTs, EPA developed the following relationship between the size of deductible chosen and the number of outlets owned by insured firms:

- Firms choosing a $5,000 deductible own an average of 6 outlets;
- Firms choosing a $10,000 deductible own an average of 14 outlets;
- Firms choosing a $25,000 deductible own an average of 40 outlets;
- Firms choosing a $50,000 deductible own an average of 53 outlets;
- Firms choosing a $100,000 deductible own an average of 136 outlets; and

---

Net working capital at least 6 times aggregate coverage,
A bond rating of AAA (Aaa), AA (Aa), A, or BBB (Baa), and
Audited financial statements with no adverse opinion.

- o Firms choosing a $250,000 deductible own an average of 486 outlets.

From these data, two conclusions may be drawn:

- o Small retail motor fuel firms (virtually all of whom have fewer than six outlets) will obtain insurance with a $5,000 deductible.

EXHIBIT P-3:
SIZE DISTRIBUTION OF RETAIL MOTOR FUEL MARKETING FIRMS

	Firms in Group		Outlets Owned by Firms in Group	
Size of Firm	**Number**	**Percent**	**Number**	**Percent**
Total Assets				
0 - $200,000	30,114	33.6 %	30,114	15.6 %
$200,001 - $400,000	33,410	37.2 %	36,705	19.0 %
$400,001 - $600,000	20.478	22.8 %	21,684	11.2 %
$600,001 - $1,000,000	3,567	4.0 %	14,268	7.4 %
$1,000,001 - $10,000,000	2,063	2.3 %	28,722	14.9 %
Over $10,000,000	107	0.1 %	61,505	25.6 %
Number of Outlets per Firm				
1	80,304	89.5 %	80,304	41.6 %
2 - 9	8,081	9.0 %	28,991	15.0 %
10 - 24	1,190	1.3 %	20,239	10.5 %
25 - 49	58	0.06%	2,004	1.0 %
50 - 99	48	0.05%	3,483	1.8 %
100 - 999	40	0.04%	11,721	6.1 %
1,000 and Over	18	0.02%	46,255	24.0 %

TOTAL[a]	89,738	100.0 %	193,000	100.0 %

[a] Columns may not total because of rounding.

SOURCE: Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks.

- In general, retail motor fuel firms choosing a $5,000 or $10,000 deductible will have to carry insurance with a $1,000,000 aggregate limit, while retail motor fuel firms choosing a deductible of $25,000 or more will have to carry insurance with a $2,000,000 aggregate limit.

Exhibit P-4 shows the unit costs of insurance for different sizes of retail motor fuel marketing firms. Small firms have net resource costs of insuring that average 4.3 times the cost for the largest firms that purchase insurance. Slightly larger firms have net resource costs of purchasing insurance that average 3.7 times the cost for the largest firms. Costs for firms that self-insure are trivial by comparison.

General Industry. Data in the RIA are not as well developed for general industry as for the retail motor fuel marketing sector. Small firms will have relatively few USTs, and few will have more than one establishment. One facility with one or two USTs seems a likely description. Such a firm would carry insurance with a $5,000 deductible, a $500,000 per-occurrence limit, and a $1,000,000 aggregate limit. Large firms, on average, seem unlikely to have more than a total of 100 USTs, much over 40 facilities with USTs, or large monthly throughput. Thus an assumption of a $25,000 deductible, a $500,000 per-occurrence limit, and a $1,000,000 aggregate limit appears to be reasonable.

Exhibit P-4 shows unit costs of insurance for small and large firms in general industry. Per establishment, small firms bear net resource costs of insuring that average 1.6 times costs for large firms. Per employee, small firms bear net resource costs of insuring that average 36.5 times the costs for large firms.

Agriculture. Both the UST technical standards and the UST financial responsibility standards exempt farm USTs with a capacity of less than 1,100 gallons. Thus most small farms will incur zero costs. Even large agricultural farms probably have few enough establishments and USTs to incur the same insurance cost per establishment as any small farms with USTs of 1,100 gallons or more.

Local Governments. EPA granted local governments additional mechanisms for demonstrating financial responsibility. Exhibit P-5 shows cost estimates for:

- Two of the original mechanisms:
  - Insurance or Risk Retention Groups, and
  - State insurance funds;

- o The four new mechanisms:
  - Bond rating,
  - A worksheet test,
  - Maintenance of a fund balance, and
  - Guarantees; and

- o Closure of USTs and retail purchase of petroleum products, which is the default mechanism for a local government that cannot qualify for any other financial responsibility mechanism.

EPA estimated that very large local governments would actually benefit from obtaining insurance (if they did not already have it). This outcome results from EPA's estimate that very large local governments would benefit more from the future

EXHIBIT P-4: UNIT COSTS OF FINANCIAL RESPONSIBILITY, BY FIRM SIZE

Sector/Size of UST Owner	Initial Insurance Cost[a] per Facility[b] or per Employee[b]	Cost Ratio[c]
Retail Motor Fuel Marketing Sector		
Small Firm[d]	$ 3,532	4.34
Intermediate Firm[e]	$ 2,986	3.67
Large Firm[f]	$ 813	1.00
General Industry		
Small Firm[g]	$ 438	36.50
Large Firm[h]	$ 12	1.00

[a] Average premiums for the first five years. Premiums for the out years are lower, but the relative costs for different size classes are constant over time. Costs are net cost above insurance payouts.

[b] Cost per facility for retail motor fuel marketing; cost per employee for general industry.

[c] Ratio of insurance cost per facility for size class to insurance cost per facility for large UST-owning firms. For general industry, ratio of insurance cost per employee for small firms to insurance cost per employee for large firms.

[d] Firm has less than $4.6 million in sales; owns fewer than 6 outlets; and has insurance with a $5,000 deductible, a $1,000,000 per-occurrence limit, and a $1,000,000 aggregate limit.

[e] Firm owns 6 to 24 outlets and has insurance with a $10,000 deductible, a $1,000,000 per-occurrence limit, and a $1,000,000 aggregate limit.

[f] Firm owns 25 or more outlets and has insurance with a $250,000 deductible, a $1,000,000 per-occurrence limit, and a $2,000,000 aggregate limit. Large firms that self-insure have an administrative cost of about $ .03 per outlet.

[g] Mean firm has 6.0 employees (average for manufacturing establishments with fewer than 20 employees). Based on insurance with a $5,000 deductible, a $1,000,000 per-occurrence limit, and a $1,000,000 aggregate limit.

[h] Mean firm has 138 employees (average for manufacturing establishments with 20 or more employees). Based on insurance with a $25,000 deductible, a $1,000,000 per-occurrence limit, and a $1,000,000 aggregate limit.

SOURCE: Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks.

EXHIBIT P-5: FINANCIAL RESPONSIBILITY COSTS FOR LOCAL GOVERNMENTS (Calculated at a Three Percent Discount Rate)

Financial Responsibility Compliance Measure	General Purpose Governments[a]				Districts[b]			
	Very Large[c]	Large[c]	Medium[c]	Small[c]	Very Large[c]	Large[c]	Medium[c]	Small[c]
Insurance/RRG								
Cost per Government								
Actual	-$ 338	$ 378	$ 215	$ 161	-$ 125	$ 553	$ 217	$ 154
Cost Ratio[d]	1.00	N.D.	N.D.	N.D.	1.00	N.D.	N.D.	N.D.
Cost per UST								
Actual	-$ 33	$ 153	$ 153	$ 153	-$ 33	$ 153	$ 153	$ 153
Cost Ratio[d]	1.00	N.D.	N.D.	N.D.	1.00	N.D.	N.D.	N.D.
Cost per Household								
Actual	-$ .005	$ .040	$ .102	$ .421	-$ .002	$ .058	$ .103	$ .403
Cost Ratio[d]	1.00	N.D.	N.D.	N.D.	1.00	N.D.	N.D.	N.D.
State Insurance Fund								
Cost per Government								
Actual	$1,016	$ 248	$ 141	$ 106	$ 375	$ 363	$ 142	$ 101
Cost Ratio[d]	1.00	0.24	0.14	0.10	1.00	0.97	0.38	0.27
Cost per UST								
Actual	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Cost Ratio[d]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Household								
Actual	$ .014	$ .026	$ .067	$ .419	$ .005	$ .038	$ .067	$ .264
Cost Ratio[d]	1.00	1.86	4.79	29.93	1.00	7.60	13.40	52.80
Bond Rating								
Cost per Government								
Actual	$ 75	$ 75	$ 75	$ 75	$ 75	$ 75	$ 75	$ 75
Cost Ratio[d]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Cost per UST								
Actual	$ 7	$ 30	$ 53	$ 70	$ 20	$ 21	$ 52	$ 74
Cost Ratio[d]	1.00	4.29	7.57	10.00	1.00	1.05	2.60	3.70
Cost per Household								
Actual	$ .001	$ .008	$ .036	$ .196	$ .001	$ .008	$ .036	$ .196
Cost Ratio[d]	1.00	8.00	36.00	196.00	1.00	8.00	36.00	196.00
Worksheet Test								
Cost per Government								
Actual	$ 104	$ 104	$ 104	$ 104	$ 104	$ 104	$ 104	$ 104
Cost Ratio[d]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per UST								
Actual	$ 10	$ 42	$ 74	$ 99	$ 28	$ 29	$ 73	$ 103
Cost Ratio[d]	1.00	4.20	7.40	9.90	1.00	1.04	2.61	3.68
Cost per Household								
Actual	$ .001	$ .011	$ .049	$ .272	$ .001	$ .011	$ .049	$ .272
Cost Ratio[d]	1.00	11.00	49.00	272.00	1.00	11.00	49.00	272.00

EXHIBIT P-5: FINANCIAL RESPONSIBILITY COSTS FOR LOCAL GOVERNMENTS (Continued)

Financial Responsibility Compliance Measure	General Purpose Governments[a]				Districts[b]			
	Very Large[c]	Large[c]	Medium[c]	Small[c]	Very Large[c]	Large[c]	Medium[c]	Small[c]
Fund Balance								
Cost per Government								
Actual	$ 164	$ 164	$ 164	$ 164	$ 164	$ 164	$ 164	$ 164
Cost Ratio[d]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per UST								
Actual	$ 16	$ 66	$ 116	$ 155	$ 44	$ 45	$ 115	$ 162
Cost Ratio[d]	1.00	4.12	7.25	9.69	1.00	1.02	2.61	3.68
Cost per Household								
Actual	$ .002	$ .017	$ .078	$ .429	$ .002	$ .017	$ .078	$ .429
Cost Ratio[d]	1.00	8.50	39.00	214.50	1.00	8.50	39.00	214.50
Guarantee								
Cost per Government								
Actual	$ 253	$ 253	$ 253	$ 253	$ 253	$ 253	$ 253	$ 253
Cost Ratio[d]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per UST								
Actual	$ 25	$ 102	$ 180	$ 239	$ 67	$ 70	$ 178	$ 250
Cost Ratio[d]	1.00	4.08	7.20	9.56	1.00	1.04	2.66	3.73
Cost per Household								
Actual	$ .004	$ .027	$ .120	$ .662	$ .004	$ .027	$ .120	$ .662
Cost Ratio[d]	1.00	6.75	30.00	165.50	1.00	6.75	30.00	165.50
Closure								
Cost per Government								
Actual	$8,329	$2,030	$1,154	$ 867	$3,073	$2,975	$1,165	-$ 353
Cost Ratio[d]	1.00	0.24	0.14	0.10	1.00	0.97	0.38	N.D.
Cost per UST								
Actual	$ 820	$ 820	$ 820	$ 820	$ 820	$ 820	$ 820	-$ 349
Cost Ratio[d]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	N.D.
Cost per Household								
Actual	$ .118	$ .313	$ .548	$2.270	$ .043	$ .312	$ .553	-$.914
Cost Ratio[d]	1.00	2.65	4.64	19.23	1.00	7.26	12.86	N.D.

[a] Includes counties, municipalities, and townships.

[b] Includes school districts and other special districts.

[c] Very Large: Over 50,000 population or over $100,000,000 revenues.
Large: 10,000-50,000 population or $5,000,000-$100,000,000 revenues.
Medium: 2,500-10,000 population or $200,000-$5,000,000 revenues.
Small: Under 2,500 population or under $200,000 revenues.

[d] Ratio of cost for size class to cost for Very Large.

reduction of corrective action costs (due to accelerated coming into compliance to qualify for insurance) would more than outweigh the cost of insurance premiums and other accelerated compliance measures. Private insurance is therefore more cost effective for very large governments than is any other option. This outcome means that cost ratios (relative to very large governments) are not defined.

EPA estimated that both private insurance and state insurance funds would have fixed costs per UST. A state insurance fund would cost large, medium, and small local governments only about two thirds of the cost of private insurance, so that it would be the preferable option of the two. Because larger local governments have far fewer USTs relative to population, small general purpose local governments incur costs per household about 30 times as high as the cost per household for very large general purpose governments, and small districts incur costs per household about 50 times as high as the cost per household for very large districts.

Each of the four new financial responsibility mechanisms was estimated by EPA to have fixed costs, regardless of local government size or type. As such, these mechanism have enormous economies of scale. For these mechanisms:[56]

- The cost ratio for small general purpose local governments is:
  - Almost 10, when measured in terms of cost per UST, and
  - Roughly 200, when measured in terms of cost per household; and

- The cost ratio for small districts is:
  - About 3.7, when measured in terms of cost per UST, and
  - Roughly 200, when measured in terms of cost per household.

EPA intended the new financial responsibility mechanisms as regulatory flexibility mechanisms that would lower costs for small local governments. While they are generally less expensive than the original financial responsibility mechanisms, this is not always the case -- particularly for the smallest local governments:

- A bond rating has a lower cost than original mechanisms for large, medium, and small local governments;

---

[56] The cost ratios (for the same size class and for the same type of local government) should be the same for all four mechanisms. Due to rounding error, however, there are instances of substantial differences in Exhibit P-5.

- A worksheet test has:
  - A lower cost than original mechanisms for large and medium local governments, but
  - About the same cost as a state insurance fund for small local governments;

- A fund balance has:
  - A lower cost than original mechanisms for large local governments, but
  - A higher cost than a state insurance fund for medium local governments, and
  - About the same cost as purchasing private insurance but higher cost than a state insurance fund for small local governments; and

- A guarantee:
  - For large local governments:
    - Has a lower cost than purchasing private insurance for general purpose governments, but
    - Has about the same cost as a state insurance fund for general purpose governments, and
    - Is more expensive than either purchasing private insurance or a state insurance fund for districts, and
  - For medium and small local governments has higher costs than either purchasing private insurance or a state insurance fund.

Thus the new mechanisms do not lower costs for small local governments that cannot qualify for the bond rating; medium local governments that cannot qualify for the bond rating or the worksheet test; or large local government districts that qualify only for a guarantee. These mechanisms may offer some useful flexibility to local governments that cannot get private insurance or use a state insurance fund.

A local government can close its USTs and purchase petroleum products at retail. EPA estimated the present value of costs of closure at $820 per UST (more expensive than any other option). EPA estimated, however, that small districts would actually save money -- from the baseline, not just compared with other alternatives -- by closing their USTs, since the average net saving in compliance costs would more than outweigh the cost of not keeping the UST in operation.

4. Conclusions

Aggregate costs of demonstrating financial responsibility for USTs are fairly small, but costs for small entities are disproportionately very large. Enormous economies of scale exist for many reasons:

- Corporations that qualify for self-insurance (which are large), as well as their subsidiaries that can get guarantees, bear virtually no cost of demonstrating financial responsibility (as opposed to complying with technical standards).

- Firms with many USTs are able to pool risk internally and obtain substantially lower insurance premiums by purchasing insurance with higher deductibles.

- Very large local governments actually achieve savings by qualifying for and obtaining private insurance.

- Costs of the financial responsibility mechanisms designed explicitly for local governments are fixed.

- Most of the financial responsibility mechanisms designed explicitly for local governments do not (as compared with the original mechanisms) actually reduce costs for small local governments.

Only two factors mitigate the disproportionate impact on small entities:

- Farms with USTs smaller than 1,100 gallons are exempt from the regulations.

- Small local government districts can achieve savings by closing their USTs.

Q. EPA EFFLUENT GUIDELINES FOR ORGANIC CHEMICALS, PLASTICS, AND SYNTHETIC FIBERS

1. Objective and Summary of the Regulation

As part of an ongoing process to ensure national water quality as mandated by the Clean Water Act (CWA), this regulation established effluent limitations guidelines and standards governing effluent discharges by the organic chemicals, plastics, and synthetic fibers (OCPSF) industries.[57] The effluent guidelines cover both:

- Direct discharges, i.e., discharges of pollutants into navigable waters, and

- Indirect discharges, i.e., discharges of pollutants into public water treatment works (POTWs).

---

[57] These covered industries include:

- SIC 2865, Cyclic Crudes and Intermediates, Dyes, and Organic Pigments,
- SIC 2869, Industrial Organic Chemicals, not Elsewhere Classified,
- SIC 2821, Plastic Materials, Synthetic Resins, and Nonvulcanizable Elastomers,
- SIC 2823, Cellulosic Man-Made Fibers, and
- SIC 2824, Synthetic Organic Fibers, except Cellulosic.

Depending on the circumstances, the CWA mandates different types of technology and standards, which include the following:

- Best Practicable Control Technology Currently Available (BPT) is the average of the best existing performance, considering characteristics of the facilities (age, size, etc.) and cost effectiveness. BPT is applicable to existing industrial direct dischargers of conventional pollutants.[58]

- Best Available Technology Economically Achievable (BAT) is based principally on engineering considerations and cost. BAT is applicable to existing industrial direct dischargers of toxic and nonconventional pollutants.

- Best Conventional Pollution Control Technology (BCT) is based on a two-part test of "cost-reasonableness," which includes:
  - Comparison of private industry and POTW costs of achieving similar levels of reduction of pollutants, and
  - Cost effectiveness of additional industrial treatment beyond BPT.

  BCT, which must be at least as stringent as BPT, is applicable (instead of BAT) to direct discharge of conventional pollutants.

- New Source Performance Standards (NSPS) require the best available demonstrated technology -- the best and most efficient production and wastewater treatment technology -- for all pollutants. NSPS apply to new industrial direct dischargers.

- Pretreatment Standards for Existing Sources (PSES), which are analogous to BAT and generally cover toxic and non-conventional pollutants. PSES apply to existing indirect discharges.

- Pretreatment Standards for New Sources (PSNS) generally cover toxic and non-conventional pollutants and apply best available demonstrated technology to new indirect dischargers.

---

[58] Conventional pollutants include biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform, pH, oil, and grease.

EPA promulgated OCPSF effluent guidelines in 1987. In 1993, in response to court remands, EPA revised the regulations to add BAT and NSPS limitations for 19 additional pollutants and PSES and PSNS limitations for 11 of these 19 pollutants.

2. Estimated Costs of Compliance With the Regulation

EPA identified 940 plants in the OCPSF industries that were covered by the regulations. Of the plants:

- o 286 were estimated to have zero discharges or had no discharge data; and

- o 654 were estimated to incur costs, including:
  - 289 direct dischargers, and
  - 365 indirect dischargers.

EPA conducted the analysis of compliance costs with micro data on 648 of these 654 affected plants.

EPA developed a variety of regulatory options for BAT, BPT, and PSES treatment.[59] Exhibit Q-1 summarizes the costs for the principal options considered. EPA's estimate of the total annualized compliance costs for the three chosen treatment options was $505.1 million.[60] The additional costs of the 1993 amendments were estimated using the options chosen in 1987. These amendments added costs of $48.2 million (in 1982 dollars), which are also shown in Exhibit Q-1.

3. Effects of the Regulation on Small Establishments

---

[59] NSPS and PSNS were not included in the economic impact analysis, since (by definition) these standards do not apply to existing facilities.

[60] EPA's published estimate in the preamble to the final rule was in 1986 dollars. Exhibit Q-1, taken from the EIA, is in 1982 dollars. Total annualized cost of BPT Option I, BAT Option IIB, and PSES Option IVB, in 1982 dollars, is $457.4 million.

EPA considered several types of definition of small plant and carried through the analysis several different levels of OCPSF production, with and without total sales limits for the parent company (if any). EPA finally settled on a definition of a small plant as one with less than 5 million pounds of OCPSF production per year. EPA considered the fact that some small plants are owned by large companies. With fairly minor exceptions (in financial impacts), however, EPA concluded that impacts on small plants were similar regardless of the size of owner.

EXHIBIT Q-1: OCPSF TREATMENT COSTS BY REGULATORY OPTION

		Treatment Costs		
Regulatory Option	Number of Plants With Costs	Capital Investment (Millions)	Operation & Maintenance (Millions)	Total Annualized (Millions)
BPT Option I[a]	214	$ 193.0	$ 39.4	$ 68.6
BAT Option I[b]	289	$ 162.6	$ 115.5	$ 139.9
BAT Option IIA[b]	289	$ 333.2	$ 230.5	$ 280.9
BAT Option IIB[b,c]	289	$ 322.7	$ 157.4	$ 206.1[d]
BAT Option V[b]	289	$1,100.8	$ 578.1	$ 744.1
PSES Option IVA[a]	365	$ 318.9	$ 262.8	$ 311.7
PSES Option IVB[a,c]	365	$ 260.7	$ 142.8	$ 182.7[e]
PSES Option VII[a]	365	$ 319.4	$ 152.4	$ 201.3

[a] Costs are incremental to current treatment in place.

[b] Plants with both direct and indirect discharges are included in BAT options. All BAT costs are incremental to BPT I costs.

[c] Option promulgated in the 1987 final rule.

[d] $210.5 million in the 1993 final rule.

[e] $226.5 million in the 1993 final rule.

SOURCES: "Economic Impact Analysis of Effluent Limitations and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," September 1987. "Re-evaluation of the Economic Impact Analysis of Effluent Limitations Guidelines for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," May 1993.

EPA identified 125 plants with less than 5 million pounds of OCPSF production that would incur costs under the regulation (19 percent of all plants that would incur costs). Of these plants:

- There were 19 small direct dischargers, which
  - Comprised 6.5 percent of all direct dischargers,
  - Produced 0.2 percent of OCPSF production by direct dischargers, and
  - Accounted for 0.1 percent of potential pollution reduction; and

- There were 106 small indirect dischargers, which
  - Comprised 29 percent of all indirect dischargers,
  - Produced 0.3 percent of OCPSF production by indirect dischargers, and
  - Accounted for 11.8 percent of potential pollution reduction.

EPA determined that impacts on small OCPSF plants would be large. Because of the very small level of pollution involved, EPA lowered BAT requirements on small direct dischargers to the equivalent of BPT in order to minimize these impacts. For indirect dischargers, however, EPA determined that the level of pollution was too large, and the alternatives were too limited in their ability to reduce impacts without allowing most of the pollution, to allow any such regulatory flexibility measure. Thus EPA made small indirect dischargers subject to PSES.

Exhibit Q-2 shows the resulting impacts of the OCPSF effluent guidelines on large and small plants. The published data are rather limited,[61] but they allow a comparison

[61] EPA examined significant impacts in terms of closures, reductions in profitability, and cost relative to sales. While the analysis was quite detailed, the EIA and RFA provide results on significant impacts only in terms of the numbers of plants that exceeded specified impact thresholds.

on the basis of cost per 1,000 pound equivalents[62] of pollution removed. EPA took BPT as an absolute requirement. Thus the search for regulatory flexibility addressed only BAT (for direct dischargers) and PSES (for indirect dischargers). As a consequence, Exhibit B shows only costs for BAT and PSES, not for BPT.

Exhibit Q-2 shows classic economies of scale and very large disproportionate impacts on small plants. Small direct dischargers, in the absence of regulatory flexibility alternatives, would have had BAT costs per 1,000 pounds of OCPSF production 38 times as high as costs of large direct dischargers. Setting BAT equal to BPT for small direct dischargers, however, entirely eliminated these incremental regulatory compliance costs. Small indirect dischargers, however, were not so fortunate. Their estimated PSES costs per 1,000 pounds of OCPSF production are 67 times as high as costs of large indirect dischargers.

[62] A "pound equivalent" is a pound of pollution multiplied by a weight (taking a value of 1.00 or greater) reflecting the degree of toxicity or health hazard of the pollutant.

EXHIBIT Q-2: OCPSF TREATMENT COSTS BY SIZE OF PLANT

	Large Plant[a]	Small Plant[b]
Direct Discharger (BAT Costs)		
Treatment Cost per Plant		
BAT for all Plants	$ 763,333[c]	$ 294,739[d]
BAT=BPT for Small Plants	$ 763,333[c]	$ 0
OCPSF Production per Plant (1,000 lbs.)	191,350[c]	1,947[d]
Treatment Cost per 1,000 lbs. OCPSF		
BAT for all Plants	$ 3.99	$151.38
BAT=BPT for Small Plants	$ 3.99	$ 0
Cost Ratio		
BAT for all Plants	-	37.94
BAT=BPT for Small Plants	-	0.00
Indirect Discharger (PSES Costs)		
Treatment Cost per Plant	$ 567,953[c]	$ 335,849[d]
OCPSF Production per Plant (1,000 lbs.)	191,350[c]	1,698[d]
Treatment Cost per 1,000 lbs. OCPSF	$ 2.97	$197.79
Cost Ratio	-	66.60

---

[a] OCPSF production of more than 5,000,000 pounds per year.

[b] OCPSF production of less than 5,000,000 pounds per year.

[c] Based on 270 plants subject to BAT and 259 plants subject to PSES. SOURCE: "Economic Impact Analysis of Effluent Limitations and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," September 1987.

[d] Based on 19 plants subject to BAT and 106 plants subject to PSES. SOURCE: "Re-evaluation of the Economic Impact Analysis of Effluent Limitations Guidelines for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," May 1993.

4. Conclusions

The OCPSF effluent guidelines impose costs on small businesses that are disproportionately high to a very large degree. Small direct dischargers would have incurred per-employee costs 38 times as large direct dischargers, and small indirect dischargers incur per-employee costs 67 times as large as large indirect dischargers. Economies of scale in retrofitting engineering controls are responsible for this disparity. For direct dischargers, however, EPA provided regulatory flexibility in the form of setting BAT equal to BPT for small plants. This redefinition eliminated compliance costs for small direct dischargers.

R. EPA REGULATIONS ON DISPOSAL OF SEWAGE SLUDGE

1. Objective and Summary of the Regulation

Under the authority of the Clean Water Act (CWA), these regulations are intended to protect public health and the environment from adverse effects of pollutants present in sewage sludge. They establish requirements for the final use and disposal of sewage sludge in three ways: beneficial agricultural uses; surface landfill storage; and incineration. The standards for each disposal practice consist of numerical limits on the pollutant concentrations in the sewage sludge, management practices, and (in some cases) operational requirements. There are also monitoring, recordkeeping, and reporting requirements.

In establishing the rule, the EPA evaluated criteria relating to the risks stemming from consumption of crops fertilized with sewage; possible contamination of drinking water when sewage is disposed of on the land; and the effects on crops, cattle, wildlife, and aquatic species. EPA also considered the effect of emissions from sewage sludge incinerators. The numerical limits for pollutants in sewage were derived from already published or promulgated environmental criteria. Thus, for example, when sewage sludge is incinerated, the numerical limit for lead emissions is based on the NAAQS for lead. The rule sets requirements for the treatment of sewage sludge before it is disposed of in the three specified ways.

EPA estimated that the final rule imposed costs on about 9,200 water treatment works. These include publicly owned treatment works (POTWs), privately owned treatment works, and federally owned treatment works. In addition, the regulation covers 6,120 domestic septage haulers.

2. Estimated Costs of Compliance With the Regulation

EPA analyzed compliance costs for each of the three major disposal practices: Land application, surface disposal, and incineration. The analysis made further distinctions among type of treatment (primary or secondary and advanced), type of entity (treatment works or septage hauler), ownership of treatment works (public, private, or federal), and size class of POTW. Cost estimates were based on specific requirements:

- o For land application, cost categories include:
  - Management practice requirements,
  - Meeting pollutant concentration limits,
  - Meeting pathogen and vector control attraction reduction requirements,
  - Monitoring requirements, and
  - Recordkeeping and reporting requirements.

- o For surface disposal, cost categories include:
  - Management practice requirements,
  - Meeting pollutant concentration limits,
  - Meeting pathogen and vector control attraction reduction requirements,
  - Monitoring requirements,
  - Recordkeeping and reporting requirements, and (in some cases)
  - Shifting to land application.

- o For incineration, cost categories include:
  - Management practice requirements,
  - Meeting pollutant concentration limits,
  - Monitoring requirements, and
  - Recordkeeping and reporting requirements.

Exhibit R-1 summarizes total compliance costs of the Part 503 sewage sludge regulations by type of entity and manner of disposal of sludge. The total estimated cost of the regulation is $44.22 million.

3. Effects of the Regulation on Small Establishments

Treatment Works. EPA analyzed costs by size of treatment works, using reported flow as a measure of size. The four size categories used in the analysis were: Over 100 million gallons per day (MGD); 10 to 100 MGD; 1 to 10 MGD; and 1 MGD or less. EPA considered treatment works with a rate of one MGD or less to be small.[63] This size class includes virtually all (about 99 percent) of privately owned treatment works, and so EPA considered privately owned treatment works as a class to be small entities. Small treatment works with one MGD or less make up 82.1 percent of all treatment works. Of these, 59.3 percent are covered by Part 503.[64]

The RIA indicated that small treatment works, as a group, incur $10.5 million in cost, or 23.7 percent of costs of all treatment works. Overall, small treatment works incur average compliance costs of $726, which is $16.50 per dry metric ton (dmt) of output and 0.365 percent of average revenue. By contrast, large treatment works incur average compliance costs of $10,661, which is $10.28 per dmt of output and 0.251 percent of revenue. Thus compliance costs per dmt are 60.5 percent higher for small

---

[63] One MGD of wastewater corresponds to a service population of 10,000.

[64] "Non-regulated" facilities have lagoons and will incur compliance costs only in years that they dredge and dispose of the contents of the lagoon.

treatment works than for large treatment works, and compliance costs relative to revenue are 45.4 percent higher for small treatment works than for large ones.

EXHIBIT R-1:
SUMMARY OF COMPLIANCE COSTS FOR SEWAGE SLUDGE DISPOSAL REGULATIONS[a]

	Primary Treatment POTWs	Secondary/ Advanced Treatment POTWs	Privately Owned Treatment Works	Federally Owned Treatment Works	Domestic Septage Haulers
Number of Affected Entities	1,296	6,249	1,580	81	6,120
Land Application					
Monitoring, Recording & Reporting Costs	$ 465,441	$2,475,464	$ 396,165	$ 20,405	$ 226,994
All Other Costs	$1,389,104	$9,164,470	$ 42,189	$ 2,173	0
Total Costs	$1,854,545	$11,639,934	$ 438,354	$ 22,578	$ 226,994
Surface Disposal					
Monitoring, Recording & Reporting Costs	$1,515,258	$10,188,030	$1,647,490	$ 83,720	$ 56,564
All Other Costs	$ 260,220	$1,919,439	$ 515,185	$ 26,180	$2,122,498
Total Costs	$1,775,478	$12,107,469	$2,162,675	$ 109,900	$2,179,062
Incineration					
Monitoring, Recording & Reporting Costs	$ 44,000	$ 722,000	0	0	0
All Other Costs	$ 445,000	$10,492,000	0	0	0
Total Costs	$ 489,000	$11,214,000	0	0	0
All Uses					
Monitoring, Recording & Reporting Costs	$2,024,699	$13,385,494	$2,043,655	$ 104,125	$ 283,558
All Other Costs	$2,094,324	$21,575,909	$ 557,374	$ 28,353	$2,122,498
Total Costs	$4,119,023	$34,961,403	$2,601,029	$ 132,478	$2,406,056

[a] Does not include $1.6 million to read and interpret the regulation and to comply with Subpart A requirements.

SOURCE: Regulatory Impact Analysis of the Part 503 Sewage Sludge Regulation.

Exhibit R-2 shows relative costs for land application and surface disposal.[65] These data show that compliance costs for small treatment works using land application are disproportionate but only by a relatively small factor of 1.1 to 1.25. For surface disposal, however, compliance costs for small treatment works are more than twice as high as land application compliance costs. For large treatment works, on the other hand, surface disposal compliance costs are less than one third of land application compliance costs. This combination means that compliance costs are disproportionately higher for small treatment works by a factor of about eight.

Septage Haulers. EPA considered septage haulers as a class to be small entities. A large majority (95 percent) of these firms haul one million gallons of septage or less (corresponding to revenues of approximately $70,000 or less) annually. Even the largest septage haulers generally have fewer than 10 employees and revenues of less than $1 million.

Data on septage haulers were not very well developed in the RIA. The RIA estimated average costs for septage haulers to be:

- $48 per facility if land application is utilized;
- $1,602 per facility if surface disposal is utilized; and
- $393 per facility overall.

The nature of the business is that one truck pumps out one septic tank in one trip, and the homeowner is billed per trip. It appears, therefore, that compliance costs would be approximately proportional to revenue, and that there is relatively little variation in impacts on septage haulers with respect to firm size.

4. Conclusion

The regulations on disposal of sewage sludge impose disproportionately large costs on small POTWs. The general reason is that most of the specific cost categories (e.g. management practices, monitoring requirements, and recordkeeping/reporting requirements) are subject to some degree of economies of scale. The quantitative measures of disproportionately large impacts on small POTWs (particularly the disparity between land application and surface disposal), however, are not clear.

---

[65] Small treatment units do not use incineration. Data in the RIA for land application and surface disposal were not entirely comparable, so that land application data in Exhibit R-2 pertain to POTWs and cost data for surface disposal are for all treatment works.

EXHIBIT R-2:
SEWAGE SLUDGE COMPLIANCE COSTS, BY SIZE OF TREATMENT WORKS

	Small Treatment Works[a]	Large Treatment Works[b]
Land Application		
Cost per POTW[c]	$ 426	$ 8,153
Output[c]	44 dmt[d]	1,037 dmt[d]
Revenue[e]	$ 198,880	$4,243,082
Cost per Unit Output	$ 9.68/dmt[d]	$ 7.86/dmt[d]
Cost Ratio[f]	1.26	1.00
Cost as a Percent of Revenue	0.214 %	0.192 %
Cost Ratio[g]	1.11	1.00
Surface Disposal		
Cost per POTW	$ 981	$ 2,755
Output[c]	44 dmt[d]	1,037 dmt[d]
Revenue[e]	$ 198,880	$4,243,082
Cost per Unit Output	$22.30/dmt[d]	$ 2.66/dmt[d]
Cost Ratio[f]	8.38	1.00
Cost as a Percent of Revenue	0.493 %	0.065 %
Cost Ratio[g]	7.58	1.00

a One MGD or less.

b Over one MGD.

c Based on POTWs with secondary or advanced treatment.

d Dry metric tons.

e Based on POTWs (i.e. private treatment works are not included).

f Ratio of cost/dmt for small works to cost/dmt for large works.

[g] Ratio of cost/revenue for small works to cost/revenue for large works.

SOURCE: Regulatory Impact Analysis of the Part 503 Sewage Sludge Regulation.

S. EPA NATIONAL PRIMARY DRINKING WATER REGULATIONS FOR LEAD AND COPPER

1. Objective and Summary of the Regulation

The Safe Drinking Water Act (SDWA) requires EPA to set stringent health-based maximum contaminant level goals (MCLGs) for drinking water contaminants and to promulgate national primary drinking water regulations (NPDWRs). NPDWRs are generally set as maximum contaminant levels (MCLs), which are based on best available technology (BAT). Lead and copper were among the contaminants specified in the SDWA Amendments of 1986. Lead and copper are unique among drinking water contaminants in that the principal source of contamination is the water distribution system itself -- often the parts of the distribution system that are beyond the water utility's ownership and control. Lead and copper are also unusual in that consumer practices (such as initially letting water run) can greatly reduce exposure levels.

This regulation sets MCLGs of zero for lead and 1.3 mg/l for copper. The regulatory requirements include:

- o Monitoring, to determine whether action is required, including:
  - Initial monitoring for lead and copper at the tap,
  - Source water monitoring if action levels are exceeded, and
  - Reduced follow-up monitoring if action levels are not exceeded; and

- o Development of a treatment plan and compliance actions that (depending on the extent to which action levels are exceeded) may include:
  - Corrosion control treatment,
  - Replacement of lead service connections,
  - Treatment of source water to reduce lead and copper levels, and
  - Public education.

The regulations require the States to determine optimum treatment plans. The regulations also include a number of elements of regulatory flexibility, including delayed phase-in for small water systems, variations in monitoring requirements, and different types of corrosion control treatment.

2. Estimated Costs of Compliance With the Regulation

SDWA requirements fall on Public Water Systems (PWSs), most of which are operated by small governmental units. PWS costs fall into two principal categories:

- o Information collection activities, including:
  - Familiarization,
  - Training,
  - Planning, and
  - Monitoring; and

- o Control and treatment activities, including:
  - Inhibition of corrosion and adjustment of pH and alkalinity, so that less lead and copper will be dissolved from pipes into the drinking water,
  - Removal of lead service lines, and
  - Public education.

States also have a substantial role -- and bear substantial costs -- of developing treatment plans and generally overseeing local water systems. This state role substantially reduces many of the costs, particularly for small PWSs.

Exhibit S-1 shows the average and total estimated costs of PWS information collection activities. Total estimated costs of initial activities and monitoring are $42,263,511, or an average of $537 per PWS. Monitoring for corrosion by-products is by far the largest single element in these costs, accounting for just over half of all costs.

Average and total costs of control and treatment activities are much more difficult to predict. The type of activities contained in a treatment plan -- and the necessity for control and treatment activities in the first place -- depend on the results of monitoring, as well as local conditions. If a PWS does need to control lead and copper and treat the water, however, the costs are large. Costs of a single treatment measure for the smallest PWS run two to five times the average PWS cost of information collection.

3. Effects of the Regulation on Small Establishments

Virtually all activities related to controlling lead and copper in drinking water are subject to large economies of scale. Exhibit S-2 shows estimated hours and costs for PWS initial staff activities and ongoing planning and review related to monitoring. In these cost estimates, the largest PWS serves <u>at</u> <u>least</u> 15 times as many people as the smallest PWS. Yet the total costs to the system are only 2.5 times as great (training) to 5 times as great (plan and review) for the largest PWS as for the smallest PWS.

Monitoring activities, shown in Exhibit S-3, are similarly subject to major economies of scale. This is due in large part to the increasing efficiency of sampling as populations become larger. In Exhibit S-3, the largest PWS serves <u>at</u> <u>least</u> 1,000 times as many as the smallest PWS. Yet for initial and follow-up monitoring, the largest PWS must sample only 20 times as many taps as the smallest PWS. Under reduced monitoring, the largest PWS must sample only 10 times as many taps as the smallest PWS. Source monitoring is even more dramatic, since all PWS must take the same number of samples (initially five; later two), regardless of size.

Exhibit S-4 shows costs for different control and treatment actions that may be taken. These costs are shown for several different sizes of PWS. (In this exhibit, the largest PWS serves at least 10,000 times as many people as the smallest PWS.) Exhibit S-4 normalizes control and treatment costs by calculating them per household for PWSs of different sizes. The disproportion in costs is striking; compared with the largest PWS, estimated costs per household for the smallest PWS are:

- o 95 times higher for corrosion inhibition;

- o 22 to 86 times higher for pH adjustment;
- o 17 to 27 times higher for alkalinity adjustment; and
- o 5 to 15 times higher for removal of lead service lines.

EXHIBIT S-1:

ANNUAL PUBLIC WATER SYSTEM BURDEN AND COST ESTIMATES

FOR INFORMATION COLLECTION ACTIVITIES

	Burden Hours		Costs	
Collection Activities	**per PWS**	**Total[a]**	**per PWS**	**Total[a]**
Read the Rule	0.1	7,870	$ 5	$ 393,515
Plan and Review	5.1	401,385	$ 66	$ 5,194,398
Train Staff	0.1	7,870	$ 3	$ 236,109
Monitoring				
Source Water	0.2	15,741	$ 6	$ 472,218
Corrosion	15.0	1,180,545	$ 274	$21,564,622
Water Quality Parameters	0.8	62,962	$ 43	$ 3,384,229
Lead Line Replacement	10.0	787,030	$ 140	$11,018,420
TOTAL	31.3	2,463,404	$ 537	$42,263,511

[a] Based on 78,703 Public Water Systems.

SOURCE: U.S. Environmental Protection Agency, Office of Drinking Water, "Information Collection Request for National Primary Drinking Water Regulations for Lead and Copper," Exhibit 8.

EXHIBIT S-2: ESTIMATES OF PWS STAFF BURDEN AND COST, BY PWS SIZE

	Size of Public Water System			
	≤ 3,300	3,301-10,000	10,001-50,000	> 50,000
Initial Activity Read the Rule				
Hours per System	2	4	4	4
Cost per Hour	$ 40	$ 40	$ 40	$ 40
Total System Cost	$ 80	$160	$160	$160
Initial Activity Train Staff				
Hours per System	2	3	4	5
Cost per Hour	$ 25	$ 25	$ 25	$ 25
Total System Cost	$ 50	$ 75	$100	$125
Ongoing Activity Plan and Review				
Hours per Sample	0.5	0.5	0.5	0.5
Cost per Hour	$ 13	$ 13	$ 13	$ 13
Total System Cost[a]	$260[b]	$520	$780[c]	$1,300[d]

[a] Based on initial monitoring requirements (see Exhibit S-1).

[b] Cost for a water system serving 501 to 3,000 people.

[c] Cost for a water system serving 10,001 to 100,000 people.

[d] Cost for a water system serving over 100,000 people.

EXHIBIT S-3: REQUIREMENTS FOR TAP SAMPLES, BY PWS SIZE

	Size of Population Served by Water System					
	≤ 100	101-500	501-3,300	3,301-10,000	10,000-100,000	>100,000
Initial Monitoring						
Minimum Number of Samples	5	10	20	40	60	100
Sampling Frequency/Year	2	2	2	2	2	2
Annual Sampling Cost[a]	$ 550	$1,100	$2,200	$4,400	$6,600	$11,000
Follow-Up Monitoring						
Minimum Number of Samples	5	10	20	40	60	100
Sampling Frequency/Year	2	2	2	2	2	2
Annual Sampling Cost[a]	$ 550	$1,100	$2,200	$4,400	$6,600	$11,000
Reduced Monitoring[b]						
Minimum Number of Samples	5	5	10	20	30	50
Sampling Frequency/Year	1	1	1	1	1	1
Annual Sampling Cost[a]	$ 275	$ 275	$ 550	$1,100	$1,650	$ 2,750

[a] Based on an estimated cost of $55 per sample ($20 for collection plus $35 for analysis).

[b] Reduced annual monitoring may be allowed by the State if the system can demonstrate that it has optimized corrosion control and is maintaining the water quality parameters established by the State. If this is demonstrated, or if the system meets the lead and copper action levels, for three consecutive one-year monitoring periods, small and medium-sized systems may reduce the frequency to once every three years. Sampling must be performed in June, July, or August.

SOURCE: U.S. Environmental Protection Agency, Office of Drinking Water, "Information Collection Request for National Primary Drinking Water Regulations for Lead and Copper."

EXHIBIT S-4:
ANNUALIZED COMPLIANCE COSTS FOR SELECTED PWS SIZE CATEGORIES

Type of Annualized Cost	Size of Population Served by Water System: 25-100	3,301-10,000	50,001-75,000	> 1,000,000
Corrosion Control Treatment				
Corrosion Inhibitor				
(e.g., Zinc Orthophosphate)				
System Cost[a]	$ 1,945	$14,491	$ 35,365	$ 988,456
Cost per Household[b]	$ 95.00	$ 6.00	$ 1.00	$ 1.00
pH Adjustment				
Lime				
System Cost[a]	$ 1,761	$28,982	$106,094	$ 988,456
Cost per Household[b]	$ 86.00	$ 12.00	$ 3.00	$ 1.00
Caustic Soda				
System Cost[a]	$ 1,352	$14,491	$106,094	$2,965,367
Cost per Household[b]	$ 66.00	$ 6.00	$ 3.00	$ 3.00
Calcite Beds				
System Cost[a]	$ 2,335	c	c	c
Cost per Household[b]	$114.00	c	c	c
Alkalinity Adjustment				
Soda Ash				
System Cost[a]	$ 1,659	$19,321	$141,459	$2,965,456
Cost per Household[b]	$ 81.00	$ 8.00	$ 4.00	$ 3.00
Sodium Bicarbonate				
System Cost[a]	$ 1,761	$21,736	$176,823	$4,942,279
Cost per Household[b]	$ 86.00	$ 9.00	$ 5.00	$ 5.00
Removal of Lead Service Lines				
System Cost[d]	$ 942	$14,491	$106,094	$8,896,102
Cost per Household[d]	$ 46.00	$ 6.00	$ 3.00	$ 9.00

[a] Derived from Table 8 in the Preamble to the Final Rule, based on the systems serving the following population sizes:

25-100:	2.048 million gallons/year;
3,301-10,000:	241.517 million gallons/year;
50,001-75,000:	3.536 billion gallons/year;
Over 1,000,000:	98.846 billion gallons/year.

[b] Derived from Table 8 in the Preamble to the Final Rule, assuming average annual household water consumption of 100,000 gallons.

[c] Systems serving over 500 people typically do not use calcite beds.

[d] Final RIA; Base Case, High Bound.

Exhibit S-5 shows costs on a relative basis for different sizes of PWS. All costs were computed per household (as in Exhibit S-4), and then the cost per household for each PWS size class was divided by the cost per household for PWSs serving over 1,000,000 people. Exhibit S-5 shows that -- comparing costs per household for the smallest PWSs with those of the largest PWSs; staff costs are hundreds of times greater for the smallest PWSs; monitoring costs are thousands of times greater; water treatment costs are 20 to 90 times greater; and lead service line removal costs are five times greater.

EPA took a service population of 50,000 (the cut-off specified in the Regulatory Flexibility Act for local governments) as the dividing line between a "small" PWS and a large one. The relative costs suggest that this is a reasonable demarcation, in that unit costs for smaller PWSs rise sharply, while many unit costs of the 50,001-75,000 PWSs are similar to those of very large PWSs. Roughly 98 percent of PWSs serve fewer than 50,000 people, however, so that this dividing line leaves rather few "large" PWSs. Moreover, it should be noted that unit costs for very small PWSs are very much higher than unit costs for PWSs that serve several thousand people.

Removal of lead service lines is the only activity that does not impose very much higher unit costs on smaller PWSs than on large (although in other contexts a factor of 5 in relative unit costs would be considered very large). The reason for this is that very large PWSs serve large metropolitan areas. Replacement of service lines in large cities is an extremely disruptive and expensive operation, while in smaller cities and residential areas with single-family dwellings it is much simpler to dig up and replace service lines.

Exhibit S-6 shows scenarios that combine all of the costs. All PWSs must undertake information collection activities. Only those with lead and/or copper above the action levels must undertake control and treatment activities. Thus the two types of activities were subtotaled separately and then combined. Exhibit S-6 shows that information collection (particularly monitoring) costs are relatively small, but that the disproportionate impact on small PWSs is astonishingly large. Costs of correction and treatment activities are very much larger, but the disparity in unit cost impacts on all but the smallest PWSs is quite moderate. When the two types of costs are combined, the pattern remains much the same as the correction and treatment costs. If the costs are considered without lead service line removal (see footnotes f and g of Exhibit S-6), relative unit costs for the smaller become considerably greater, and the jump in unit costs between 10,000 and 50,000 service population becomes clearer.

4. Conclusion

The lead and copper drinking water standards impose extremely high costs per household on small public water systems. The smallest PWSs have costs per household that are over 20 times as high as large urban PWSs. Economies of scale affect nearly all compliance activities and are particularly high for statistical activities (sampling), as well as for familiarization, information, and planning activities. Simplified water treatment mitigates the disparity, but even water treatment is more expensive per household for very small PWSs.

EXHIBIT S-5: RELATIVE UNIT COSTS OF COMPLIANCE, BY PWS SIZE[a]

Activity	Size of Population Served by Water System 25-100[b]	3,301-10,000[b]	50,001-75,000[b]	> 1,000,000[b]
INFORMATION COLLECTION				
Initial Activity[c]				
Read the Rule	614.15	409.15	27.96[c]	1.00
Train Staff	786.16	246.04	22.37[c]	1.00
Ongoing Activity[c]				
Plan and Review	245.63	163.73	16.78	1.00
Monitoring[d]				
Initial/Follow-Up	2,419.80	164.10	16.80	1.00
Reduced	4,845.43	163.73	16.77	1.00
CONTROL AND TREATMENT				
Corrosion Control[e]				
Corrosion Inhibitor	95.00	6.00	1.00	1.00
pH Adjustment				
Lime	86.00	12.00	3.00	1.00
Caustic Soda	22.00	2.00	1.00	1.00
Alkalinity Adjustment				
Soda Ash	27.00	2.67	1.33	1.00
Sodium Bicarbonate	17.20	1.80	1.00	1.00
Lead Service Line Removal[e]	5.11	0.67	0.33	1.00

[a] Cost per household for PWS size class divided by cost per household for PWS serving over 1,000,000 people.

[b] Numbers of households are as follows:
20.4 for a PWS serving 25-100 people,
2,415 households for a PWS serving 3,001-10,000 people,
35,365 households for a PWS serving 50,001-75,000 people, and
988, 456 households for a PWS serving over 1,000,000 people.

[c] Based on Exhibit S-2. PWS serving over 1,000,000 people and PWS serving 50,001-75,000 people based on costs for over 50,000 people; PWS serving 25-100 based on costs for less than 3,300, adjusted for number of households.

[d] Based on Exhibit S-3. PWS serving over 1,000,000 people based on costs for over 100,000 people; PWS serving 50,001-75,000 people based on costs for 10,000-100,000 people.

[e] Based on Exhibit S-4.

EXHIBIT S-6:
ACTUAL AND RELATIVE ANNUALIZED SYSTEM COMPLIANCE COST, BY PWS SIZE

		Size of Population Served by Water System			
Activity		**25-100**	**3,301-10,000**	**50,001-75,000**	**> 1,000,000**
Information Collection[a]					
Read the Rule		$ 80	$ 160	$ 160	$ 160
Train Staff		$ 50	$ 75	$ 100	$ 125
Plan and Review		$ 260	$ 520	$ 780	$ 1,300
Monitoring[b]		$ 550	$ 4,400	$ 6,600	$11,000
Subtotal:	Actual	$ 940	$ 5,155	$ 7,640	$12,585
	Relative[c]	3,619.13	167.66	16.97	1.00
Control and Treatment					
Corrosion Inhibitor		$ 1,945	$14,491	$ 35,365	$ 988,456
pH Adjustment		$ 1,352	$14,491	$106,094	$2,965,367
Alkalinity Adjustment[e]		$ 1,761	$21,736	$176,823	$2,965,456
Lead Service Line Removal		$ 942	$14,491	$106,094	$8,896,102
Subtotal:	Actual	$ 6,000	$65,209	$424,286	$15,815,381
	Relative[c]	18.38[f]	1.69[f]	0.75[f]	1.00
Total					
Actual		$ 6,940	$70,364	$431,926	$15,827,966
Relative[c]		21.25[g]	1.82[g]	0.76[g]	1.00

[a] Initial cost for reading the rule and training staff; one year cost for planning, review, and monitoring.

[b] Initial or follow-up monitoring costs.

[c] Cost per household for PWS size class divided by cost per household for PWS serving over 1,000,000 people.

[d] Caustic soda method.

[e] Sodium bicarbonate method.

[f] Without lead service line removal, the relative costs are 35.42 for a 25-100 PWS, 3.00 for a 3,301-10,000 PWS, and 1.29 for a 50,001-75,000 PWS.

[g] Without lead service line removal, the relative costs are 41.93 for a 25-100 PWS, 3.30 for a 3,301-10,000 PWS, and 1.31 for a 50,001-75,000 PWS.

T. EPA NATIONAL PRIMARY DRINKING WATER REGULATIONS FOR PHASE V SYNTHETIC ORGANIC CHEMICALS AND INORGANIC CHEMICALS

1. Objective and Summary of the Regulation

This Phase V regulation sets forth drinking water maximum contaminant level goals (MCLGs) for eighteen synthetic organic chemicals and five inorganic chemicals. The regulation also includes requirements pertaining to monitoring, reporting, and public notification for these chemicals. This regulation is part of a series of rules mandated under the Safe Drinking Water Act (SDWA).

As required by the SDWA, the MCLGs for synthetic organic and inorganic chemicals in this regulation have been set at concentrations at which no known or anticipated adverse health effects occur, allowing for an adequate margin of safety. For five of the chemicals, the MCLG is zero, and for these EPA has set different maximum contaminant levels (MCLs), which are as close to the MCLGs as feasible, using best available technology (BAT). Establishment of an MCLG for each specific contaminant depends on evidence of the chemical being a carcinogen and/or on non-carcinogenic hazards. Exhibit T-1 shows the chemicals regulated under Phase V, as well as the MCLGs, MCLs, and carcinogenicity.

2. Estimated Costs of Compliance With the Regulation

EPA's analysis implicitly divided the contaminants into three groups:

- o Contaminants that would not occur at concentrations above the MCL, and thus would not result in treatment costs (eight contaminants);
- o Contaminants for which national occurrence data did not exist, so that they could not be included in the cost analysis (11 contaminants); and
- o Contaminants included in the analysis (5 contaminants), which were:
  - Antimony,
  - Nickel,
  - Sulfate,
  - Dichloromethane, and
  - Dinoseb.

Sulfate was estimated to affect five times as many water systems as the other four contaminants combined, and to account for almost 60 percent of the total cost. EPA finally decided to defer Sulfate, and Sulfate was not included in the Final Rule.

EPA estimated the number of water systems in which concentrations of each contaminant would exceed the MCL. EPA then estimated, for each contaminant:

- o Capital costs of water treatment and waste disposal;
- o Operation and maintenance costs;
- o Monitoring costs; and

- State implementation costs.

EXHIBIT T-1: PHASE V DRINKING WATER CONTAMINANTS

Contaminants	Final MCLG (mg/l)	Final MCL (mg/l)
Inorganic Chemicals		
Antimony	0.006	0.006
Beryllium	0.004	0.004
Cyanide	0.2	0.2
Nickel	0.1	0.1
Thallium	0.0005	0.0005
Volatile Organic Chemicals		
Dichloromethane	zero[a]	0.005
1,2,3-Trichlorobenzene	0.07	0.07
1,1,2-Trichloroethane	0.003[b]	0.005
Synthetic Organic Chemicals, Pesticides		
Dalapon	0.2	0.2
Dinoseb	0.007	0.007
Diquat	0.02	0.02
Endothall	0.1	0.1
Endrin	0.002	0.002
Glyphosate	0.7	0.7
Oxamyl	0.2	0.2
Picloram	0.5	0.5
Simazine	0.004	0.004
Synthetic Organic Chemicals, Non-Pesticides		
Benzo(a)pyrene	zero[a]	0.0002
Di(2-ethylhexyl)adlpate	0.4	0.4
Di(2-ethylhexyl)phthalate	zero[a]	0.004
Hexachlorobenzene	zero[a]	0.001
Hexachlorocyclopentadiene	0.05	0.05
2,3,7,8-TCCD (Dioxin)	zero[a]	3×10^{-8}

[a] Regulated on the basis of carcinogenicity.

[b] Additional safety factor incorporated because of limited evidence of carcinogenicity.

SOURCE: Regulatory Impact Analysis, National Primary Drinking Water Regulations: Phase V Synthetic Organic and Inorganic Chemicals.

Exhibit T-2 shows the resulting national cost estimates, both with and without Sulfate. In the final rule (i.e., without sulfate), capital costs were estimated to constitute just over one third of the annualized costs; recurring system costs were estimated to constitute just over 40 percent; and state implementing costs were estimated to constitute less than one quarter of annualized costs. State implementing costs are not of interest to this study, since states have no small-entity functional counterpart, and so they will not be considered further.

3. Effects of the Regulation on Small Establishments

Exhibit T-3 shows the compliance costs for the Phase V regulations by water system size. Although they vary by contaminant,[66] costs for small water systems are disproportionately large. Two principal factors contribute to this result:

- Larger water systems generally have fewer (or no) problems with regulated contaminants; and

- Treatment of contaminants and monitoring are subject to large economies of scale.

Large water systems generally are not estimated to have concentrations of contaminants above the MCLs. Water systems serving populations of over 50,000 do not have any contaminations in concentrations that need to be treated.[67] For Dichloromethane, EPA estimated that no systems serving populations over 10,000 require compliance activities; for Dinoseb, no systems serving over 3,300 require compliance activities; and for Nickel, no systems serving over 500 require compliance activities. Among other things, it is difficult to make standard size comparisons when large systems do not have to undertake compliance activities.

Even without large water systems having to incur compliance costs, economies of scale are quite evident for all of the contaminants. Antimony, which is the contaminant in about 80 percent of the affected water systems, allows the clearest comparison.

---

[66] Costs for each contaminant should be considered separately and not aggregated over contaminants for any one water system, because EPA's data on affected systems suggests that an individual water system will generally have to deal with only one contaminant.

[67] Some systems serving over 50,000 people -- but none serving over 75,000 -- were estimated to have Sulfate concentrations above the MCL.

Compared with water systems serving populations between 10,000 and 50,000, systems serving 10,000 or fewer people have the following relative costs:[68]

[68] These relative cost calculations use unweighted averages of size classes, since the RIA does not provide sufficient data for weighted averages. Thus, for example, water systems serving populations between 10,000 and 50,000 are estimated to have unit costs of $1.58 per 1,000 gallons and compliance costs that are 102 percent of operating revenues.

EXHIBIT T-2: AGGREGATE ANNUAL COSTS OF PHASE V REGULATIONS
($ Millions)

	Best Cost Estimate[a] (Including Sulfate)[b]	Best Cost Estimate[a] (Excluding Cost Sulfate)[c]
Number of Systems Affected	1,607	256
Capital Water Treatment and Waste Disposal Costs		
Capital Cost	$ 565	$ 238
Annualized Capital Cost	$ 38	$ 17
Recurring Annual Costs		
Operation and Maintenance	$ 57	$ 14
Monitoring Costs	$ 6	$ 5
State Implementation Costs	$ 10	$ 10
Total Annual Costs	$ 111	$ 46

---

[a] National occurrence data were not available for Thallium, Diquat, Endothall, Glyphosate, Simazine, 1,1,2-Trichloroethane, Di(2-ethylhexyl)adlpate, Di(2-ethylhexyl)phthalate, Hexachlorobenzene, Hexachlorocyclopentadiene, or 2,3,7,8-TCCD (Dioxin). Thus costs do not reflect control of these contaminants. EPA estimated that Beryllium, Cyanide, 1,2,3-Trichlorobenzene, Dalapon, Endrin, Oxamyl, Picloram, and Benzo(a)pyrene would not occur in drinking water at concentrations above the MCL. Thus there are no costs associated with these contaminants.

[b] SOURCE: Regulatory Impact Analysis, National Primary Drinking Water Regulations: Phase V Synthetic Organic and Inorganic Chemicals. Sulfate had not yet been deferred at the time the final RIA was developed. Thus RIA costs and other data include costs of controlling Sulfate, even though the final rule does not include these costs.

[c] SOURCE: National Primary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals; Final Rule, 57 FR 138, July 17, 1992.

[d] Annualized at 3% over 20 years.

EXHIBIT T-3: COST IMPACTS OF PHASE V REGULATIONS, BY SYSTEM SIZE

Cost	25-100	101-500	501-1,000	1,001-3,300	3,301-10,000	10,001-25,000	25,001-50,000	Over 50,000
Industry Operating Revenue ($/1,000 gal.)	2.14	2.62	1.98	2.20	1.61	1.94	1.23	N.A.
Antimony[a]								
Unit Cost ($/1,000 gal.)	36.51	17.21	5.34	3.54	2.74	1.80	1.37	0.00
Cost as % of Operating Revenue	1708.8%	658.1%	269.0%	160.7%	170.3%	92.4%	111.7%	0.0%
Nickel[b]								
Unit Cost ($/1,000 gal.)	17.47	7.17	0.00	0.00	0.00	0.00	0.00	0.00
Cost as % of Operating Revenue	817.8%	274.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dichloromethane[c]								
Unit Cost ($/1,000 gal.)	3.53	1.38	0.60	0.35	0.12	0.00	0.00	0.00
Cost as % of Operating Revenue	165.4%	53.0%	30.5%	15.8%	7.5%	0.0%	0.0%	0.0%
Dinoseb[d]								
Unit Cost ($/1,000 gal.)	9.84	3.43	1.49	0.88	0.00	0.00	0.00	0.00
Cost as % of Operating Revenue	460.6%	131.0%	75.2%	39.9%	0.0%	0.0%	0.0%	0.0%

[a] 200 systems affected.

[b] 7 systems affected.

[c] 39 systems affected.

[d] 10 systems affected.

SOURCE: Regulatory Impact Analysis, National Primary Drinking Water Regulations: Phase V Synthetic Organic and Inorganic Chemicals.

- o Unit compliance costs for Antimony in smaller water systems:
  - Range from 73 percent higher to 23.1 times higher, and
  - Average 8.3 times the cost of systems serving populations between 10,000 and 50,000.

- o Compliance costs for Antimony as a percent of operating revenue in smaller water systems:
  - Range from 58 percent higher to 16.75 times higher, and
  - Average 5.8 times the cost of systems serving populations between 10,000 and 50,000.

These cost comparisons probably understate the relative costs, if much large water systems had to treat drinking water for Antimony.

4. Conclusion

Small public water systems incur disproportionately high costs of complying with the Phase V chemical regulations. On average, the cost per gallon for the smallest PWS is over eight times the cost per gallon of a large PWS. This figure may well be understated because of the deferral of some contaminants and because no very large water systems were thought to have a problem with antimony. The principal causes of the cost disparity are large economies of scale in control equipment and statistical economies of scale in monitoring.

U. EPA REGULATIONS FOR TITLE III, SECTIONS 311/312 OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986

1. Objective and Summary of the Regulation

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), is known as the Emergency Planning and Community Right-to-Know Act of 1986. Title III addresses the right of the community to know about stocks, use, and releases of hazardous chemicals. It is also intended to provide information to local State Emergency Response Commissions (SERCs), Local Emergency Planning Committees (LEPCs), and fire departments that will assist in planning for emergencies and responding to them.

Section 311 and Section 312 of Title III require submission of different information. They have many elements in common, however, and so they were covered by the same rulemaking. The requirements apply to all facilities that are required to prepare and file OSHA material safety data sheets (MSDSs). Initially the requirement applied just to the manufacturing sector, but it was later expanded to cover non-manufacturing facilities.[69] Reporting requirements include the following:

[69] The detailed analysis in the RIA, particularly analysis by facility size, was performed only for the manufacturing sector. Thus the available data, which are used here, pertain to the manufacturing sector only.

- o Under Section 311, facilities were required to file MSDSs or lists of chemicals in the facility's inventory, by hazard category. The regulation requires one-time initial filing with updates for significant changes as they occur.

- o Regulations for Section 312 required filing two different types of report, with differing degrees of detail.
  - A Tier I Report, which must be filed annually, includes:
    - . The maximum and average amount of chemicals in each hazard category, and
    - . The general location of these chemicals.
  - A Tier II Report, which must be filed only if demanded by one of the recipient organizations, includes:
    - . Name of each hazardous chemical,
    - . Maximum and average amount of each hazardous chemical, and
    - . Location and storage mode of each hazardous chemical.

Regulations require each facility to file reports with the SERC, the LEPC, and the local fire department.[70] After considerable analysis of thresholds and phase-in, EPA set a threshold of 10,000 pounds for hazardous chemicals and 500 pounds (as a default) or less (if specified) for extremely hazardous chemicals. The final rule also reduced OSHA's 23 MSDS hazard categories to five general hazard categories.

2. Estimated Costs of Compliance With the Regulation

The RIA broke the compliance process for both Section 311 and Section 312 into small, discrete steps:

- o Section 311 requires:
  - Becoming familiar with the Section 311 requirements,
  - Formulating and establishing a filing system and recordkeeping system,
  - Deciding which chemicals are subject to the reporting thresholds,
  - Duplicating and mailing MSDSs,
  - Reviling MSDSs, and
  - Preparing a cover letter for MSDS submission.

- o Section 312 requires:
  - Becoming familiar with Section 312 requirements,
  - Deciding whether to send Tier I or Tier II information,[71] and
  - Preparing and sending forms.

---

[70] SERCs, LEPCs, and fire departments also incur costs of handling the information filed with them. EPA estimated these costs, but was unable to estimate distinct costs for large and small governmental entities.

[71] In the final rule, submission of Tier II reports was required only if the LEPC or fire department requested it.

The familiarization costs (both Sections), and filing system and cover letter costs (Section 311) are roughly equal for all facilities, regardless of size. All other costs are essentially proportional to the number of chemicals reported. Exhibit U-1 shows estimated costs of the final rule for industry and governmental entities.

EXHIBIT U-1: SECTION 311 AND SECTION 312 COSTS

Entity/Cost		Year 1	Subsequent Years
INDUSTRY			
Section 311	Total Costs	$ 82,900,000	$ 14,600,000
	Average Cost	$ 236	$ 42
Section 312	Total Costs	$ 78,600,000	$ 9,600,000
	Average Cost	$ 224	$ 27
Sections 311 & 312	Total Costs	$161,500,000	$ 24,200,000
	Average Cost	$ 461	$ 69
GOVERNMENTS			
State Governments			
Section 311	Total Costs	$ 5,800,000	$ 1,100,000
	Average Cost	$103,743	$ 19,699
Section 312	Total Costs	$ 1,000,000	$ 1,000,000
	Average Cost	$ 17,887	$ 17,908
Sections 311 & 312	Total Costs	$ 6,800,000	$ 2,100,000
	Average Cost	$121,630	$ 37,607
Local Emergency Planning Committees			
Section 311	Total Costs	$ 9,850,000	$ 1,250,000
	Average Cost	$ 3,225	$ 417
Section 312	Total Costs	$ 1,650,000	$ 1,150,000
	Average Cost	$ 539	$ 383
Sections 311 & 312	Total Costs	$ 11,500,000	$ 2,400,000

	Average Cost	$ 3,764	$ 800
Fire Departments			
Section 311	Total Costs	$ 21,600,000	$ 1,250,000
	Average Cost	$ 719	$ 42
Section 312	Total Costs	$ 3,200,000	$ 1,150,000
	Average Cost	$ 107	$ 39
Sections 311 & 312	Total Costs	$ 24,800,000	$ 2,400,000
	Average Cost	$ 826	$ 81

SOURCE: Regulatory Impact Analysis in Support of Final Rulemaking Under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act of 1986.

One of the key elements in compliance costs of Section 311 and Section 312 is the threshold below which a chemical need not be reported. EPA considered ten alternatives that would phase reporting thresholds in over a period of as much as three years. Initial thresholds of these regulatory alternatives ranged from zero to 50,000 pounds of any one chemical; final thresholds did not exceed 2,000 pounds of any one chemical. The actual rule set a threshold for the first two years of 10,000 pounds of any one chemical and left the final threshold open for more consideration. In the eventual final rule, EPA left the threshold at 10,000 pounds.[72]

Thresholds have a major mitigating effect on regulatory costs. Based on studies of several state regulations, EPA estimated that at a 10,000-pound threshold:

- 77.7 percent of facilities with hazardous chemicals present would not have any chemicals present above the threshold quantity; and

- 87.1 percent of chemicals stored in facilities covered by the regulation would not be present in quantities above the threshold.

3. Effects of the Regulation on Small Facilities

Exhibit U-2 shows estimates of the costs of compliance with Section 311 reporting requirements, and Exhibit U-3 shows estimates of the costs of compliance with Section 312 reporting requirements, for large and small facilities. The cost estimates include

[72] One implications of this process is that none of the alternatives considered in the RIA corresponded to the actual final rule. Nevertheless, these costs can be reconstructed by taking first-year and second-year costs from an alternative that had thresholds of 10,000 pounds for those two years and then using the second-year costs for all subsequent years. This derivation was done in Exhibit U-1.

separate estimates for each activity by size class,[73] although some costs were estimated to be the same for all facilities, regardless of size. EPA's also estimated the number of regulated chemicals found in each size class, and this information was used to compute costs related to the number of MSDSs shown in Exhibit U-2 for large and small facilities.

Data in Exhibit U-2 and Exhibit U-3 are based on a 10,000-pound threshold. EPA assumed that the same proportion (22.3 percent) of facilities in each size class would have to file reports. EPA also assumed that only 12.9 percent of "regulated chemicals" (operationally defined as one hazardous chemical at one facility) would be found in quantities exceeding the threshold. EPA did not, however, attempt to allocate the regulated chemicals in excess of the threshold to facility size classes. Exhibit U-2 is based on the assumption that non-exempt small facilities have the same proportion of regulated chemicals in excess of the threshold (47.8 percent) as all small facilities have of all regulated chemicals. This assumption almost certainly overstates the cost impacts on small facilities, since large facilities seem far more likely to have regulated chemicals in excess of the threshold. Nevertheless, there is really no basis for making any other assumption.

[73] EPA analyzed costs for four size classes: 1-19 employees, 20-99 employees, 100-249 employees, and 250 employees and over. The detail of the analysis allowed the three largest size classes to be combined. This was done in Exhibit U-2.

EXHIBIT U-2: COSTS OF SECTION 311, BY FACILITY SIZE

Cost	Small Facilities[a]	Large Facilities
Cost for Exempt Facilities		
Rule Familiarization[b]	$ 43.50	$ 80.62
Evaluation of Threshold Effect[c]	$ 27.20	$ 50.41
Total Cost	$ 70.70	$131.03
Cost per Employee[d]	$ 11.44	$ 0.93
Cost as a Percent of Revenue	0.01321%	0.00076%
Cost for Non-Exempt Facilities		
Rule Familiarization[b]	$ 43.50	$ 80.62
Evaluation of Threshold Effect[c]	$ 27.20	$ 50.41
Filing and Recordkeeping System[b]	$400.62	$742.95
Copying and Mailing MSDSs[c]	$ 79.12	$154.56
Filing MSDSs[c]	$100.19	$195.72
Cover Letter for MSDS[c]	$ 14.56	$ 14.56
Total Cost	$665.19	$1,238.82
Cost per Employee[d]	$107.64	$ 8.79
Cost as a Percent of Revenue	0.12435%	0.00725%

[a] Facility with 1 to 19 employees.

[b] Costs incurred in the first year only for hazardous chemicals initially in inventory.

[c] Costs incurred in the first year that may be incurred again as new chemicals are added or inventories increase above threshold quantities.

[d] Based on employment data from U.S. Bureau of the Census, County Business Patterns.

EXHIBIT U-3: COSTS OF SECTION 312, BY FACILITY SIZE

Cost	Small Facilities[a]	Large Facilities
Cost for Exempt Facilities		
Rule Familiarization[b]	$ 43.50	$ 80.62
Cost per Employee[d]	$ 7.04	$ 0.57
Cost as a Percent of Revenue	0.00813%	0.00047%
Cost for Non-Exempt Facilities		
Rule Familiarization[b]	$ 43.50	$ 80.62
Preparation of Cover Letter[c]	$ 6.18	$ 6.18
Hazard Classification[c]	$321.64	$628.32
Typing and Quality Control[c]	$ 67.81	$ 67.81
Copying and Mailing[c]	$ 1.71	$ 1.71
Total Cost	$440.84	$784.64
Cost per Employee[d]	$ 71.33	$ 5.57
Cost as a Percent of Revenue	0.08241%	0.00459%

[a] Facility with 1 to 19 employees.

[b] Costs incurred in the first year only.

[c] Costs incurred annually. Costs are based on Tier I Reports only.

[d] Based on employment data from U.S. Bureau of the Census, County Business Patterns.

Exhibit U-2 and Exhibit U-3 show that costs of most compliance activities for Section 311 and Section 312 are greater for large facilities than for small, although several specific costs are the same, regardless of the size of the facility. Where large facilities have larger costs, however, the difference is usually slightly less than twice the cost for small facilities. Overall cost differences are as follows:

- For Section 311,
  - For facilities that are exempt (i.e., that have no chemicals in excess of the 10,000-pound threshold), large-facility costs are 85.3 percent higher than small-facility costs, and
  - For facilities that are not exempt, large-facility costs are 86.2 percent higher than small-facility costs.

- For Section 312:
  - For facilities that are exempt, large-facility costs are 85.3 percent higher than small-facility costs, and
  - For facilities that are not exempt, large-facility costs are 78.0 percent higher than small-facility costs.

The disproportionately high costs for small facilities are far clearer when costs per facility are normalized by average employment and average revenue of large and small facilities. Exhibit U-2 shows that, for Section 311:

- Cost per employee is:
  - 12.3 times as high for small exempt facilities as for large exempt facilities, and
  - 12.2 times as high for small non-exempt facilities as for large non-exempt facilities; and

- Cost as a percent of revenue is:
  - 17.4 times as high for small exempt facilities as for large exempt facilities, and
  - 17.2 times as high for small non-exempt facilities as for large non-exempt facilities.

Exhibit U-3 shows that, for Section 312:

- Cost per employee is:
  - 12.4 times as high for small exempt facilities as for large exempt facilities, and
  - 12.8 times as high for small non-exempt facilities as for large non-exempt facilities; and

- Cost as a percent of revenue is:

- 17.3 times as high for small exempt facilities as for large exempt facilities, and
- 18.0 times as high for small non-exempt facilities as for large non-exempt facilities.

4. Conclusions

Costs of the Emergency Planning and Community Right-to-Know Act of 1986 fall disproportionately on small businesses. Per employee, small-business costs are about 12.5 times the costs for large businesses. As a percent of revenue, small-business costs are about 17.5 times the costs for large businesses. The economies of scale that work against small firms are related to paperwork and include familiarization, evaluation, and reporting. Exemptions do virtually nothing to mitigate the disparate impacts on small business because they apply to quantities of individual materials, not to establishment size as such.

V. EPA FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA) REGULATIONS

1. Objective and Summary of the Regulation

Pesticides have been regulated by the federal government under FIFRA since 1947. In 1974, under FIFRA authority, regulations were promulgated to protect the pesticide-related occupational health and safety of farm workers. The amendment considered here extends these protections to employees in forests, nurseries and greenhouses, and it adds new requirements for pesticide labeling, pesticide decontamination, and emergency assistance. The regulations are intended to reduce the risk of pesticide poisonings and injuries through implementation of appropriate exposure standards.

The basic standard to be extended to forest, nursery, and greenhouse employees includes four requirements:

- A prohibition against spraying workers or other persons with pesticides;
- A clause prohibiting re-entry to pesticide sprayed fields until pesticides have dried, with longer waiting periods for 12 specific pesticides;
- A requirement of protective clothing for any worker who must enter the sprayed fields prior to the expiration of the re-entry period; and
- A requirement for "appropriate and timely" warnings of pesticide sprayings.

The revisions to the standard include two new requirements pertaining to decontamination and emergency assistance:

- A requirement that employees handling pesticides must be provided with facilities for washing; and
- A requirement that employees handling pesticides must be provided with transportation to medical care in the event of a pesticide-related accident.

The revisions also expanded the requirements for labeling of pesticides. They require pesticide registrants to label pesticides with information specifying application restrictions, restricted-entry intervals, and necessary personal protective equipment.

2. Estimated Costs of Compliance With the Regulation

EPA developed estimates of costs to pesticide users for the draft final rule and for high and low options that provided alternatives and sensitivity analysis. EPA estimated compliance costs by identifying the number of people and units affected; developing unit costs of items and time required; and summing these values to obtain total costs. Total estimated costs were $297 million for the draft final rule, $1,760 million for the high option, and $109 million for the low option. EPA then considered the extent to which these costs were already incurred because of existing state regulations and federal (primarily OSHA) regulations. After netting out the costs of complying with existing regulations, EPA's estimated total cost for the draft final rule was $119.9 million in the first year and $94.1 million per year thereafter. (The difference between first year costs and out year costs is attributable to differences in notification requirements.) Exhibit V-1 shows these estimated costs by provision of the regulation and by type of employee protected (i.e., regular workers and workers who actually handle pesticides). Exhibit V-2 shows costs for each or the industries affected.

Exhibit V-1 disaggregates costs by type of worker. About two thirds of the costs in the first year and a majority of costs thereafter are attributable to protecting hired workers other than handlers. Not surprisingly, however, costs per worker protected are nearly twice as high in the initial year for pesticide handlers as for other workers and nearly three times as high in subsequent years.

Overall, most of the costs are incurred for decontamination (39.0 percent), notification/posting (29.4 percent), and personal protective equipment (18.4 percent). For hired workers, decontamination and notification/posting account for 84.4 percent of protection costs, but personal protective equipment is a minor cost. For handlers, on the other hand, decontamination and personal protective equipment account for 86.5 percent of protection costs, but notification/posting requirements of this regulation do not impose incremental costs.

The feed/grain crops sector alone accounts for one third of all compliance costs. Cotton, commercial handlers, greenhouses, and fruit crops account for 10 to 12 percent of costs each. Per establishment, commercial handlers, nurseries, and greenhouses have the highest costs ($1,000 to $1,500), while the next highest costs (just under $500 per establishment) occur in vegetable crops.

3. Effects of the Regulation on Small Establishments

Assessing relative impacts on small farms is somewhat complicated by the fact that most farms are small by any employment definition. The RIA provided data indicating that 89 percent of farms with hired labor have fewer than 10 hired workers. The Preamble to the Final Rule[74] (which went farther than the RIA) made trial

[74] 57 Federal Register, pp. 38145-38146.

calculations based on the assumption that a "large" farm had ten hired workers. Exhibit V-3 shows costs, by farm size, using 20 hired workers as the dividing line between large and small farms. Ratios derived from data on the crop services

EXHIBIT V-1: INCREMENTAL COST OF WORKER PROTECTION STANDARDS FOR AGRICULTURAL PESTICIDES, BY REGULATORY PROVISION

Provision	First Year Cost		Out Year Cost	
	Total Cost ($Millions)	Cost per Worker Protected	Total Cost ($Millions)	Cost per Worker Protected
Restricted Entry				
Hired Workers[a] Protected	$ 6.2	$ 3.44	$ 6.2	$ 3.44
Handlers[b] Protected	$ 0.0	$ 0.00	$ 0.0	$ 0.00
Total Costs	$ 6.2	N.A.	$ 6.2	N.A.
Personal Protective Equipment				
Hired Workers[a] Protected	$ 2.1	$ 1.17	$ 2.1	$ 1.17
Handlers[b] Protected	$20.1	$38.12	$20.1	$38.12
Total Costs	$22.1	N.A.	$22.1	N.A.
Notification/Posting				
Hired Workers[a] Protected	$33.7	$18.72	$ 7.9	$
Handlers[b] Protected	$ 0.0	$ 0.00	$ 0.0	$ 0.00
Other Costs[c]	$ 1.5	N.A.	$ 1.5	N.A.
Total Costs	$35.2	N.A.	$ 9.4	N.A.
Decontamination				
Hired Workers[a] Protected	$32.6	$18.11	$32.6	$18.11
Handlers[b] Protected	$15.9	$30.15	$15.9	$30.15
Total Costs	$46.8	N.A.	$46.8	N.A.
Emergency Assistance				
Hired Workers[a] Protected	$ 4.0	$ 2.22	$ 4.0	$ 2.22
Handlers[b] Protected	$ 5.6	$10.62	$ 5.6	$10.62
Total Costs	$ 9.6	N.A.	$ 9.6	N.A.
All Provisions				
Hired Workers[a] Protected	$78.6	$43.66	$52.8	$22.33
Handlers[b] Protected	$41.6	$78.89	$41.6	$78.89
Other[c]	$ 1.5	N.A.	$ 1.5	N.A.
Total Costs	$119.9	N.A.	$94.1	N.A.

[a] 1.8 million hired workers estimated (excluding hired handlers).

[b] 527,300 handlers estimated, including 170,000 commercial handlers.

[c] Costs attributed only to establishments, not per worker.

SOURCE: Regulatory Impact Analysis, Worker Protection Standards for Agricultural Pesticides.

EXHIBIT V-2: INCREMENTAL FIRST YEAR COST OF WORKER PROTECTION STANDARDS FOR AGRICULTURAL PESTICIDES, BY INDUSTRY

Industry	Protection of Workers ($Millions)	Protection of Handlers ($Millions)	Total Costs ($Millions)	Cost per Establishment
Feed/Grain Crops	$26.40	$14.20	$40.60	$ 77.33
Cotton	$ 1.60	$ 0.90	$ 2.50	$ 131.58
Other Field Crops	$10.30	$ 5.60	$15.90	$ 75.71
Fruit Crops	$ 7.70	$ 4.10	$11.80[a]	$ 160.00
Vegetable Crops	$ 5.70	$ 3.00	$ 8.70[b]	$ 496.30
Forestry	$ 0.04	$ 0.56	$ 0.60	$ 0.03[c]
Forestry Nurseries	$ 0.09	$ 0.01	$ 0.10	$ 354.61
Greenhouses	$11.10	$ 2.20	$13.30	$1,023.08
Nurseries	$ 5.50	$ 0.90	$ 6.40	$1,280.00
Commercial Handlers	$ 0.00	$14.90	$14.90	$1,490.00
TOTAL	$68.43	$46.37	$119.90	$ 137.25

[a] Includes $0.2 million in restricted entry costs, which are considered establishment costs that are not allocable to workers or handlers.

[b] Includes $5.7 million in restricted entry costs, which are considered establishment costs that are not allocable to workers or handlers.

[c] Cost per acre.

NOTE: Totals may not correspond to sums due to rounding.

SOURCE: Regulatory Impact Analysis, Worker Protection Standards for Agricultural Pesticides.

EXHIBIT V-3: INCREMENTAL COST OF WORKER PROTECTION STANDARDS FOR AGRICULTURAL PESTICIDES, BY SIZE OF FARM

	Small Farms[a]	Large Farms[b]
Number of Farms[c]	821,898	47,939
Mean Number of Hired Workers[d]	4.67	66.20
Compliance Cost		
Fixed Cost[e]	$ 8.05	$ 8.05
Worker-Specific Cost[f]	$241.17	$3,418.71
Total Cost		
Per Farm	$249.22	$3,426.76
Per Hired Worker	$ 53.37	$ 51.76
Cost Ratio[g]	1.03	-

---

[a] Fewer than 20 hired workers.

[b] Twenty or more hired workers.

[c] Based on the assumption that half of the farms with ten or more hired workers have at least 20 hired workers. This proportion is found in crop services and forestry industries (County Business Patterns, 1987).

[d] Averages derived from data for the crop services industry (County Business Patterns, 1987).

[e] Computed as the sum of restricted entry costs ($6.2 million) and "other" costs ($1.5 million), divided by the number of farms (869,837). See Exhibit V-1.

[f] Based on the assumption that hired farm labor is 77.3 percent hired workers and 22.7 percent handlers (see Exhibit V-1, Notes a and b) and costs per worker protected for handlers and non-handlers (see Exhibit V-1).

[g] Ratio of the cost per hired worker for small farms to the cost per hired worker for large farms.

industry were used where necessary[75] to fill gaps in data and complete the calculations. Computations are documented in the footnotes of Exhibit V-3.

Exhibit V-3 shows that compliance costs per hired worker are only 3 percent higher for small farms than for large farms. This is not surprising, since almost all of the costs are proportional to the number of hired workers. This appears to understate the disproportion in costs, since decontamination and posting (which are major cost elements) would seem subject to some economies of scale. On the other hand, entry restrictions (which are mostly lost productivity while waiting) do not appear to be an entirely fixed cost. Nevertheless, the disproportion in costs to small farms does appear to be small, and a 1.03 cost ratio is emblematic of this conclusion.

EPA introduced one major regulatory flexibility provision. Farms that use only family members as workers are exempt from all regulatory requirements except for those included on the pesticide label (essentially entry and personal protection equipment requirements). This exemption reduces compliance costs by about 75 percent.[76] The presumption, of course, is that farmers do not have to be regulated to protect family members; these measures are part of the baseline. This exemption points out one difference between EPA and OSHA regulations. The Occupational Safety and Health Act does not apply to business owners, only to hired workers. Thus EPA's exemption does no more than bring the regulation into line with OSHA regulations.

4. Conclusion

The FIFRA standards do not appear to impose disproportionately high costs on small businesses to any large degree. On the one hand, the analysis is tainted by virtual assumption of proportionality of costs and workers. On the other hand, the types of compliance measures involved do not suggest large economies of scale. On balance, therefore, the finding is not especially compelling.

---

[75] The two key variables taken from this source were the proportion of farms with 10 or more hired employees that have at least 20 hired employees (50 percent) and the average numbers of employees for establishments with fewer than 20 and with 20 or more employees (4.67 and 66.2, respectively).

[76] An employment-based cost ratio cannot be calculated when there are no hired employees. Nevertheless, the burdens on family farms, which tend to be among the smallest farms, are vastly lower by any measure than the burdens on farms with hired workers.

W. FDA FOOD LABELING REGULATIONS

1. Objective and Summary of the Regulation

The Food and Drug Administration promulgated the food labeling regulations to implement the National Labeling and Education Act of 1990, which amended the Federal Food, Drug and Cosmetic Act. The 1990 amendments:

- Expanded the coverage of nutrition labeling to all food products except meat and poultry;
- Produced more ingredient labeling;
- Regulated health claims;
- Standardized nutrient content claim definitions;
- Standardized serving sizes; and
- Required that nutrition information be readily understandable.

The food labeling regulations included a number of individual rules, which generally fall into three categories:

- Mandatory ingredient labeling for standardized foods and certified colors;
- "Voluntary" labeling of raw fruit, vegetables, and fish (which were to become mandatory if not sufficiently widely adopted); and
- All other regulations, including:
  - Percent juice labeling,
  - Cholesterol free and percent fat labeling,
  - Mandatory status of nutrition labeling and nutrition content revision,
  - Nutrient content claims,
  - Cholesterol, fat, and fatty acid labeling,
  - Lite butter,
  - Serving size, and
  - Health claims general requirements.

The 1990 amendments stipulated that the last set of regulations become effective on May 8, 1993. The 1990 amendments, however, allowed an extension if this timetable caused "undue economic hardship." The FDA examined a six-month extension and a twelve-month extension and ultimately invoked this provision to set May 8, 1994 as the effective date.

The regulations were designed to give consumers more accurate and complete information, as well as more consistent definitions. Anticipated benefits from this improved information included reduced rates of cancer, coronary heart disease, osteoporosis, obesity, hypertension, and allergic reactions to food.

2. Estimated Costs of Compliance With the Regulation

The FDA identified three types of businesses that are affected by the food labeling regulations:

- o All food processing businesses (SIC 20) are affected. At the four-digit SIC level:
  - All food processing industries are affected by mandatory nutrition labeling, format, and nutrient content claims requirements,
  - Most food processing industries are affected by standard foods, ingredients, and colors labeling requirements, and
  - Only a handful of food processing industries are affected by percent juice labeling requirements (3) and raw fruit, vegetables, and fish labeling (1).

- o Commercial food service establishments[77] (CFEs) are subject to nutrient content and health claims regulations. The FDA estimated that there were:
  - 536,796 total CFEs,
  - 294,051 CFEs with printed menus, signs, and posters, and
  - 120,688 CFEs that made nutrient content and/or health claims and would thus be affected by the regulations.

- o Grocery stores are affected by the raw fruit, vegetables, and fish labeling requirements. The FDA estimated that these regulations would affect:
  - 31,000 chain grocery stores, and
  - 68,000 independent grocery stores.

<u>a. Food Labeling</u>

The FDA estimated compliance costs of the food labeling regulations for the following activities:

- o Administrative activities;
- o Analytical testing;
- o Printing of labels (or menus);
- o Label inventory disposal; and
- o Reformulation (including market testing).

In estimating the administrative costs, the FDA considered the following distinctions:

- o The scope and intricacy of the regulations, which were classified as:
  - Minor regulations (which have little or no effect on product composition, so that no testing or reformulation is involved), and

---

[77] Institutional and military food service establishments are exempt.

- Intricate regulations (which lead to testing and possibly reformulation);

- The number of distinct products; and

- The length of time before compliance would be required, as defined by:
  - Option 1: The statutory effective date,
  - Option 2: Six months after the statutory effective date, and
  - Option 3: Twelve months after the statutory effective date.

In estimating the analytical costs for testing, the FDA used unit costs of a Brix level (i.e., level of soluble solids) test for juice labeling requirements and unit costs of several nutrient tests. The FDA initially assumed that three analyses would be required for each product for initial testing, with one analysis every five years for follow-up testing. In addition, the FDA made adjustments for previously required tests that could be discontinued and for the estimated percentage of businesses that were already in compliance.

In estimating printing costs for food labels, the FDA based costs on the number of different labels to be printed, the type of process used for printing, and the complexity of the mandated printing change. The EPA estimated menu printing costs by estimating the number of affected CFEs by number of seats and average check size, estimating the average cost per menu for different average check sizes,[78] and assuming that one menu must be printed per seat.

Label inventory disposal cost estimates were driven by the average label supply and the compliance period. Essentially, the FDA estimated that businesses could use their label inventory if allowed an extension beyond the shortest (statutory) compliance period.

<u>b. "Voluntary" Raw Fruit, Vegetables, and Fish Regulation</u>

The raw fruit, vegetables, and fish regulation was "voluntary" only if enough grocery stores complied. If fewer than 60 percent of grocery stores evaluated after two years complied, the FDA would have to make the regulations mandatory. Costs were aggregated under the assumption that 60 percent of grocery stores complied (and thus incurred costs). The FDA estimated costs related to printing brochures and in-store signage.

<u>c. Summary of Compliance Costs</u>

The FDA estimated that total compliance costs over 20 years would be $1.676 billion if the statutory effective date were used but only $841 million if the effective date

---

[78] Average menu printing costs were estimated to be:
- $2.65 for CFEs with an average check size of less than $15,
- $4.25 for CFEs with an average check size of $15 to $30, and
- $175.00 for CFEs with an average check size of more than $30.

of the regulation was deferred for a year. The FDA selected this option. Exhibit W-1 summarizes the different types of costs for the different options on the effective date.

EXHIBIT W-1:
PRELIMINARY ESTIMATED FOOD LABELING COMPLIANCE COSTS
($ Millions Over 20 Years)

Type of Cost	Statutory Date	Statutory Date Plus Six Months	Statutory Date Plus Twelve Months
Mandatory Labeling			
Administrative	$ 177[a]	$ 93	$ 70
Analytical	$ 195[b]	$ 195	$ 195
Printing	$ 862	$ 600	$ 436
Inventory	$ 306	$ 8	$ 4
Subtotal	$ 1,540	$ 896	$ 705
"Voluntary" Labeling	$ 136	$ 136	$ 136
Total Costs	$ 1,676	$ 1,032	$ 841

---

[a] Of this amount:
- o $16 million is for mandatory ingredient labeling for standardized foods and certified colors;
- o $152 million is for nutrition and other labeling requirements (excluding labeling of raw fruit, vegetables, and fish); and
- o $9 million is for CFE administrative costs.

[b] Of this amount:
- o $112 million is for one-time initial testing, and
- o $83 million (discounted) is for subsequent testing.

SOURCE: Food and Drug Administration, "Regulatory Impact Analysis of the Proposed Rules to Amend the Food Labeling Regulations," Federal Register, Vol. 56, No. 229, p. 60876.

3. Effects of the Regulation on Small Establishments

The analysis of costs is uneven with respect to small entities. The principal administrative costs were estimated by size; other costs were estimated as proportional to output; and others were estimated only per firm. The cost estimates in the final rule are not always consistent with the preliminary RIA, and the way that different costs were presented is not consistent.

a. Administrative Costs

For the effective date ultimately proposed, the FDA estimated administrative costs of mandatory nutritional labeling to be:

- $3,375 per firm for small/medium firms, which were defined as having fewer than 100 employees;

- $25,700 per firm for large firms; and

- $320 per firm for diet supplement manufacturers (whose size was unspecified).

The total of these costs "for the 8,900 medium and large firms affected" is $56 million. An additional 3,900 small firms are also affected, for an additional cost of up to $13 million. These small-firm costs are problematic, however, since the 1990 amendments specifically exempted from nutrition labeling -- but not from health claim regulations -- foods sold by businesses having annual total gross sales of not more than $500,000 or annual gross sales of food of not more than $50,000. Small firms that make health claims would incur these costs, therefore, but that other small firms would not.

The FDA also estimated that administrative costs for the labeling of ingredients in standardized foods and certified colors were $16 million, which is a relatively small amount compared with the other administrative costs. The RIA did not separate this amount out by firm size. If the costs per firm for small/medium firms is the same proportion of costs per firm for large firms as it is for other administrative costs,[79] then the administrative costs of this provision (from which small firms are not exempt) are:

- $786 per firm for small/medium firms; and

- $5,984 per firm for large firms.

[79] In all of the instances where administrative costs were estimated by firm size in the Preliminary RIA and the Final RIA, small/medium-firm costs are 13 or 14 percent of large-firm costs.

Total CFE compliance costs were estimated to be $17 million. Printing costs were estimated to be $9 million in the Preliminary RIA, which suggests that $8 million are administrative costs. Since each establishment would generally have one menu, it is a reasonable assumption that administrative costs are the same for all CFEs. For the 120,688 establishments estimated to have menus or menu boards, this assumption produced an administrative cost of $66 per CFE.

b. Analytical Costs

The preliminary estimate of analytical costs drew numerous comments, particularly with respect to the frequency of retesting. The FDA revised these estimates to:

- $228 million in the first year; and

- Total discounted analytical costs of:
  - $466 million, assuming retesting every 5 years, to
  - $1.1 billion, assuming annual retesting.

The FDA assumed that all products of medium and large firms would undergo some sort of analytical testing. The RIA assumed that 40 percent of products would undergo full nutritional testing (at $1,785 per product) and 60 percent of products would undergo partial nutritional testing (at $723 per product). Small firms are exempt from nutritional labeling (and thus from analytical costs) and have the option of using nutritional data bases for making health claims. Thus small-firm costs are either zero or well below $723 per product.

c. Printing Costs

The RIA estimated that printing costs would total $518 million, of which $112 million was attributed to the requirement for labeling of ingredients in standardized foods and certified colors. The average printing cost ($2,015 per label) was calculated as a broad average of different types of printing. Printing costs are estimated entirely on the basis of number of products. While this is somewhat related to sales, larger food processors can be expected to sell more units per product. Thus there are economies of scale, but they were not identified.

Printing costs for CFEs are related to the number of menus or menu boards. In the case of menus, the RIA assumed that menus (at all cost levels) are proportional to the number of seats, which are probably distributed in proportion to the number of customers and sales.[80] In effect, therefore, the RIA posits no returns to scale, or a constant ratio of cost to sales. This assumption appears to be as plausible as any other.

d. Other Costs of Mandatory Regulations

---

[80] The RIA also makes the assumption that the size distribution of CFEs is the same for all price classes.

Inventory disposal costs were not really addressed with any degree of clarity. The RIA noted that small firms tend to keep larger inventories per product than larger firms, which implies some economies of scale. Given the relatively long compliance period, however, the assumption that most firms would be able to use up their inventories appears to be plausible. The total estimated cost was small, about $6 million,[81] which works out to about $23 per product. Thus any disproportionate impact is probably also small.

One of the costs mentioned is $40 million for compliance with the percent juice labeling requirement. The RIA did not disaggregate this figure by either size of firm or type of compliance activity.

e. "Voluntary" Raw Fruit, Vegetables, and Fish Labeling

The FDA based compliance cost estimates for these "voluntary" standards on two types of expenses:

- Brochures, at $4,000 to $6,000 per 100,000; and

- In-store signage, at $200 per store per year.

Costs of brochures were implicitly estimated to be proportional to the number of customers and/or level of sales, although the RIA made no attempt to relate the brochure costs (about 5 cents each) to either customers or sales. The RIA did note that large chains could probably get a better price through quantity orders of brochures (although independent grocers might counter with simpler brochures). The RIA did not consider whether a small grocer would want 100,000 brochures.

The FDA estimated the cost of signage per customer[82] for large (over $2,000,000 in sales) chain grocery stores and small (under $2,000,000 in sales) independent grocery stores:

- Signage in large grocery stores was estimated to cost $ 0.03 per customer; and

- Signage in small grocery stores was estimated to cost $ 1.66 per customer.

The assumption of equal signage costs for all grocery stores appears to overstate the degree of disproportion in costs. It seems quite unlikely that large stores (averaging about 44 times as many customers as small stores) would not have fruit, vegetable, and fish departments large enough to need multiple signs.

The impact is also problematic in the sense that the labeling is voluntary. Thus (at least as long as enough stores comply), any small grocer can opt out of the costs. Since large grocery stores are likely to have far smaller printing costs (particularly multi-

[81] It is not at all clear from the RIA where this figure comes from.

[82] This appears to mean per person who patronizes the store, not per customer visit.

store chains, for which printing can be done centrally), they are far more likely to comply with the voluntary labeling than are small grocery stores. Thus the "voluntary" labeling requirement has built-in regulatory flexibility.

f. Comparison of Costs by Size

Exhibit W-2 shows estimated administrative food labeling compliance costs for different sizes of food processors. The cost estimates reflect large returns to scale. Small businesses that do not make health claims (and are exempt from nutrition labeling and analysis) still have unit costs that are two or three times as high as large firms. Small businesses that do make nutrition claims have unit costs that are 12 to 17 times the costs of large food processors.

EXHIBIT W-2: FINAL ESTIMATED FOOD LABELING COMPLIANCE COSTS[a]
($ Millions)

Type of Cost	Small Firms[b] Health Claims	Small Firms[b] No Health Claims	Medium Firms[c]	Large Firms[d]
Mandatory Nutrition Labeling				
Per Firm	$ 3,375	$ 0	$ 3,375	$25,700
Per Employee	$ 1,022	$ 0	$ 94	$ 80
As a Percent of Sales	0.500%	0.0%	0.034%	0.029%
Ingredient Labeling[e]				
Per Firm	$ 786	$ 786	$ 786	$ 5,984
Per Employee	$ 238	$ 238	$ 22	$ 19
As a Percent of Sales	0.116%	0.116%	0.008%	0.007%
Total Administrative				
Per Firm	$ 4,161	$ 786	$ 4,164	$31,648
Per Employee				
Actual	$ 1,260	$ 238	$ 116	$ 99
Cost Ratio	12.7	2.40	1.17	-
As a Percent of Sales				
Actual	0.616%	0.116%	0.042%	0.036%
Cost Ratio	17.1	3.22	1.17	-

[a] Includes administrative costs only.

[b] Establishments with fewer than 10 employees are estimated to be "small." For Food and Kindred Products (SIC 20), these establishments average 3.3 employees and $675,000 in sales. This is the size class found in the data that appears to correspond most closely with the statutory cutoff of $500,000 in sales. SOURCE: U.S. Bureau of the Census, 1992 Census of Manufactures, Industry Statistics.

[c] Establishments with 10 to 99 employees are estimated to be "medium sized." The lower bound comes from the definition of "small;" the upper bound is defined in the RIA. For Food and Kindred Products (SIC 20), these establishments average 36 employees and $9,961,000 in sales.

[d] Establishments with 100 or more employees are "large," as defined in the RIA. For Food and Kindred Products (SIC 20), these establishments average 323 employees and $87,333,000 in sales.

[e] Costs are assumed to be distributed by size in the same proportion as administrative costs of mandatory nutritional labeling.

4. Conclusions

The estimates of costs in the RIA are crude. Costs were frequently estimated on a basis that makes comparison of impacts on large and small firms problematic. Simplifications of this nature include the following:

- A number of costs were assumed to be the same for small and medium firms, which seems quite doubtful.

- Some costs, particularly analysis and label printing, were estimated per product rather than per food producer. Since there is no information on how many products small, medium, and large producers sell, there is no basis for estimating costs per firm (or establishment).

- Costs of use of data bases in lieu of individual product analysis -- an option available to small firms -- were not estimated.

- Menu printing costs were also estimated as being proportional to restaurant capacity (although different for different quality restaurants). Although this assumption is not implausible, it does drive the results.

- Costs of brochures were estimated for a volume that is suitable for large grocery stores but not small ones. Assumptions about the number of brochures needed per customer, however, are lacking.

In addition to these limitations, there are aspects of the costs that make them inherently difficult to estimate:

- The general statutory exemption of small businesses from mandatory nutrition labeling -- but only if they do not make health claims -- creates uncertainties about:
  - How many small food processing businesses will incur administrative costs, analysis costs, and printing costs, and
  - How many products of each small food processing businesses that does incur costs will actually entail analysis costs and printing costs.

- The voluntary nature of raw fruit, vegetables, and fish labeling makes it unclear how many small grocery stores will incur costs.

The combination of these factors means that:

- It is difficult to compare administrative costs for large and small businesses;

- It is essentially impossible to compare any other impacts on large and small food producers;

- The estimate that CFE costs are proportional to capacity is driven entirely by assumptions; and

- Total costs to grocery stores of any size are undetermined.

Despite these limitations, it is clear that cost impacts fall disproportionately on small businesses. Most of the activities that are undertaken are subject to economies of scale. Where these economies of scale can be measured, they reflect major cost elements that are 12 to 17 times as high on a per-unit basis for small businesses as for large and in some cases (e.g., signage) run as much as 50 times as high on a per-unit basis.

X. USDA PATHOGEN REDUCTION/HACCP STANDARDS

1. Objective and Summary of the Regulation

The Department of Agriculture's Food Safety and Inspection Service (FSIS) has the responsibility of ensuring that meat, poultry, and egg products are safe and wholesome. Traditionally this mission has been carried out through FSIS inspectors stationed within meat and poultry slaughter and processing establishments. Inspection was largely visual, and it resulted in the acceptance or rejection of each carcass or product.

Both outbreaks of foodborne illness and more systematic empirical research convinced FSIS that a fundamental change in the inspection program was required, particularly to address the problem of pathogenic microorganisms on raw meat and poultry products. The general food safety strategy developed by FSIS included:

- Provisions for systematic prevention of biological, chemical, and physical hazards through adoption by meat and poultry establishments of science-based process control systems;

- Targeted efforts to control and reduce harmful bacteria on raw meat and poultry products;

- Adoption of food safety performance standards that provide a measure of accountability for achieving acceptable food safety results;

- Clarification and strengthening of the responsibilities of establishments for maintaining effective sanitation, following sound food safety procedures, and achieving acceptable food safety results;

- Removal of unnecessary obstacles to innovation; and

- Efforts to address hazards that arise throughout the food safety continuum from farm to table.

This strategy was implemented through the Pathogen Reduction/Hazard Analysis and Critical Control Point (HACCP) regulations. These regulations applied to 9,079 establishments -- both 6,186 federally inspected meat and poultry products establishments and 2,893 state inspected establishments. The final Pathogen Reduction/HACCP rule included the following requirements:

- o All inspected establishments were required to develop and implement:
  - Sanitation Standard Operating Procedures (SOP's), and
  - HACCP programs.
- o Certain inspected establishments were required to:
  - Comply with new pathogen reduction performance standards for Salmonella,[83] and
  - Implement microbial testing programs for generic E. coli.[84]

The final rule required one of two schedules for these actions:

- o Implementation of SOP's and microbial testing programs for generic E. coli was required within six months of publication of the final rule.

- o Implementation of HACCP programs and compliance with Salmonella standards was required:
  - Within 18 months for large establishments,
  - Within 36 months for small establishments, and
  - Within 42 months for very small establishments.

2. Estimated Costs of Compliance With the Regulation

The analysis of regulatory costs drew on unusually detailed data on the regulated industries, since the establishments were already being inspected by FSIS. A contractor compiled existing FSIS data bases and added data from other data bases (e.g., Dun & Bradstreet and American Business List). The result afforded great precision about the number and size of establishments with different processes.

Most of the compliance activities were highly labor-intensive, with few material or equipment costs. Thus regulatory costs chiefly involved estimates of labor effort. Cost estimates were based on four categories of labor: Quality Control managers; supervisors/QC technicians; laboratory technicians; and production workers.

The final cost analysis retained some of the cost estimates from the preliminary rule. For some provisions, however, the compliance activities, their frequency, the effective date, or the basis for a requirement was changed in response to comments on the proposed rule. In such cases, new estimates of final rule costs were typically developed. Costs were estimated for the first year and for successive years, but the "first year" varied across provisions and size of establishment because of differing phase-in schedules. Exhibit X-1 shows the total estimated cost for the pathogen reduction/HACCP standards.

---

[83] This requirement applies to all establishments slaughtering cattle, swine, chickens, or turkeys, or producing a raw ground product from beef, pork, chicken, or turkey.

[84] This requirement applies to all establishments slaughtering cattle, swine, chicken or turkeys.

Sanitation Standard Operating Procedures. Estimated costs for sanitation SOPs were based on labor estimates for plan development, annual recordkeeping (with a small add-factor for maintaining records), and training. Recurring annual costs were estimated to be equal to annual recordkeeping costs.

EXHIBIT X-1: TOTAL COSTS OF PATHOGEN REDUCTION/HACCP FINAL RULE

(Millions -- Present Value of 20-Year Costs)

Regulatory Component	**Cost**
Sanitation Standard Operating Procedures	$ 171.9
Microbial Sampling	$ 174.1
Pathogen Reduction	$ 55.5 - 243.5
Hazard Analysis and Critical Control Point Programs	
Plan Development	$ 54.8
Annual Plan Reassessment	$ 8.9
Recordkeeping[a]	$ 440.5
Initial Training	$ 22.7
Recurring Training	$ 22.1
Additional Overtime	$ 17.5
SUBTOTAL: INDUSTRY COSTS	$ 968.0 - 1,156.0
FSIS Costs	$ 56.5
TOTAL COSTS	$1,024.5 - 1,212.5

[a] Recording, reviewing, and storing data.

SOURCE: "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule," Federal Register, July 25, 1996.

Pathogen Reduction and Microbial Sampling. The final rule included a combination of testing and compliance activities:

- o Microbial testing for generic E. coli was required, with frequency based on output,[85] to validate control of slaughter and sanitary dressing procedures.

- o The regulation did not include minimum testing requirements for Salmonella[86] (and no establishment testing was a possibility because FSIS does testing for enforcement purposes), but it did require compliance with a Salmonella performance standard.

Estimated costs of E. coli testing were based on annual slaughter production, by species, of affected establishments. Estimated costs had two components:

- o Generic E. coli sampling costs, consisting of labor costs for:
  - Training for aseptic sampling,
  - Sampling plan development,
  - Sample collection and analysis (a recurring cost), and
  - Recording and review (a recurring cost); and

- o Sample analysis costs, based on commercial laboratory and FSIS field laboratory costs.

Because Salmonella testing was not required in the final rule, cost estimation was problematic.[87] FSIS recognized that Salmonella testing might implicitly be indirectly required by the pathogen reduction standard, although FSIS also noted that testing by the Agency (particularly pre-implementation testing) and HACCP itself should be sufficient for establishments that do not have Salmonella problems. Estimation of costs of coming into compliance was also problematic,[88] since information on how many

[85] Required frequencies of testing were as follows:
- Cattle: 1 test per 300 carcasses,
- Swine: 1 test per 1,000 carcasses,
- Chickens: 1 test per 22,000 carcasses, and
- Turkeys: 1 test per 3,000 carcasses.

With these frequencies, it was estimated that 90 percent of all cattle, 94 percent of all swine, and 99 percent of all chickens and turkeys would be slaughtered in establishments conducting at least one E. coli test per day.

[86] The proposed rule had required each affected establishment to collect one sample daily for each species or variety of raw ground product and to analyze it for Salmonella. The results of each establishment's Salmonella testing program were to be used both for regulatory enforcement and as a measure of process control.

[87] Costs of Salmonella testing required in the proposed rule had been estimated to be $74,672,000 in the first year and $68,020,000 annually thereafter.

[88] These costs had been omitted from the cost analysis of the proposed rule.

establishments would not be in compliance was not available. FSIS addressed these difficulties by developing scenarios for high and low costs:

- o Under the low-cost scenario, it was assumed that the establishments that would test and take corrective actions[89] would include the following:
  - Establishments that typically had problems controlling operations before the regulation (about 5 to 10 percent of establishments inspected) would also have problems meeting the Salmonella standards, and
  - Some large establishments would take any action necessary to provide assurance that they met all regulatory requirements.

- o Under the high-cost scenario, it was assumed that the establishments that would test and take corrective actions would include the following:
  - Approximately half of the affected establishments were not meeting the proposed standards at the time of the rule, and
  - Most large establishments and the majority of smaller establishments would take some action necessary to assure compliance.

Based on these premises, FSIS made assumptions about how many establishments would test for Salmonella and take corrective action, how often they would test, and what type of corrective action they would use.

HACCP Programs. The final rule required a single, comprehensive HACCP plan for each establishment. In the absence of specific comments on the assumptions used,[90] however, the final RIA used the cost estimates developed for the proposed rule.[91] These costs had been based on the cost of writing initial plans of three levels of difficulty.[92] FSIS had then estimated the cost of developing a second HACCP plan for

---

[89] Options for antimicrobial treatments of cattle and hogs included:
- A hot water spray system with no cabinet (@ $0.08 per carcass),
- A pre-evisceration acid spray system with both a pre-wash spray cabinet and a sanitizing cabinet (@ $0.79 per carcass),
- A TSP system for cattle (@ $0.85 per carcass),
- A steam vacuum system (with $10,000 installation cost and $4,500 annual operation and maintenance cost).

For poultry, the principal treatment was a TSP system (with $40,000 per line installation cost and $0.003 per broiler or $0.014 per turkey operating costs).

[90] Comments typically provided cost estimates, which ranged widely but generally fell in the same range as FSIS estimated costs.

[91] The proposed rule had required each inspected establishment to develop a written HACCP plan for each distinct "process" conducted on the premises. FSIS judged that the difference in cost between writing separate HACCP plans and one comprehensive HACCP plan (which would probably be developed in stages) was not substantial enough to warrant re-estimation of costs.

[92] An easy HACCP plan (@ $4,000), a moderate HACCP plan (@ $8,000), and a difficult HACCP plan (@ $12,500).

an establishment to be half the cost of the first plan; and estimated the cost of developing a third plan to be half the cost of the second one.

Other HACCP costs, which were based on estimated labor effort for the task(s), included the following:

- o Annual reassessment was estimated to require two hours of QC manager's time.

- o Annual recordkeeping costs were based on labor estimates per production line for:
  - Recording observations,
  - Certifying records, and
  - Maintaining records.

- o Initial training costs were based on training one employee for each separate slaughter and processing operation at a three-day training session.

- o Annual recurring training costs, due to worker turnover, were estimated to be 10 percent of initial training costs.

Additional Overtime. One of the concerns raised by the preliminary RIA was that "with the publication of the [HACCP] rule, TQC [Total Quality Control] establishments could lose their authority to produce and ship product after their normal shift production time." The 287 active TQC establishments would have to pay overtime for inspection. FSIS estimated the overtime costs based on two hours of overtime inspection each day.

3. Effects of the Regulation on Small Establishments

Size Categories. In developing estimates of costs for the Preliminary RIA, FSIS differentiated among three sizes of federally inspected establishment:

- o High volume: More than $50 million in sales (849 establishments);

- o Medium volume: $2.5 million to $50 million in sales (3,103 establishments); and

- o Low volume: Less than $2.5 million in sales (2,234 establishments).

This categorization readily translated (at least informally) into "large," "medium-sized," and "small." These size classes drew substantial criticism in the comments. Since the size was relevant for the effective date of the Salmonella and HACCP plan requirements, FSIS rethought the matter and developed the following definitions for sequencing of these requirements:

- o Large: 500 employees or more (353 establishments);

- o Small: Both of the following:
  - 10 to 499 employees, and
  - $2.5 million or more in sales (2,941 establishments);

- o Very small: Either of the following:
  - Fewer than 10 employees, or
  - Less than $2.5 million in sales (2,892 establishments).

Costs in the final rule involve both bases. Where the Preliminary RIA costs were not modified (sanitation SOPs, overtime, and -- ironically -- HACCP costs), the basis was high, medium, and low volume. Where costs were re-estimated for the final rule particularly microbial sampling and pathogen reduction), the basis used was a melange of process (Salmonella requirements) and physical production (E. coli requirements). In addition, state-inspected establishments were treated as a distinct group for cost estimation -- in part because they were generally rather small, but principally because they had different compliance baselines.

Sanitation Standard Operating Procedures. Cost estimates for sanitation SOP are shown in Exhibit X-2, by size of establishment. These costs are for the SOP plan; they do not reflect costs of changing procedures themselves. Thus the costs are essentially paperwork costs.

Salmonella Testing and Process Modification. Exhibit X-3 shows cost estimates for Salmonella testing and process modifications, by establishment size. Since these costs were estimated as part of the Final RIA, "size" uses the final rule HACCP definition. The costs are disaggregated into three production categories:

- o Cattle and hog slaughter establishments are estimated to incur costs of both sampling/testing and process changes to eliminate Salmonella.

- o Poultry slaughter establishments are estimated to incur only process change costs, since FSIS estimated that most establishments already sample for Salmonella as much as they are likely to.

- o Raw ground meat processors are estimated to incur only sampling/testing costs, since process changes (other than changing suppliers) are not feasible.

Exhibit X-3 provides cost estimates per establishment for establishments that actually do incur costs. In each production category and for each size class of establishments, FSIS made specific assumptions about the percent of establishments that would incur costs and the types of measures that they would take. The principle differences in process are the following:

- o For sampling and testing:
  - Large establishments were assumed to use in-house laboratories with a cost of $25.50 per sample, while
  - Small and very small establishments were assumed to use commercial laboratories with a cost of $33.25 per sample.

- o As an antimicrobial treatment by cattle and hog slaughter establishments:
  - Large establishments were assumed to use steam vacuum systems with an installation cost of $10,000 and annual operating costs of $4,500, while

- Small and very small establishments were assumed to use a hot water rinse at $0.08 per carcass.

These assumptions tend to drive the results, which show either relatively minor or very large differences in cost per establishment across establishment size. Very large differences occur in the case of antimicrobial treatment (because of the different processes assumed) and in scenarios where no very small or small establishments are assumed to take compliance actions (particularly sampling by raw ground processing establishments).

EXHIBIT X-2:

SANITATION SOP AND HACCP COSTS PER ESTABLISHMENT, BY SIZE

	Establishment Category			
Regulatory Component	**Low**	**Medium**	**High**	**State**
Sanitation SOP				
Plan Development	$ 128	$ 256	$ 640	$ 128
Annual Recordkeeping	$1,242	$2,204	$4,104	$1,242
Training	$ 62	$ 155	$ 372	$ 128
Total First Year Cost	$1,432	$2,615	$5,116	$1,432
Total Recurring Cost	$1,242	$2,204	$4,104	$1,242
HACCP Plan				
Plan Development	$7,950	$9,048	$10,496	$4,230
Annual Reassessment	$ 117	$ 144	$ 186	$ 108
Recordkeeping				
Recording	$2,560	$4,202	$10,994	$2,163
Certification	$1,442	$2,368	$6,195	$1,219
Maintenance	$ 28	$ 52	$ 90	$ 33
Training				
Initial	$2,937	$2,911	$3,121	$3,368

Annual Recurring	$ 294	$ 291	$ 312	$ 337
Total First Year Cost	$10,887	$11,959	$28,459	$7,598
Total Recurring Cost	$4,441	$7,057	$17,777	$3,860

SOURCE: "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule," Federal Register, July 25, 1996.

EXHIBIT X-3: SALMONELLA TESTING AND PROCESS MODIFICATION COSTS PER ESTABLISHMENT,[a] BY SIZE

Production Category/ Regulatory Component	Establishment Category		
	Very Small	**Small**	**Large**
Cattle and Hog Slaughter Establishments			
Sampling[b]			
Low-Cost Scenario	$ -	$1,734	$5,265
High-Cost Scenario	$ 400	$1,734	$42,120
Process Changes (Both Scenarios)[c]			
Installation Costs	$ -	$ -	$10,000
Operating Costs	$ 131	$4,867	$ 4,500
Total First Year Cost			
Low-Cost Scenario	$ -	$6,601	$19,765
High-Cost Scenario	$ 531	$6,601	$56,620
Total Recurring Cost			
Low-Cost Scenario	$ 531	$6,601	$9,765
High-Cost Scenario	$ 531	$6,601	$46,620

[a] The table shows costs for the establishments that actually incur them.

[b] The low-cost scenario and the high cost scenario make the following assumptions about sampling:

- All large establishments will sample daily under the low-cost scenarios; all will sample eight times a day under the high-cost scenario.
- Half of small establishments will sample weekly under the low-cost scenario; all will sample weekly under the high-cost scenario.
- Half of very small establishments will sample weekly under the high-cost scenario.

[c] The low-cost scenario and the high-cost scenario make the following assumptions about process changes:

- Ten percent of large establishments will install steam vacuum systems under the low-cost scenario; half will use the controls under the high-cost scenario.
- Half of small establishments will use a hot water rinse under the low-cost scenario; all will use the controls under the high-cost scenario.
- All very small establishments will use a hot water rinse under the high-cost scenario.

EXHIBIT X-3: SALMONELLA TESTING AND PROCESS MODIFICATION COSTS

PER ESTABLISHMENT, BY SIZE

(continued)

Production Category/ Regulatory Component	**Establishment Category**		
	Very Small	**Small**	**Large**
Poultry Slaughter Establishments[d]			
Process Changes (Both Scenarios)[e]			
Installation Costs	$ -	$60,000[f]	$80,000
Operating Costs			
Chicken Slaughter	$ -	$78,750[f]	$105,000
Turkey Slaughter	$ -	$63,000[f]	$84,000
Total First Year Cost			
Chicken Slaughter	$ -	$138,750[f]	$185,000
Turkey Slaughter	$ -	$123,000[f]	$164,000
Total Recurring Cost			

Chicken Slaughter	$ -	$78,750[f]	$105,000
Turkey Slaughter	$ -	$63,000[f]	$84,000

---

[d] FSIS estimated that poultry slaughter establishments would not increase their level of sampling. Thus no sampling costs are included.

[e] The low-cost scenario and the high-cost scenario make the following assumptions about process changes:
- Under the low-cost scenario, one quarter of large establishments will install TSP rinse systems.
- Under the high-cost scenario, two thirds of large establishments and two thirds of small establishments will install TSP rinse systems.

[f] No costs are incurred under the low-cost scenario.

EXHIBIT X-3: SALMONELLA TESTING AND PROCESS MODIFICATION COSTS

PER ESTABLISHMENT, BY SIZE

(continued)

Production Category/ Regulatory Component	Establishment Category: Very Small	Small	Large
Raw Ground Processing[g]			
Sampling[h]			
Low-Cost Scenario	$ -	$1,734	$5,265
High-Cost Scenario	$ -	$1,734	$10,530
Total Recurring Cost			
Low-Cost Scenario	$ -	$1,734	$5,265

High-Cost Scenario	$ -	$1,734	$10,530

[g] FSIS noted that raw ground meat processing establishments could not do much to reduce Salmonella through processes changes; the most likely action was to change suppliers if sampling and testing indicated a problem. Thus no process change costs are included.

[h] The low-cost scenario and the high cost scenario make the following assumptions about sampling:

- All large establishments will sample daily under the low-cost scenarios; all will sample twice daily under the high-cost scenario.
- Ten percent of small establishments will sample weekly under the low-cost scenario; half will sample weekly under the high-cost scenario.
- No very small establishments will sample under either scenario.

SOURCE: "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule," Federal Register, July 25, 1996.

Generic E. Coli. Cost estimates for sampling and testing for generic E. coli are shown in Exhibit X-4. These are costs of showing that the E. coli criteria are met, not costs of meeting the criteria. The first year costs fall very disproportionately on small and very small establishments, since the cost of developing a sampling is constant regardless of establishment size and larger establishments are assumed to have more baseline training for sampling. Recurring costs, which are far more favorable to very small establishments, are determined principally by the frequency of sampling. Unlike the Salmonella testing costs (which are based only on assumptions), however, the frequency of sampling for generic E. coli is stipulated in the regulations.

HACCP Plan. Exhibit X-2 also shows costs associated with the HACCP plan by establishment size. These costs are also essentially paperwork; training is related to how to carry out the plan. As such, they do not vary greatly across establishment size. The HACCP plan development and annual reassessment costs from the preliminary RIA were used for the final rule. Since there were significant changes in the HACCP requirements, the original costs may not be particularly accurate, although FSIS concluded that the two sets of requirements would entail sufficiently similar actions that re-estimation of the costs was not warranted.

Exhibit X-2 compares "first year" costs of different sizes of establishment directly. In fact, one of the regulatory flexibility measures included in the regulation is deferral of development and implementation of the HACCP plan beyond the effective date for large establishments (18 months after publication of the final rule) by an additional 18 months for small establishments and by an additional two years for very small establishments. This deferral is reflected (by discounting) in Exhibit X-1, but not in Exhibit X-2. It seems unlikely that the discount rate is an adequate measure of the value of a deferred effective date, and no other measure is available.

Relative Costs by Establishment Size. Exhibit X-5 shows compliance costs per employee and costs as a percent of value of shipments, by size of establishment, for each of the compliance activities in each of the principal affected industries. The establishment size categories are not really comparable, so that the results are very much an approximation. There are two principal problem areas:

- o Costs were estimated on three different size classifications:
    - Sanitation SOP and HACCP costs were based on a sales definition of "low," "medium," and "high" volumes (see Exhibit X-2),
    - Salmonella-related costs were based on a primarily employment definition of "very small," "small," and "large" (see Exhibit X-3), and
    - Costs related to generic E. coli were based on physical output definitions (see Exhibit X-4).

- o Average employment and value of shipments used in Exhibit X-5 were computed for employment-based size classes, since revenue data were not available. There were several respects in which these size classes could not be matched exactly with any of the classifications used for cost estimation:
    - The employment-based boundary between "very small" and "small" establishments (10 employees) was retained in Exhibit X-5, but the

revenue-based component of "very small" (< $2.5 million in sales) could not be included without the micro data available to FSIS.

EXHIBIT X-4:

GENERIC E. COLI PROGRAM COSTS PER ESTABLISHMENT, BY SIZE

Production Category/ Regulatory Component	Establishment Category: Very Small	Small	Large
Poultry Slaughter Establishments[a]			
Training for Aseptic Sampling	$ 403	$ 214	$ 13
Sampling Plan Development	$ 640	$ 640	$ 640
Sample Collection & Analysis	$ 620	$2,500	$43,825
Recording and Review	$ 28	$ 107	$2,030
Total First Year Cost	$1,691	$3,464	$47,161
Total Recurring Cost	$ 648	$2,607	$46,508
Cattle and Swine Slaughter Establishments[b]			
Training for Aseptic Sampling	$ 403	$ 250	$ 9
Sampling Plan Development	$ 640	$ 640	$ 640
Sample Collection & Analysis	$ 620	$1,824	$39,527
Recording and Review	$ 28	$ 83	$1,839
Total First Year Cost	$1,691	$2,797	$42,015
Total Recurring Cost	$ 648	$1,907	$41,366

[a] Establishment categories are defined in terms of annual production as follows: Low: Under 60,000 turkeys; under 440,000 chickens
Medium: 60,000 - 780,000 turkeys; 440,000 - 5,720,000 chickens
High: Over 780,000 turkeys; over 5,720,000 chickens

[b] Establishment categories are defined in terms of annual production as follows: Low: Under 6,000 cattle; under 20,000 hogs
Medium: 6,000 - 78,000 cattle; 20,000 - 260,000 hogs
High: Over 78,000 cattle; over 260,000 hogs

SOURCE: "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule," Federal Register, July 25, 1996.

EXHIBIT X-5:

DETAILED COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

BY ESTABLISHMENT SIZE[a]

Production Category/ Regulatory Component	Establishment Category Very Small	Small	Large
CATTLE & HOG SLAUGHTERING (SIC 2011)			
First Year Cost			
Sanitation SOP			
Cost per Employee	$ 427	$ 53	$ 4.92
Cost Ratio	86.8	10.8	1.0
Cost as a Percent of Revenue	0.210%	0.015%	0.0011%
Cost Ratio	190.9	13.6	1.0
Salmonella Testing/Process			
Low-Cost Scenario			
Cost per Employee	$ -	$ 133	$19.00
Cost Ratio	0.0	7.0	1.0
Cost as a Percent of Revenue	-	0.037%	0.0044%
Cost Ratio	0.0	8.4	1.0
High-Cost Scenario			
Cost per Employee	$ 159	$ 133	$54.44
Cost Ratio	2.9	2.4	1.0
Cost as a Percent of Revenue	0.078%	0.037%	0.0126%
Cost Ratio	6.2	2.9	1.0
Generic E. Coli			
Cost per Employee	$ 311	$ 57	$40.40
Cost Ratio	7.7	1.4	1.0
Cost as a Percent of Revenue	0.153%	0.016%	0.0094%
Cost Ratio	16.3	1.7	1.0
HACCP Plan			
Cost per Employee	$3,250	$ 242	$27.36

Cost Ratio	118.8	8.8	1.0
Cost as a Percent of Revenue	1.598%	0.066%	0.0064%
Cost Ratio	149.7	10.3	1.0

[a] Cost estimates are based on three different size categories. Exhibit X-2 gives size categories for sanitation SOP and HACCP plan costs; Exhibit X-3 gives size categories for Salmonella testing and process changes; and Exhibit X-4 gives size categories for generic E. coli procedures. See also source note in Exhibit X-5.

EXHIBIT X-5:

DETAILED COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	Establishment Category: Very Small	Small	Large
Recurring Annual Cost			
Sanitation SOP			
Cost per Employee	$ 371	$ 45	$ 3.95
Cost Ratio	93.92	11.39	1.00
Cost as a Percent of Revenue	0.182%	0.012%	0.0009%
Cost Ratio	202.22	13.33	1.00
Salmonella Testing/Process			
Low-Cost Scenario			
Cost per Employee	$ 159	$ 133	$ 9.39
Cost Ratio	16.9	14.2	1.0
Cost as a Percent of Revenue	0.078%	0.037%	0.0022%
Cost Ratio	35.4	16.8	1.0
High-Cost Scenario			
Cost per Employee	$ 159	$ 133	$44.83
Cost Ratio	16.9	14.2	1.0
Cost as a Percent of Revenue	0.078%	0.037%	0.0104%
Cost Ratio	35.4	16.8	1.0
Generic E. Coli			
Cost per Employee	$ 505	$ 39	$39.77
Cost Ratio	12.7	1.0	1.0
Cost as a Percent of Revenue	0.095%	0.011%	0.0092%
Cost Ratio	10.3	1.2	1.0
HACCP Plan			
Cost per Employee	$1,326	$ 143	$17.09
Cost Ratio	77.6	8.4	1.0

Cost as a Percent of Revenue	0.652%	0.039%	0.0040%
Cost Ratio	163.0	9.7	1.0

EXHIBIT X-5

DETAILED COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	**Establishment Category** Very Small	Small	Large
POULTRY SLAUGHTERING (SIC 2015)			
First Year Cost			
Sanitation SOP			
Cost per Employee	$ 577	$ 31	$ 7.11
Cost Ratio	81.1	4.4	1.0
Cost as a Percent of Revenue	0.301%	0.019%	0.0060%
Cost Ratio	50.2	3.2	1.0
Salmonella Testing/Process[a]			
Chicken Slaughtering			
Cost per Employee	$ -	$1,630	$ 257
Cost Ratio	0.0	6.3	1.0
Cost as a Percent of Revenue	-	1.017%	0.2160%
Cost Ratio	0.0	4.7	1.0
Turkey Slaughtering			
Cost per Employee	$ -	$1,445	$ 228
Cost Ratio	0.0	6.3	1.0
Cost as a Percent of Revenue	-	0.901%	0.1915%
Cost Ratio	0.0	4.7	1.0
Generic E. Coli			
Cost per Employee	$ 682	$ 20	$65.56
Cost Ratio	10.4	0.3	1.0
Cost as a Percent of Revenue	0.356%	0.025%	0.0551%
Cost Ratio	6.5	0.4	1.0
HACCP Plan			
Cost per Employee	$4,390	$ 141	$39.56
Cost Ratio	111.0	3.6	1.0

Cost as a Percent of Revenue	2.291%	0.088%	0.0332%
Cost Ratio	69.0	2.6	1.0

EXHIBIT X-5

DETAILED COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	**Establishment Category** Very Small	Small	Large
Recurring Annual Cost			
Sanitation SOP			
Cost per Employee	$ 501	$ 26	$5.70
Cost Ratio	87.9	4.6	1.0
Cost as a Percent of Revenue	0.261%	0.016%	0.0048%
Cost Ratio	54.4	3.3	1.0
Salmonella Testing/Process[b]			
Chicken Slaughtering			
Cost per Employee	$ -	$ 925	$ 146
Cost Ratio	0.0	6.3	1.0
Cost as a Percent of Revenue	-	0.577%	0.1226%
Cost Ratio	0.0	4.7	1.0
Turkey Slaughtering			
Cost per Employee	$ -	$ 740	$ 117
Cost Ratio	0.0	6.3	1.00
Cost as a Percent of Revenue	-	0.462%	0.0981%
Cost Ratio	0.0	4.7	1.0
Generic E. Coli			
Cost per Employee	$ 261	$ 8	$64.65
Cost Ratio	4.04	0.12	1.00
Cost as a Percent of Revenue	0.136%	0.005%	0.0543%
Cost Ratio	2.50	0.09	1.00
HACCP Plan			
Cost per Employee	$1,791	$ 83	$24.71
Cost Ratio	72.48	3.36	1.00
Cost as a Percent of Revenue	0.935%	0.052%	0.0207%
Cost Ratio	45.17	2.51	1.00

[b] Costs are for high-cost scenario; small establishments incur no costs under the low-cost scenario.

EXHIBIT X-5

DETAILED COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	Establishment Category: Very Small	Small	Large
RAW GROUND PROCESSING (SIC 2013)			
First Year Cost			
Sanitation SOP			
Cost per Employee	$ 366	$ 40	$11.68
Cost Ratio	31.3	3.4	1.0
Cost as a Percent of Revenue	0.242%	0.018%	0.0049%
Cost Ratio	49.4	3.7	1.0
Salmonella Testing/Process			
Low-Cost Scenario			
Cost per Employee	$ -	$ 26	$12.02
Cost Ratio	0.0	2.2	1.0
Cost as a Percent of Revenue	-	0.012%	0.0051%
Cost Ratio	0.0	2.3	1.0
High-Cost Scenario			
Cost per Employee	$ -	$ 26	$24.03
Cost Ratio	0.0	1.1	1.0
Cost as a Percent of Revenue	-	0.012%	0.0101%
Cost Ratio	0.0	1.2	1.0
HACCP Plan			
Cost per Employee	$2,784	$ 182	$64.95
Cost Ratio	42.9	2.8	1.0
Cost as a Percent of Revenue	1.836%	0.082%	0.0274%
Cost Ratio	67.0	3.0	1.0

EXHIBIT X-5

DETAILED COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	Establishment Category		
	Very Small	**Small**	**Large**
Recurring Annual Cost			
Sanitation SOP			
Cost per Employee	$ 318	$ 34	$ 9.37
Cost Ratio	33.9	3.6	1.0
Cost as a Percent of Revenue	0.210%	0.015%	0.0039%
Cost Ratio	53.8	3.8	1.0
Salmonella Testing/Process			
Low-Cost Scenario			
Cost per Employee	$ -	$ 26	$12.02
Cost Ratio	0.0	2.2	1.0
Cost as a Percent of Revenue	-	0.012%	0.0051%
Cost Ratio	0.0	2.3	1.0
High-Cost Scenario			
Cost per Employee	$ -	$ 26	$24.03
Cost Ratio	0.0	1.1	1.0
Cost as a Percent of Revenue	-	0.012%	0.0101%
Cost Ratio	0.0	1.2	1.0
HACCP Plan			
Cost per Employee	$1,136	$ 108	$40.57
Cost Ratio	28.0	2.7	1.0
Cost as a Percent of Revenue	0.749%	0.048%	0.0171%
Cost Ratio	43.8	2.8	1.0

SOURCE: Cost estimates taken from Exhibit X-2, Exhibit X-3, and Exhibit X-4. Employment and Value of Shipments data taken from U.S. Bureau of the Census, "1992 Census of Manufactures." Size classes are 1-9 employees, 10-249 employees, and 1,000-2,499 employees. Data in the largest size class (2,500 and up for SIC 2011 and 1,000-2,499 for SIC 2013) were not available because the small number of establishments (4) in these size classes created confidentiality problems.

- A boundary between "small" and "large" was set at 250 employees, rather than 500 employees, since this appeared to correspond better to the "medium" and "high" volume categories (which were used for HACCP costs, the largest cost category).
- Employment data were not available for the largest size class of cattle and hog slaughtering establishments (2,500 employees and over) and of poultry slaughtering establishments (1,000 to 2,499 employees), because the small number of establishments (four in each case) created confidentiality problems. This omission substantially <u>understates</u> the disproportionate impact of the regulations on small businesses.
- Estimates were based on data for the entire four-digit industry, rather than the set of federally inspected establishments used by FSIS.

Exhibit X-5 shows substantial variation in the degree of disproportion of costs to small establishments:

- o The disproportion in costs to small establishments is greatest for the sanitation SOP and HACCP plan and is:
  - Greatest for the HACCP plan in the case of first year costs, and
  - Greatest for the sanitation SOP in the case of recurring annual costs.

- o The disproportion in costs to small establishments is, of course, least for Salmonella procedures when:
  - The analysis assumes that very small establishments take no action (poultry slaughtering), and
  - No generic E. coli activities are required (raw meat processing).

- o For cattle and hog slaughtering:
  - The disproportion in first year costs is least for Salmonella procedures, and
  - The disproportion in recurring annual costs is least for generic E. coli procedures.

- o The disproportion in costs to small establishments is:
  - Higher with respect to revenue than with respect to employment in cattle and hog slaughtering and raw meat processing, and
  - Higher with respect to employment than with respect to revenue in poultry slaughtering.

Exhibit X-6 summarizes the costs relative to employment and revenue for each of the three principal affected industries. The main results include the following:

- o The disproportion in costs to small establishments is extremely high. Depending on the time frame (first year or recurring), cost scenario, and base (employment or revenue), normalized costs for small establishments are:
  - 22 to 93 times the normalized costs for large establishments in cattle and hog slaughtering,
  - 6.6 to 17 times the normalized costs for large establishments in poultry slaughtering, and

- 20 to 56 times the normalized costs for large establishments in raw ground processing.

EXHIBIT X-6:

SUMMARY COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

Production Category/ Regulatory Component	Establishment Category		
	Very Small	**Small**	**Large**
CATTLE & HOG SLAUGHTERING (SIC 2011)			
Total First Year Cost			
Low-Cost Scenario			
Cost per Employee	$3,988	$ 485	$ 92
Cost Ratio	43.3	5.3	1.0
Cost as a Percent of Revenue	1.961%	0.134%	0.021%
Cost Ratio	93.4	6.4	1.0
High-Cost Scenario			
Cost per Employee	$4,147	$ 485	$ 127
Cost Ratio	32.6	3.8	1.0
Cost as a Percent of Revenue	2.039%	0.134%	0.030%
Cost Ratio	68 0	4.5	1.0
Recurring Annual Cost			
Low-Cost Scenario			
Cost per Employee	$2,361	$ 360	$ 70
Cost Ratio	33.7	5.1	1.0
Cost as a Percent of Revenue	1.007%	0.099%	0.016%
Cost Ratio	62.9	6.2	1.0
High-Cost Scenario			
Cost per Employee	$2,361	$ 360	$ 106
Cost Ratio	22.3	3.4	1.0
Cost as a Percent of Revenue	1.007%	0.099%	0.025%
Cost Ratio	40.3	4.0	1.0

EXHIBIT X-6

SUMMARY COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	Establishment Category		
	Very Small	Small	Large
POULTRY SLAUGHTERING (SIC 2015)[a]			
Total First Year Cost			
Chicken Slaughtering			
Cost per Employee	$5,649	$1,822	$ 369
Cost Ratio	15.3	4.9	1.0
Cost as a Percent of Revenue	2.948%	1.149%	0.310%
Cost Ratio	9.5	3.7	1.0
Turkey Slaughtering			
Cost per Employee	$5,649	$1,637	$ 340
Cost Ratio	16.6	4.8	1.0
Cost as a Percent of Revenue	2.948%	1.033%	0.286%
Cost Ratio	10.3	3.6	1.0
Recurring Annual Cost			
Chicken Slaughtering			
Cost per Employee	$2,553	$1,042	$ 358
Cost Ratio	7.1	2.9	1.0
Cost as a Percent of Revenue	1.332%	0.650%	0.202%
Cost Ratio	6.6	3.2	1.0
Turkey Slaughtering			
Cost per Employee	$2,553	$ 857	$ 212
Cost Ratio	12.0	4.0	1.0
Cost as a Percent of Revenue	1.332%	0.535%	0.178%
Cost Ratio	7.5	3.0	1.0

[a] High-cost scenario. Costs are the same in the low-cost scenario except for small establishments, which incur no costs for salmonella testing/processing in the low-cost scenario and thus have normalized costs less than those of large establishments.

EXHIBIT X-6:

SUMMARY COST RATIOS FOR PATHOGEN REDUCTION/HACCP FINAL RULE

(continued)

Production Category/ Regulatory Component	**Establishment Category**		
	Very Small	**Small**	**Large**
RAW GROUND PROCESSING (SIC 2013)			
Total First Year Cost			
Low-Cost Scenario			
Cost per Employee	$3,150	$ 248	$ 89
Cost Ratio	35.4	2.8	1.0
Cost as a Percent of Revenue	2.078%	0.112%	0.037%
Cost Ratio	56.2	3.0	1.0
High-Cost Scenario			
Cost per Employee	$3,150	$ 248	$ 101
Cost Ratio	31.2	2.4	1.0
Cost as a Percent of Revenue	2.078%	0.112%	0.042%
Cost Ratio	49.5	2.7	1.0
Recurring Annual Cost			
Low-Cost Scenario			
Cost per Employee	$1,454	$ 168	$ 62
Cost Ratio	23.4	2.7	1.0
Cost as a Percent of Revenue	0.959%	0.075%	0.026%
Cost Ratio	36.9	2.9	1.0
High-Cost Scenario			
Cost per Employee	$1,454	$ 168	$ 74
Cost Ratio	19.6	2.3	1.0
Cost as a Percent of Revenue	0.959%	0.075%	0.031%
Cost Ratio	30.9	2.4	1.0

SOURCE: Exhibit X-5.

- The disproportion in costs to small establishments is:
  - Higher with respect to revenue than employment in cattle and hog slaughtering and raw ground processing, and
  - Higher with respect to employment than revenue in poultry slaughtering.

- The disproportion in costs to small establishments is smaller for the high-cost scenario than for the low-cost scenario (except in poultry slaughtering, where there is no difference), because large establishments are assumed to perform very intensive testing.

- The disproportion in costs to small establishments is substantially larger for first year costs than for recurring annual costs, principally because of the relatively fixed cost of developing sanitation SOPs and HACCP plans.

4. Conclusions

The degree of disproportion in costs to small establishments is very large. This conclusion seems robust even considering the imprecision introduced by using different bases for cost estimation and other factors.

The individual costing assumptions appear to be plausible. FSIS had detailed micro data; the analysis is unusually detailed in terms of establishment size, industry, and process. Differences in impact across size of establishments, however, are driven in part by pure assumptions about which size group would use which technology and (in the case of Salmonella) how often they would test. FSIS appears to have used the micro data principally to get a more accurate estimate of total costs and less to gain a real understanding about differential impacts.

The staggered effective dates for HACCP and Salmonella provisions clearly benefitted smaller establishments and were intended to do so. Yet the analysis made no real attempt to quantify the benefit of this regulatory flexibility provision. It shows up in two ways: Lower value of discounted costs, and presentation of costs in a year-by-year format. As with other differences in cost related to establishment size, this treatment seems more designed to present a detailed picture of total costs than to assess disproportionate impacts.

Except for pathogen reduction process changes related to Salmonella (which themselves were omitted from the preliminary RIA), the cost estimates cover only planning, monitoring, and recordkeeping activities. There are no costs of process changes that might result from generic E. coli tests or implementatig the HACCP plan. (Indeed, the analysis suggests that E. coli process changes need not be costed because the process changes will be included in the HACCP plan.) In a sense this omission is legitimate. What the regulation is really about is changing the way in which it is determined that the meat and poultry products are safe and wholesome, using procedures that will help prevent problems as well as detect them, and shifting much of the responsibility to the producers. The goal of safe and wholesome food has not changed, and the producers who will have to make process changes (other than Salmonella-related) were, in a sense, out of compliance. Yet to the extent that changes in detection are more effective and preventative, they have the effect of tightening the standards. To this extent, additional process changes are costs of the regulation. As such, they should be more completely included.

III. IRS PAPERWORK BURDENS

A. THE ARTHUR D. LITTLE MODEL

The Internal Revenue Service estimates taxpayer burden using a model developed by Arthur D. Little, Inc. (ADL) in the mid 1980s.[93] At that time, the ADL model represented a major step forward in the measurement of taxpayer burden, and the model has remained so authoritative that most researchers have preferred to use its results rather than undertake the task of estimating taxpayer burden anew. The ADL model, however, fails to estimate many aspects of taxpayer burden, particularly taxpayer size. Nevertheless, the ADL model remains the starting place for measuring taxpayer burden.

1. Overview of the Model

The ADL model defines paperwork burdens to business taxpayers[94] as the time costs of:

- Keeping records;
- Getting advice and learning about federal income tax filing requirements;
- Obtaining materials and deciding what to do;
- Finding and using tax preparation services;
- Preparing the federal income tax return; and
- Getting the federal income tax return out.

The ADL model meets the requirements of the Paperwork Reduction Act by estimating burdens associated with forms, but ADL made no attempt to cover burdens that could not be related to a form. The ADL model explicitly excludes effort associated with tax planning or post-filing activities, and it limits the definition of burden to hours expended. The equations for business taxpayer burden are extremely simplified. The final version of the model includes only a few exogenous variables, which are descriptive

[93] Arthur D. Little, Development of Methodology for Estimating the Taxpayer Paperwork Burden, Report to the Department of the Treasury, Internal Revenue Service, Washington, D.C., June 1988.

[94] Separate equations in the model estimate paperwork burdens for individual tax payers.

of tax forms -- a measure of form length, a count of references to the IRS code, and a count of IRS form attachments.[95]

[95] Ibid., pp. VIII-30 - VIII-31.

2. Other Dimensions of Taxpayer Burden

Business (and individual) taxpayers incur numerous burdens that are not estimated by the ADL model. While not directly related to forms, these burdens come under the heading of "paperwork burdens."

Post-Filing Burdens. IRS enforcement activities impose substantial burdens on taxpayers, including:

- Computer matching of tax returns with information returns in the Information Returns Program and the Delinquent Returns Program;

- Audits, which are targeted primarily on a probabilistic basis;

- The Accounts Receivable Program, which collects past-due assessments; and

- Litigation, including:
    - Audit appeals,
    - Tax court cases initiated by taxpayers,
    - Refund litigation,
    - Civil suits brought by the IRS to secure payments,
    - Judicial appeals in the above cases, and
    - Criminal prosecution based on investigation by the IRS.

These enforcement actions impose burdens on taxpayers, which often mirror burdens of tax preparation:

- Taxpayer time to read, understand, and respond to enforcement actions is a major burden. For audits and litigation, time costs also include extensive preparation and participation time.

- Record-keeping burdens are large. Even the most basic of notices often come one to three years after the return was filed, so that records must be stored and retrieved. Audits and litigation require the most detailed documentation of any taxpayer activity.

- Paid preparers or other professionals may be required. While taxpayers are often capable of handling computer-generated notices, it is probably foolhardy in an audit not to involve a preparer (if one was used) or even to consult an accountant or attorney (if the return was self-prepared).

- Litigation and the aftermath of forced collection virtually always require an attorney.

- Forced collection can impose additional burdens, including costs of resisting the collection, loss of use of the assets (or replacement cost), and damage to credit and reputation.

Payroll Burdens. The ADL study included a separate model to estimate burdens of informational returns (the W-2 and 1099 series)[96] and most related annual reporting forms. The ADL model, however, omitted forms related to withholding, including:

- o Form W-4, which estimates withholding (filled out by the worker, but handled by the business);

- o Form 8901, Federal Tax Deposit Coupons, to be filed monthly or within three days of payroll (depending on the size of the liability); and

- o Form 940, for the Federal Unemployment Tax, which must be filed quarterly or annually (depending on the size of the liability).

Alternative Modes of Tax Preparation and Filing. Since the ADL model was developed, modes of preparing and filing tax returns have proliferated. Private sector development of PC accounting and tax preparation software accessible to small businesses has greatly expanded the options. The IRS has also embarked on a program of computerized filing modes, including electronic filing, electronic deposits, and filing by telephone. For the computer-literate, these alternatives have changed the face of the tax system. Differences in burdens related to alternative modes of tax filing are not estimated by the ADL model.

Non-Filing Burdens. The ADL model reflects forms actually filed. It omits burdens of determining whether to file if no form is filed, such as the following:

- o The Alternative Minimum Tax applies to over two million corporations (2.1 million in 1992). Less than one fifth of these corporations (400,000 in 1992) file a return, and just over one percent (28,000 in 1992) actually pay the tax.[97] Many corporations that did not file a return would have had to engage in some degree of record-keeping and other work just to be sure that they did not have to file. ADL model simulations do not measure such a burden.

- o Deposits of withheld federal income tax and FICA payments must be made quarterly, monthly, or in three business days, depending on the amount of the liability. A business just below a thresholds must carefully monitor its liabilities to be sure that it does not unknowingly exceed the next threshold and fail to meet the deposit requirements. This is a particularly big problem for businesses with seasonal or otherwise fluctuating liabilities.

Intensity of Time Costs. The ADL methodology treats each form, page, item, record, attachment, and reference to the IRS code as exactly equivalent to every other form, page, item, record, attachment, and reference to the IRS code, respectively. Yet there are major differences in complexity, clarity, and inherent burden. Alternative

---

[96] Arthur D. Little, pp. VIII-18 - VIII-20.

[97] General Accounting Office, Experience With the Corporate Alternative Minimum Tax, GAO/GGD-95-88 (Washington, D.C.: GAO, 1995), p. 7.

Minimum Tax computations, for example, are widely reported as notoriously complex and difficult.

Direct Costs. Except for the cost of tax preparers, the ADL model omits direct costs -- monetary outlays related to tax preparation activities (broadly construed) -- including:

- o Equipment, such as computers or filing cabinets;
- o General office supplies;
- o Specific materials, such as tax manuals and software;
- o Facilities, particularly office space; and
- o Other overhead costs.

Psychic Costs. Psychic costs of paying taxes include anger, frustration, anxiety, and fear. IRS Value Tracking focus groups, for example, consistently found that small business taxpayers resent IRS double standards (e.g., exacting penalties when errors result from incorrect information provided by the IRS, and responses by the IRS that take far longer than the time allowed to taxpayers[98]); and that small business taxpayers are greatly frustrated with all aspects of penalty administration,[99] and with the threatening and accusatory tone of IRS letters, particularly when honest mistakes are involved.[100] While intangible, psychic costs can have very real consequences. IRS focus groups, for example, have found that fear can inhibit responses to IRS notices.[101] Psychic costs can contribute to errors, lead taxpayers to pay more than necessary just to be safe, exacerbate the force of other burdens, and contribute significantly to political complaints about the IRS.

Delays and Interest. Acceleration of payments and delay of refunds impose costs on taxpayers. Timing issues are complicated, however, by the fact that businesses receive free use of payroll withholding until the funds are deposited. None of these effects is included in the ADL estimates of burden.

Tax Planning and Payment of Excess Taxes. The ADL model does not include any costs or burdens of tax planning. This would be a significant omission even if the

---

[98] Internal Revenue Service, "Simplified Tax and Wage Reporting System: Focus Group Report" (Mimeograph, 1995), p. 6.

[99] Internal Revenue Service, "IRS Outreach to Small Business" (mimeograph), 1995), p. 5.

[100] "1993 Value Tracking Focus Groups With Taxpayers," p. III-9.

[101] Internal Revenue Service, "Simplified Tax and Wage Reporting System: Focus Group Report" (Mimeograph, 1995), p. 6.

tax code were static. In fact, Congress frequently changes major provisions of the tax code, and these changes greatly increase planning burdens. If taxpaying activities become too burdensome, taxpayers may avoid burdens by forgoing tax savings to which they are entitled. Lack of tax planning and failure to contest IRS compliance action errors are two examples in which small businesses may pay more taxes than they should. In such cases, the excess taxes are a proxy for burden.

Start-Up Costs for Small Businesses. The ADL model includes burdens of familiarization and record-keeping, but (given the survey methodology) these are inherently annual costs that relate to getting ready to file taxes. The ADL survey methodology did not really capture the one-time cost that businesses (or first-time individual taxpayers) face of learning what their filing obligations are and what records to keep in the first place. Businesses of all sizes identified as burdens:

o Finding out requirements
- What forms to fill out for what agency
- What type of deposits to make to each agency
- Any other necessary procedures for each agency[102]

The burden of finding out requirements in the first place is far greater than the burden of annually or quarterly brushing up on what and how to file; setting up records is more burdensome than keeping them; the likelihood of mistakes -- and post-filing burden -- is greater for inexperienced taxpayers; and psychic costs are far greater for those who feel they do not know what they are doing. These start-up costs are distinct burdens above and beyond the ongoing burdens of paying taxes. It is not surprising, therefore, that the IRS small business tax workshops (although not yet widely known) are very well received.[103]

Changes in the Tax System. The tax system existing at any one time creates substantial burdens. Burdens are exacerbated because tax laws change -- frequently and substantially. Hall notes that there were 13 significant federal tax enactments in the 40 years following the Internal Revenue Act of 1954, an average of one every 3.1 years. Hall calculates an Instability Ratio (the number of times a section has been amended divided by the number of years since it was enacted) for a sample of "core sections" of the tax code relating to rates of tax, credit against tax, and base of tax for individuals and businesses. The Instability Ratio has a mean value of 0.24 -- one amendment every four years for each core section.[104]

---

[102] Internal Revenue Service, "Simplified Tax and Wage Reporting System Focus Group Report," pp. 7, 16.

[103] "1993 Value Tracking Focus Groups With Taxpayers," p. III-13.

[104] Arthur P. Hall, "The Cost of Unstable Tax Laws," Tax Foundation Special Report No. 41 (October 1994), pp. 1-3.

Changes in the tax code have widespread consequences that increase paperwork burdens for taxpayers. These burdens include:

- Repetition of tax planning and learning how to prepare the return;
- Modifications of systems used for tax preparation;
- Increased use of paid preparers; and
- Increased uncertainty and related psychic costs.

Changes in the tax code can be particularly burdensome when:

- Controversy, prolonged debate, and uncertainty complicate tax planning;
- Changes in the tax law are retroactive;
- Changes in the tax law are made shortly before taxes are due; or
- Tax provisions with sunset periods (for congressional review) lapse for a period before re-authorization.

3. Taxpayer Characteristics and Burden Measurement

The level of paperwork burden can vary substantially with characteristics of the taxpayer and the process used to pay taxes. For purposes of this study, the taxpayer characteristics of greatest interest are:

- Size of the business paying taxes;
- Form of business organization:
  - Sole proprietorship,
  - Partnership, or
  - Corporation (and type of corporation, S or C); and
- Experience of taxpayer/preparer.

The ADL model distinguishes among forms of business organization by the forms for which burdens are estimated. Unfortunately, the ADL model makes no distinction between large and small businesses. It is interesting to note, however, that the firms in the ADL sample were overwhelmingly quite small. A majority (60 percent) had five or fewer employees, and over 90 percent had 25 or fewer employees.[105]

B. QUALITATIVE ASPECTS OF TAXPAYER BURDEN AND BUSINESS SIZE

[105] Arthur D. Little, p. VIII-6.

The limitations of the ADL model make it largely unsuitable for analysis of relative paperwork burdens on different sizes of business. Lacking a model for quantitative analysis, it is useful to examine in a more qualitative way some of the factors that contribute to disproportionately high (or, in some instances, disproportionately low) paperwork burdens on small businesses.

1. Economies of Scale

Scale and Costs. Numerous aspects of the tax system are subject to substantial economies of scale. Many taxpayer activities represent fixed costs that vary only slightly over considerable ranges of business size. Examples of such activities include:

- Setting up record-keeping systems (including payroll) or modifying them for tax purposes;
- Learning about tax filing requirements;
- Filling out individual tax forms; and
- Many post-filing activities (if they occur).

Many other aspects of paying taxes vary with business size, but not nearly in proportion to measures of size, such as employment or sales. Examples of such activities include:

- Tax planning;
- Adapting to changes in the tax system;
- Organizing data and records for tax preparation;
- Paperwork burdens associated with payroll taxes;
- Direct costs of tax preparation;
- Costs of using a paid tax preparer; and
- Probability of post-filing burdens due to taxpayer error.

Another aspect of economies of scale is that small businesses may incur some costs simply because the amounts involved are too small to justify the expense of avoiding those costs. Examples may include:

- Elements of tax planning;
- Identifying the most cost-effective tax preparer services;
- Contesting erroneous IRS enforcement actions; and

- Optimal filing to minimize interest costs.

Payroll Taxes: An Illustrative Example. The manner in which firm size affects paperwork burdens is illustrated by activities associated with payroll taxes. (As noted above, this aspect of paperwork burden was inadequately treated in the ADL model.)

Learning about withholding and deposit requirements requires nearly as much effort for a very small firm as for a larger one. In a small business, the entrepreneur's time is likely to be involved, rather than a specialist's, so that the learning process is likely to be less efficient than in a large business.

Setting up (or modifying) accounting systems to comply with payroll tax requirements is largely a fixed cost. Moreover, the elements of an accounting system associated with taxes are almost entirely incremental costs to the business. While it is true that businesses would have accounting systems even if they did not withhold, the entire process and burden of deducting taxes, FICA, and FUTA from gross pay; making deposits; and filing quarterly and annual reports is solely attributable to tax system requirements.

Filling out forms is also substantially a fixed cost. Most quarterly and annual forms (940, 941, W-3, etc.) are filed only once, regardless of the number of employees. Even forms that are filed for each employee (e.g., W-2) are subject to overhead costs of setting up automated systems or (if filled out manually) overhead costs of familiarization (since it takes much longer to fill out the first W-2 than, say, the tenth).

Full-time employees generally receive equal sized paychecks on a regular schedule. Part-time or seasonal employees hired directly by business may receive fluctuating paychecks that require repeated calculation of taxes withheld. To the extent that small businesses have more fluctuations in their work forces, the burden per employee of computing withholding will be increased.

Withholding deposits must be made on a quarterly basis, on a monthly basis, or within three days of the payroll, depending on the size of the liability. While large businesses are required to make deposits more often, deposits are routine. Small businesses need to monitor their liability situation to determine the frequency of deposit and must file different forms if they move across a threshold.

2. Start-Up Costs and the Initial Learning Curve

Although many small businesses are well established, virtually all new businesses are small. Thus inexperience with tax system requirements is concentrated among small businesses. This lack of experience and familiarity with the tax system imposes burdens on small businesses that are usually not found in larger businesses. Two types of burdens are principally involved:

- It takes a great deal of effort to move up the learning curve; to become familiar with the what, when, where, and how of paying taxes. While some brushing up is required every year, or if the tax code (or the business) changes, the initial learning process is far more burdensome.

- o Inexperience tends to lead to mistakes. Mistakes can lead to enforcement actions, which themselves involve considerable burden, including penalties.

The inexperienced business taxpayer is a principal target of technical assistance provided by Small Business Development Centers, Minority Business Development Centers, and other similar programs. Within the IRS, the Office of Small Business Affairs is conducting its own education campaign. Continuing creation of new businesses, however, pretty much guarantees that inexperience will continue to be a major source of paperwork burden for small businesses.

3. Burden Thresholds

The paperwork burdens on small businesses do not vary smoothly with size; burden may drop sharply once some thresholds are passed or practices are adopted. Experience is one such threshold; after a small business person has once filed a complete and correct set of tax forms, preparation and learning effort falls sharply. Other thresholds exist, and some of them involve increases in paperwork burden.

Burden Reduction Thresholds. Computerization is a major factor in the severity of paperwork burden. Computerized tax filing is substantially less burdensome than manual filing, and it reduces the need for familiarization and planning, as well as the potential for errors. Payroll taxes are another area in which computerization reduces burden, and integrated accounting systems are even more efficient. Recent developments in personal computer hardware and software have removed major economies of scale in computerization, so that even very small businesses can reduce their own paperwork burdens by utilizing computers. Limited computer literacy and sophistication, rather than size, appear to be the principal sources of disparate paperwork burden in this threshold.

Access to specialized tax expertise can also reduce paperwork burden, particularly in planning and post-filing activities. For a very small business, such expertise may seem too expensive, but it becomes more affordable as a business grows. At some point, the specialist does not just provide expertise in the tax code but also more thoroughly considers the peculiarities of the business. Ability to access such expertise -- either through the market or to have it in house -- is a hallmark of a business that is ready to graduate from an assistance program. Size is not the only consideration in passing this threshold; managerial sophistication, experience, and willingness to delegate are also important factors.

Paperwork burden of paying taxes consists of activities that are incremental to regular accounting activities. It is easy to suggest that this incremental cost is small, because any well managed business will keep detailed accounts for other purposes anyway. Yet the requisite sophistication of a baseline accounting system depends on the demands that will be placed on it:

- o For a large business, a sophisticated computerized accounting system is essential. Payroll functions include many pay grades and levels and a variety of fringe benefits, so that taxes add a relatively small incremental burden. Detailed accounting is wanted for management purposes -- and by lenders and shareholders -- to determine how the business is performing.

- o A firm with relatively few employees and much less complex benefits packages will have a much simpler payroll. Withholding, deposits, and information returns may then become larger increments to the payroll paperwork, in absolute as well as relative terms.

- o Many small businesses cannot obtain formal financing on their own. It doesn't matter how detailed their financial data are; financial institutions will not lend to them. If they can get financing at all, such businesses must use informal sources or rely on their owners' personal financial condition. When this major reason for detailed financial data is lacking, the incremental burden of requirements by the tax system to provide such information become greater.

- o Many small businesses, particularly those without employees, are founded to provide their owners with a job. There may not be any major strategic objectives or other managerial reasons for detailed data beyond the information that is found in a properly maintained checkbook. Where the baseline accounting system is that modest, virtually all activities related to paying taxes are paperwork burden of the tax system.

Other things being equal, the more modest are the accounting needs of a business, the more burdensome is any particular tax provision.

Burden Increase Thresholds. Some thresholds trigger additional requirements that increase paperwork burden. These thresholds are correlated with business size but have more to do with specific activities. Examples include the following:

- o Businesses without employees avoid all paperwork burdens related to withholding and payroll taxes.

- o Businesses meeting certain revenue and cost criteria may use simplified forms (Form 1120A and Schedule C-EX).

- o Businesses making capital investments of less than $18,500 (rising to $25,000 after 2002) in a year may expense these costs and avoid the burdens of capital recovery (depreciation) provisions.

- o Businesses in services and some other sectors avoid paperwork burdens related to inventories.

- o Businesses with relatively simple costs avoid paperwork burdens associated to the Alternative Minimum Tax.

- o Businesses with only domestic business avoid paperwork burdens related to tax provisions on overseas activities.

Such threshold provisions, some of which are explicitly intended as regulatory flexibility measures, mitigate the disproportionate impact on small businesses, but only to a very limited extent.

C. BURDEN AND COST-EFFECTIVENESS ESTIMATES

1. IRS Paperwork Burden and Firm Size

Arthur D. Little collected information on firm size in the survey conducted for the model of IRS paperwork burdens. The model itself, however, produces estimates only of average paperwork burden. There are two more recent surveys that did retain information on firm size. One was by Arthur Hall of the Tax Foundation; the other by Slemrod and Blumenthal.[106] Unfortunately, both of these surveys included only large firms -- generally over $250 million in assets, $250 million in sales revenue, and 1,000 employees. A more recent unpublished survey by Blumenthal included only seven firms with fewer than 50 employees. Thus there is no single data set or model that estimates tax paperwork burden by firm size.

Hall filled in data for small firms by assuming that the ADL results were representative of small firms -- a very reasonable assumption given the ADL sample:

- Of respondents reporting employment:
  - 58.3 percent reported five or fewer employees,
  - 84.5 percent reported 15 or fewer employees, and
  - 90.4 percent reported 25 or fewer employees.

- Of respondents reporting receipts:
  - 35.0 percent reported receipts of less than $200,000,
  - 61.6 percent reported receipts of less than $500,000, and
  - 77.8 percent reported receipts of less than $1,000,000.

- Of respondents reporting assets:
  - 47.0 percent reported assets of less than $100,000,
  - 67.8 percent reported assets of less than $200,000, and
  - 82.4 percent reported assets of less than $500,000.[107]

Hall used the ADL results to represent his smallest size classes ($1,000,000 in sales and $1,000,000 in assets); used his survey data for the larger size classes ($250,000,000 and above in sales and $250,000,000 and above in assets); and interpolated results for intermediate size classes. Hall's results, as well as Slemrod and Blumenthal's results, are shown in Exhibit III-A and Exhibit III-B. Slemrod and Blumenthal's results for employees are shown in Exhibit III-C.

---

[106] Joel Slemrod and Marsha Blumenthal, "The Income Tax Compliance Cost of Big Business" (Washington, DC: The Tax Foundation, 1993).

[107] Arthur D. Little, pp. VIII-6 - VIII-7.

Hall's use of ADL results as an approximation of small firms can be applied to employment as well. For estimating taxpayer burden, a representative small firm:

- Has five employees; and

- Fills out only two forms:
  - Form 1120 and Schedule D or
  - Form 1120A and Schedule D.

Five employees is about the median for the ADL sample, but this is larger than the median for all non-farm firms.[108] Thus burden per employee will be understated for the actual median small firm. Similarly, the assumption of two forms significantly understates the ADL burden, since only about one sixth of ADL respondents reported filling out fewer than five forms, and the median was about eight forms.[109] Total time estimated for these forms is 193.72 hours for Form 1120, 111.88 hours for Form 1120A, and 16.63 hours for Schedule D. Using Hall's hourly cost of $42.40:[110]

---

[108] U.S. Small Business Administration, Handbook of Small Business Data (U.S.G.P.O., Washington, DC: 1994), p. 21.

[109] Arthur D. Little, p. VIII-7.

[110] Arthur Hall, "Compliance Costs of Alternative Tax Systems II: House Ways & Means Committee Testimony," Tax Foundation Special Brief, March 1996, p. 5.

EXHIBIT III-A

ESTIMATED CORPORATE INCOME TAX COMPLIANCE COST BY ASSET SIZE

Asset Size[a] ($ Millions)	Estimated Compliance Cost ($ Thousands)	Estimated Compliance Cost as a Percent of Assets
Hall Estimate[b]		
$ 1	$ 8.1	0.81 %
$ 25	$ 165.0	0.66 %
$ 50	$ 245.0	0.49 %
$ 100	$ 310.0	0.31 %
$ 250	$ 350.0	0.14 %
$ 500	$ 500.0	0.10 %
$ 1,000	$ 900,0	0.09 %
$ 2,000	$1,600,0	0.08 %
$ 3,000	$2,400.0	0.08 %
$ 4,000	$1,600.0	0.04 %
$ 5,000	$2,000.0	0.04 %
$ 7,500	$3,750.0	0.03 %
$10,000	$3,000.0	0.03 %
Slemrod and Blumenthal Estimate[c]		
< $250	$ 580.5	0.40 %
$250-500	$ 525.5	0.14 %
$500-1,000	$ 797.3	0.10 %
$1,000-2,000	$1,286.4	0.09 %
$2,000-3,000	$1,855.0	0.08 %
$3,000-4,000	$2,806.2	0.08 %
$4,000-5,000	$1,788.9	0.04 %
$5,000-7,500	$2,626.3	0.04 %
$7,500-10,000	$4,968.8	0.05 %
> $10,000	$7,836.8	0.03 %
Overall Mean	$1,677.3	0.06 %

[a] Excludes financial and life insurance firms.

[b] Arthur Hall, "Compliance Costs of Alternative Tax Systems II: House Ways and Means Committee Testimony," Tax Foundation Special Brief, March 1996, p. 5.

[c] Joel Slemrod and Marsha Blumenthal, "The Income Tax Compliance Cost of Big Business" (Washington, DC: The Tax Foundation, 1993), Table 11.

EXHIBIT III-B

ESTIMATED CORPORATE INCOME TAX COMPLIANCE COST BY SALES

Annual Sales[a] ($ Millions)	Estimated Compliance Cost ($ Thousands)	Estimated Compliance Cost as a Percent of Sales
Hall Estimate[b]		
$ 1	$ 5.0	0.50 %
$ 25	$ 126.0	0.50 %
$ 50	$ 251.0	0.50 %
$ 100	$ 470.0	0.47 %
$ 250	$ 325.0	0.13 %
$ 500	$ 650.0	0.13 %
$ 750	$ 900,0	0.12 %
$ 1,250	$ 875,0	0.07 %
$ 2,000	$1,600,0	0.08 %
$ 3,000	$2,100.0	0.07 %
$ 5,000	$3,500.0	0.07 %
$ 7,500	$3,750.0	0.05 %
$10,000	$5,000.0	0.05 %
Slemrod and Blumenthal Estimate[c]		
< $250	$ 701.5	0.47 %
$250-500	$ 518.1	0.13 %
$500-750	$ 724.4	0.12 %
$750-1,250	$ 720.2	0.07 %
$1,250-2,000	$1,187.9	0.08 %
$2,000-3,000	$1,800.6	0.07 %
$3,000-5,000	$2,542.4	0.07 %
$5,000-10,000	$3,302.7	0.05 %
> $10,000	$9,025.9	0.05 %
Overall Mean	$1,677.3	0.06 %

---

[a] Excludes financial and life insurance firms.

[b] Arthur Hall, "The High Cost of Tax Compliance," Tax Foundation Special Report, November 1993, p. 6.

[c] Joel Slemrod and Marsha Blumenthal, "The Income Tax Compliance Cost of Big Business" (Washington, DC: The Tax Foundation, 1993), Table 12.

EXHIBIT III-C

ESTIMATED CORPORATE INCOME TAX COMPLIANCE COST BY U.S. EMPLOYMENT

Employee Size Category (Thousands)	Estimated Compliance Cost ($ Thousands)	Estimated Compliance Cost per Employee
Slemrod and Blumenthal Estimate[a]		
< 1.0	$ 696.5	$ 1,203.4
1.0-2.75	$ 615.5	$ 326.0
2.75-6.0	$ 894.1	$ 210.7
6.0-15.0	$1,307.5	$ 135.9
15.0-40.0	$3,070.8	$ 120.2
> 40.0	$5,180.9	$ 63.6
Overall Mean	$1,568.5	$ 125.0

[a] Joel Slemrod and Marsha Blumenthal, "The Income Tax Compliance Cost of Big Business" (Washington, DC: The Tax Foundation, 1993), Table 10.

- o The total paperwork cost of a small corporation is:
  - $5,449 if a Form 1120A is filed, and
  - $8,919 if a Form 1120 is filed; and

- o The paperwork cost per employee of a small corporation is:
  - $1,090 if a Form 1120A is filed, and
  - $1,784 if a Form 1120 is filed.

These estimates (shown in Exhibit III-D) are quite in line with Hall's and Slemrod and Blumenthal's findings. They show that small corporations (fewer than 20 employees) bear an IRS paperwork burden that is disproportionately large. Relative to their size measured in sales or employment, their IRS paperwork burden is about 10 times as large as that of large firms. Relative to assets, small business IRS paperwork burden is about 27 times as large as that of large firms.

Similar analysis can be performed for other types of small businesses. The basic assumptions are:

- o Employment size is:
  - Five for S corporations and partnerships and
  - One for proprietorships.

- o Each firm files the two most basic tax forms, which are:
  - Form 1120S and Schedule D for an S corporation,
  - Form 1065 and Schedule D for a partnership, and
  - Schedule C and Schedule SE (in addition to Form 1040) for a proprietorship.

Using ADL time estimates and Hall's hourly cost, IRS paperwork burdens for these model small businesses are:

- o An average of:
  - $8,919 (with Form 1120) or $5,449 (with Form 1120A) for a C corporation,
  - $5,964 for an S corporation,
  - $4,478 for a partnership, and
  - $492 for a proprietorship.

- o A per-employee cost of:
  - $1,784 (with Form 1120) or $1,090 (with Form 1120A) for a C corporation,
  - $1,193 for an S corporation,
  - $896 for a partnership, and
  - $492 for a proprietorship.

EXHIBIT III-D

ESTIMATED INCOME TAX COMPLIANCE COST FOR MODEL SMALL FIRMS

Type of Firm	Forms Filed	Employees	Average Paperwork Burden	Paperwork Burden per Employee
Corporation	Form 1120 Schedule D	5[a]	$8,919	$1,784
	Form 1120A Schedule D	5[a]	$5,449	$1,090
S Corporation	Form 1120S Schedule D	5[a]	$5,964	$1,193
Partnership	Form 1065 Schedule D	5[a]	$4,478	$ 896
Proprietorship	Schedule C Schedule SE	1	$ 492	$ 492

[a] Median for the ADL survey.

2. IRS Paperwork Burden and Fiscal Cost Effectiveness

In the case of IRS paperwork burden, it is possible to compare the regulatory impact directly with the regulatory result (raising tax revenue), since both are measured in dollars. A direct comparison suggests that taxing the net income of small businesses is an extremely inefficient way to raise tax revenue.

Burden-to-Revenue Ratio. Hall observes that even the smallest corporation will incur a minimum cost of $8,160[111] Hall then makes the following comparison:

- Corporations with assets of $10 billion or more (6,290 tax returns):
  - Constituted 0.16 percent of all U.S. corporations and
  - Paid three quarters of all corporate income taxes in 1992.

- Corporations with assets of $1 million or less:
  - Constituted 90 percent of all U.S. corporations and
  - Paid about 4 percent of all corporate income taxes in 1992.

Hall further notes that, "as a group, these small corporations [with assets of $1 million or less] had to pay at a *minimum* $724 in compliance costs for every $100 they paid in income tax."[112] Even if one assumes that all of these small corporations file Form 1120A instead of Form 1120, their compliance costs are still $421 for every $100 they pay in income tax.

Break-Even Profits. Cost-effectiveness also can be gauged by the question: How much net income must a firm have before the tax liability is as great as the burden involved in filing the return. As noted above, the ADL paperwork burden estimates are $5,449 for a firm filing Form 1120A and Schedule D and $8,919 for a firm filing Form 1120 and Schedule D. Paperwork burden is $4,744 for a firm filing *only* Form 1120A. The lowest corporate tax rate and individual tax rates are 15 percent. At this tax rate,[113] the break-even net income for each model business is:

- $31,627 for a corporation filing only Form 1120A;

- $36,326 for a corporation filing Form 1120A and Schedule D;

- $59,460 for a corporation filing Form 1120 and Schedule D;

- $39,760 for an S corporation filing Form 1120S and Schedule D;

---

[111] This figure is based on costs for Form 1120, with no other forms being filed.

[112] Arthur Hall, "Compliance Costs of Alternative Tax Systems II: House Ways & Means Committee Testimony," Tax Foundation Special Brief, March 1996, p. 6.

[113] The exact formula is:

(Break-Even Net Income) = (Paperwork Burden)/(0.15)

- $29,853 for a partnership filing Form 1065 and Schedule D; and
- $3,280 for a proprietorship filing Schedule C and Schedule SE.

D. CONCLUSIONS

The estimates of paperwork burden for small businesses necessarily require assumptions. The key assumption is that the ADL results reflect small businesses generally. This is not really known, although ADL's sample itself is representative of small businesses. Unfortunately, there is no information on the weights that ADL may have used.[114] To offset this uncertainty, we have made two assumptions that tend to understate the IRS paperwork burden on the model small businesses:

- We have assumed five employees, which is the 67th percentile rather than the median for establishments with fewer than 20 employees.
- We have assumed that the model small businesses file two forms, although the ADL data indicate that the median number of forms filed by their respondents was about eight.

These assumptions have resulted in the following findings with respect to paperwork burden per employee:

- Small corporations, including S corporations, incur about ten times the IRS paperwork burden per employee that large corporations do, and the impact is even more disproportionate if the small corporations file Form 1120.
- Partnerships incur seven or eight times the IRS paperwork burden per employee that large corporations do.
- Proprietorships incur about four times the IRS paperwork burden per employee (i.e. proprietor) that large corporations do.

The findings on the cost effectiveness of raising revenue by taxing the net income of small businesses are as follows:

- Corporations that file Form 1120 and have net income of less than about $60,000 generate tax revenues that is smaller than the IRS paperwork burden.
- Other corporations, including S corporations, must have net incomes in the $30,000 to $40,000 range before they generate tax revenues as large as their IRS paperwork burden.
- Proprietorships must have net incomes over $3,000 before they generate tax revenues as large as the IRS paperwork burden.

---

[114] The IRS Research and Studies Division has been trying to recover these weights, but at the time of this writing it had not succeeded.

IV. REGRESSION ESTIMATION OF REGULATORY COST FUNCTIONS

A. SPECIFICATION OF THE FUNCTIONAL FORM OF THE REGRESSION MODELS

1. Attempted Replication of the Faucett Methodology

The original intention of the regression analysis was to replicate the earlier methodology used by Jack Faucett Associates.[115] That study had suggested two simple specifications[116] for a cost function:

Linear: $TC = K + MQ$

Hyperbolic: $ATC = \frac{K}{Q} + M$

Where:

TC	=	Total regulatory compliance cost for size Q
K	=	A constant representing the minimum total cost of compliance for the minimun-sized entity
Q	=	A size measure (employees, revenue, output, etc.)
M	=	Incremental cost of compliance as size increases
$ATC = \frac{TC}{Q}$	=	Average total cost for an entity of size Q

Faucett tried both specifications and found that the linear form produced superior regression statistics. We performed the same test with the same result.

Our attempt to replicate Faucett's methodology ran into difficulties, since the underlying data were dissimilar in two respects:

- o The regulations studied by Faucett all had data that supported four size classes, so that the Faucett equations had at least four observations for each "industry-regulation pair" (i.e. cost data for impacts of one regulation on firms of different sizes in one industry). Many of the regulations studied here, however, had only two sizes of firm, yielding only two observations for an industry-regulatory pair. Two observations make a solution indeterminate for a hyperbolic specification and simplistic for a linear specification.

---

115 Faucett, 1984, pp. 60-66.

116 The variable notation is different from Faucett Associates's anti-mnemonic variable names.

- All of the regulations studied by Faucett have size data in terms of employees, which was Faucett's definition of "Q." Many of the regulations studied here did not measure size in terms of employees, so that many of the regression coefficients would not have been comparable with the Faucett coefficients.

An attempt to compare results with the Faucett results was further compounded by the fact that the Faucett study did not really do anything with the regression results. They are presented in summary form in the body of the Faucett report and extensively in appendices, but there is not really any interpretation or discussion.

2. Regression Analysis Methodology

We followed Faucett's methodology to the point of determining that the linear specification performed better, and then we estimated equations in linear form. We grouped industries in various ways, however, rather than using industry-regulation pairs exclusively:

- For some regulations, for which there were four size classes, we did use a single industry-regulation pair.[117]

- For some regulations, an equation was estimated for one industry-regulation pair with only two observations, because no other specification was possible.[118]
- For some regulations, for which any specific industry had only two size classes, the two observations from every industry were included in a single regression equation.[119]

---

[117] This occurred for:
- OSHA's concrete and masonry construction safety regulation,
- EPA's fuels and fuel additives registration regulation,
- EPA's OCPSF effluent guidelines,
- EPA's regulation on disposal of sewage sludge,
- EPA's regulation of lead and copper in drinking water, and
- FDA's regulation of food labeling.

[118] This occurred for:
- OSHA's regulation of occupational exposure to cadmium,
- EPA's phaseout of ozone depleting chemicals (where two separate equations were estimated for two very different production processes),
- EPA's Financial responsibility standards for underground petroleum storage tanks in general industry,
- EPA's SARA Title III regulations, and
- EPA's FIFRA regulations.

[119] This occurred for:
- OSHA's electrical safety-related work practices regulation,
- OSHA's permit-required confined spaces regulation,
- OSHA's personal protective equipment standard for general industry,

- OSHA's regulation of process safety management of highly hazardous chemicals, and
- USDA's pathogen reduction and HACCP regulation.

- For some regressions, industry groups or industries were combined in one equation or separated into different equations because exposure (and thus control) conditions were non-comparable.[120]

- For industries subject to more than one regulation in the study, we combined all of the regulations into a single regression equation to represent the cumulative impact. This could be done, however, only with regulations that use the same variable to measure size. That constraint prevented us from estimating similar aggregated equations for different regulatory agencies.

We developed a procedure to test the hypothesis that compliance costs are subject to economies of scale. We used a second specification of the equation that estimated average cost for the entire industry under conditions of economies of scale (i.e. average cost = marginal cost). This specification was:

$TC = AQ$ Where: A = average cost for the entire industry

The hypothesis that compliance costs are subject to economies of scale implies the following regression results:

- A value of "M" (the slope coefficient, or marginal cost) in the with-constant equation that is less than average cost for all size classes, as measured by the value of "A" in the without-constant equation;

- A value of "K" that is:
  - Positive,
  - Larger than "M," and
  - Statistically significant; and

---

[120] This occurred for:

- OSHA's electric power generation and protective equipment regulation, for which all power generation and line work was included in one equation but tree trimming was dropped entirely,
- OSHA's lockout/tagout regulation, for which the RIA combined all industries but included four size classes,
- OSHA's asbestos final revisions, for which primary manufacturing and construction were estimated in separate regression equations and auto repair was dropped entirely,
- OSHA's regulation of lead exposure in construction, where individual construction industries were grouped into three equations according to high, medium, and low potential lead exposure,
- EPA's regulation of PCE in the dry cleaning industry, where separate regression equations were estimated for existing controls and for no controls, regardless of process involved, and
- EPA's financial responsibility standards for underground petroleum storage tanks, where separate regression equations were estimated for the retail motor fuel sector and local government.

- o Regression statistics for the with-constant equation that are superior to the regression statistics of the without-constant equation.

B. ESTIMATED COST FUNCTIONS

1. Results for Regulation Regression Equations

a. Increasing Returns to Scale in Compliance

Exhibit IV-1 shows the regression results. Disproportionately high unit costs on small entities are shown in regressions for the following regulations:

- o The regression equations reflect all of the expected characteristics of economies of scale in compliance for regulations on:
  - Electric power generation and protective equipment (OSHA),
  - Permit-required confined spaces (OSHA),
  - Process safety management of highly hazardous chemicals (OSHA),
  - Asbestos (OSHA) for primary manufacturing,
  - PCE in dry cleaning (EPA) for existing controls, and
  - Pathogen reduction & HACCP (USDA).

- o The regression equations reflect all of the expected characteristics of economies of scale in compliance, except for significance on the constant term (intercept) for regulations on:
  - Electric safety-related work practices (OSHA),
  - Asbestos (OSHA) for construction,
  - Lead in construction (OSHA) for high exposures,
  - Lead in construction (OSHA) for medium exposures,
  - Financial responsibility for USTs (EPA), for retail motor fuel,
  - OCPSF effluent guidelines (EPA),
  - Disposal of sewage sludge (EPA), and
  - Food labeling (FDA).

- o The regression equation for financial responsibility for USTs (EPA), for general industry, has some of the expected characteristics of economies of scale in compliance, but the slope coefficient in the with-constant equation is negative and neither this coefficient nor the constant term is significant.

- o The regression variables have the expected sign and generally the relative size properties but lack meaningful statistical significance because only two observations were available for regulations on:
  - Ozone depleting chemicals (EPA) for MCF aerosol,
  - SARA Title III (EPA),

b. Constant Returns to Scale in Compliance

Some regressions have quite different characteristics that indicate constant returns to scale in regulatory compliance. These characteristics include:

- Slope coefficients that are equal (or coefficients that differ minimally) for both specifications (with and without constant term), indicating that incremental unit cost and average unit cost are equal; and

- When meaningful measures of statistical significance are possible, constant terms that are non-significant.

EXHIBIT IV-1: MINIMUM COST, MARGINAL COST, AND AVERAGE COST FROM REGRESSION RESULTS

Agency/Regulation	Equation With a Constant Term: Intercept[a]	Equation With a Constant Term: Slope[b]	Equation Without Constant Term: Slope[c]
OSHA			
Concrete and Masonry Construction Safety	-3,753	395[d]	369[d]
Electrical Safety-Related Work Practices	143	3.81[d]	4.16[d]
Electric Power Generation and Protective Equipment	2,882[g]	0.0000838[d]	0.00012[d]
Lockout/Tagout	27.9	123.0[d]	123.2[d]
Permit-Required Confined Spaces	815[d]	7.46[d]	14.2[d]
Personal Protective Equipment	-1.16	1.71[d]	1.71[d]
Process Safety Management/ Highly Hazardous Chemicals	30,997[d]	99.2[d]	281[d]

[a] Constant term of the equation; represents the portion of cost that does not vary with firm size.

[b] Coefficient of the size variable (employment, revenue, etc.); represents the incremental cost per unit increase in size.

[c] Equation specification for constant returns to scale (zero intercept); represents average and incremental cost, which are equal.

[d] Significant at the 99.5% level.

[e] Significant at the 99.0% level.

[f] Significant at the 97.5% level.

[g] Significant at the 95.0% level.

[h] Significant at the 90.0% level.

EXHIBIT IV-1: MINIMUM COST, MARGINAL COST, AND AVERAGE COST FROM REGRESSION RESULTS (Continued)

	Equation With a Constant Term		Equation Without Constant Term
Agency/Regulation	**Intercept[a]**	**Slope[b]**	**Slope[c]**
OSHA			
Asbestos Final Revisions			
Primary manufacturing	9,501[g]	177[f]	281[e]
Construction	631	125[h]	137[d]
Occupational Exposure to Cadmium[i]	36.4	353	355
Lead Exposure in Construction			
High Exposure	8,924	1,986[d]	2,133[d]
Medium Exposure	1,048	237[d]	256[d]
Low Exposure	12.9	17.3[e]	17.6[d]
All Sectors Combined			
EPA			
Phaseout of Ozone Depleting Chemicals			
Flexible Foam[i]	4,444	221	222
MCF Aerosol[i]	7,439	0.00371	0.00500
Fuels/Fuel Additives Registration	-1,032	41.1[d]	38.1[d]
PCE: Dry Cleaning			
No controls	-71	569[f]	561[d]
Existing Controls	293[d]	22.5[f]	56.5[d]
Underground Petroleum Storage			

Tanks Financial Responsibility			
Retail motor fuel	7,214	774[d]	793[d]
General industry[i]	2,672	-7.36	12.8
Local government	204[g]	0.0100[f]	0.0102[d]
OCPSF Effluent Guidelines	163,251	2.63[g]	3.49[e]

[i] Level of statistical significance is meaningless, since only two observations were available, and thus the equation with an intercept had no degrees of freedom.

EXHIBIT IV-1: MINIMUM COST, MARGINAL COST, AND AVERAGE COST FROM REGRESSION RESULTS
(Continued)

	Equation With a Constant Term		Equation Without Constant Term
Agency/Regulation	**Intercept[a]**	**Slope[b]**	**Slope[c]**
EPA			
Disposal of Sewage Sludge	493	4.78[h]	5.28[f]
Drinking Water: Lead & Copper	1,821	12.0[f]	12.0[d]
SARA Title III[i]	1,032	6.88	14.7
FIFRA[i]	5.3	51.8	51.9
FDA			
Food Labeling	1,748	93.2[d]	99.3[d]
USDA			
Pathogen Reduction & HACCP	41,636[h]	179[e]	237[d]

These regulations fall into two groups, depending on whether there are enough degrees of freedom to measure statistical significance:

- Regulations with adequate degrees of freedom (and statistically significant slope coefficients) include:
  - Lockout/tagout (OSHA),
  - Personal protective equipment (OSHA),
  - Lead in construction (OSHA) for low exposures,
  - PCE in dry cleaning (EPA), for no controls.
  - Financial responsibility for USTs (EPA), for local government, and
  - Lead and copper in drinking water (EPA).

- Regulations for which only two observations are available include:
  - Cadmium (OSHA),
  - Ozone depleting chemicals (EPA) for flexible foam, and
  - FIFRA (EPA).

c. Decreasing Returns to Scale in Compliance

Two regression equations have characteristics that indicate disproportionately small impacts on small entities. In particular, these equations have a slope coefficient for the with-constant equation that is larger than the slope coefficient for the without-constant equation. This indicates that incremental unit cost is larger than average unit cost. This situation holds for:

- Concrete and masonry construction safety regulations (OSHA); and

- Fuels and fuel additives registration (EPA).

2. Results for Industry Regression Equations

A few industries were subject to several regulations. Where this was the case, we pooled the observations from all of the regulations that used employment as a size measure that affected that industry. Exhibit IV-2 indicates the industries and regulations involved, and it shows the regression results, which are as follows:

- Regressions reflected the characteristics of disproportionately high costs for small entities (with the variants noted) for the following industries:
  - Food processing,
  - Construction (except for a non-significant constant term),
  - Chemicals and Plastics (except for a negative and non-significant constant term), and
  - Wholesale trade (except that all terms are non-significant).

- The regression for local government reflected approximately constant returns to scale or slightly decreasing returns to scale.

EXHIBIT IV-2: MINIMUM COST, MARGINAL COST, AND AVERAGE COST FROM REGRESSION RESULTS FOR MULTIPLE REGULATIONS OF ONE INDUSTRY

	Equation With a Constant Term		Equation Without Constant Term
Industry	**Intercept**[a]	**Slope**[b]	**Slope**[c]
Construction[d]	2,540	4.03[i]	473[i]
Food Processing[e]	27,590[i]	82.8[j]	86.7[i]
Chemicals and Plastics[f]	-416	88.5[i]	227[i]
Wholesale Trade[g]	6,515	-4.75	3.72
Local Government[h]	-266,036	12.1[i]	11.9[i]

a,b,c See Exhibit IV-1 for interpretation.

d Regression includes the impacts of:
- OSHA's concrete and masonry construction standard,
- OSHA's asbestos final revisions,
- OSHA's regulation on occupational exposure to cadmium, and
- OSHA's regulation of lead exposure.

e Regression includes the impacts of:
- OSHA's electrical work practices regulation,
- OSHA's confined spaces regulation, and
- FDA's food labeling regulation.

f Regression includes impacts of:
- OSHA's process safety management regulation, and
- EPA's SARA Title III rule.

g Regression includes impacts of:
- OSHA's confined spaces regulation,
- OSHA's PPE regulation, and
- OSHA's process safety management regulation.

h Regression includes impacts of:
- EPA's financial responsibility standards for petroleum USTs, and
- EPA's regulation of lead and copper in drinking water.

i Significant at the 99.5% level.

[j] Significant at the 95.0% level.

C. INDEX ESTIMATION OF RELATIVE REGULATORY BURDENS BY ENTITY SIZE

1. Methodology

Economies of scale in regulatory compliance and the relative regulatory burdens on small entities are summarized in Exhibit IV-3 in the form of two indices:

- o A size index is calculated as the ratio of the average size entity in larger size classes to the average size entity in the smallest size class.

- o An average unit cost index is calculated as the ratio of the average unit cost of entities in smaller size classes to the average unit cost of the entities in the largest size class. This measure is the cost ratio presented in Chapter II.

The use of indices normalizes the results and makes possible comparisons between regulations that use different units to measure entity size.

The results presented in Exhibit IV-3 summarize the economies of scale for each regulation. In most cases, one set of indices summarizes a whole regulation, although there are a few instances in which the regulated population is segmented. The format of the indices is as follows:

- o In cases where the RIA included only one set of cost estimates (a single industry-regulation pair), each index has a single number for each size class.

- o In cases where the RIA included cost estimates for two industries, production lines, etc., both index values are presented in the table.

- o In cases where the RIA included three or more sets of cost estimates for different industries, the median value of an index for a size class is presented in the table, and the ranges of index values are presented in footnotes.

2. Findings

The data show fairly consistent and often quite large economies of scale in compliance activities.

- o Economies of scale are by far the greatest in:
  - Asbestos (ship repair),
  - OCPSF effluent guidelines (indirect dischargers),
  - Financial responsibility regulations for USTs,
  - Regulation of lead and copper in drinking water,
  - Regulation of Phase V chemicals in drinking water, and
  - Pathogen reduction and HACCP regulations.

EXHIBIT IV-3: SIZE AND UNIT COST INDICES FOR REGULATIONS

Agency/Regulation	Size Class	Size Index	Average Unit Regulatory Cost Index
OSHA			
Concrete & Masonry Construction Safety	Very Small	1.00	0.33
	Small	6.90	0.47
	Medium	25.11	0.72
	Large	71.64	1.00
Electrical Safety-Related Work Practices	Small	1.00	3.71-4.27
	Large	40.49-83.06	1.00
Electric Power Generation and Protective Equipment	Small	1.00	1.37[a]
	Large	13.60[a]	1.00
Lockout/Tagout	Very Small	1.00	0.72
	Small	10.15	1.04
	Medium	34.10	1.01
	Large	170.82	1.00
Permit-Required Confined Spaces	Small	1.00	8.59[b]
	Large	15.98[b]	1.00
Personal Protective Equipment	Very Small	1.00	2.27[c]
	Small	8.23[c]	1.29[c]
	Medium	61.64[c]	1.23[c]
	Large	311.37[c]	1.00

---

[a] Median values. Range is 10.56 to 41.53 for the size index and 0.42 to 1.69 for the unit cost index.

[b] Median values. Range is 45.28 to 180.16 for the size index and 2.73 to 34.63 for the unit cost index.

[c] Median values. Ranges are as follows:
- Very Small: 1.22 to 3.97 for the unit cost index.
- Small: 7.03 to 9.91 for size index and 1.09 to 2.30 for unit cost index.

- Medium: 45.27 to 68.16 for the size index and 1.17 to 2.25 for the unit cost index.
- Large: 235.94 to 452.05 for the size index.

EXHIBIT IV-3: SIZE AND UNIT COST INDICES FOR REGULATIONS (Continued)

Agency/Regulation	Size Class	Size Index	Average Unit Regulatory Cost Index
OSHA			
Process Safety Management of Highly Hazardous Chemicals	Small	1.00	6.66[d]
	Large	13.79[d]	1.00
Asbestos Final Revisions			
Manufacturing & Auto Repair	Small	1.00	6.00[e]
	Large	5.98[e]	1.00
Construction	Small	1.00	1.05[f]
	Large	11.53[f]	1.00
Ship Repair	Small	1.00	66.31
	Large	65.51	1.00
Occupational Exposure to Cadmium	Small	1.00	1.06-4.65[g]
	Large	14.35	1.00
Lead Exposure in Construction	Small	1.00	1.25[h]
	Large	10.43[h]	1.00

---

[d] Median values. Range is 5.31 to 73.45 for the size index and 0.71 to 37.4 for the unit cost index.

[e] Median values. Range is 5.98 to 13.52 for the size index and 4.00 to 9.0 for the unit cost index.

[f] Median values. Range is 10.21 to 17.47 for the size index and 0.21 to 3.93 for the unit cost index.

[g] Based on the assumption that establishments will require a HEPA vacuum and local exhaust ventilation.

[h] Median values. Range is 2.07 to 15.16 for the size index and 1.22 to 4.89 for the unit cost index.

EXHIBIT IV-3: SIZE AND UNIT COST INDICES FOR REGULATIONS (Continued)

Agency/Regulation	Size Class	Size Index	Average Unit Regulatory Cost Index
EPA			
Acid Rain	Small	1.00	1.00[i]
	Medium	35.00[i]	1.00
Phaseout of Ozone Depleting Chemicals	Small	1.00	1.11-5.24
	Large	3.5-10	1.00
Fuels/Fuel Additives Registration	Small	1.00	0.55-1.17
	Large	33.46-185.5	1.00
PCE: Dry Cleaning			
No controls	Very Small	1.00	0.23-0.94
	Small	1.96	1.20-3.94
	Large	6.45	1.00
Existing Controls	Very Small	1.00	1.49-5.54
	Small	1.96	1.08-3.13
	Large	6.45	1.00
Air Emission Standards for Hazardous Waste Facilities	Small	1.00	1.08
	Large	N.A.	1.00
Underground Petroleum Storage Tanks Financial Responsibility			
Retail Motor Fuel	Small	1.00	4.34[j]
	Medium	5.30	3.77[j]
	Large	397.00	1.00[j]
General Industry	Small	1.00	36.50
	Large	23.00	1.00
Local Government	Small	1.00	0.00-19.28
	Medium	5.50	4.66-12.73
	Large	16.98	2.66-10.54

	Very Large	184.78	1.00

i Median values. Range is 8.33 to 175.0 for the size index and 0.05 to 6.76 for the unit cost index.

j Based on commercial insurance. In fact, large firms self-insure, which is very much less expensive.

EXHIBIT IV-3: SIZE AND UNIT COST INDICES FOR REGULATIONS (Continued)

Agency/Regulation	Size Class	Size Index	Average Unit Regulatory Cost Index
EPA			
OCPSF Effluent Guidelines	Small	1.00	0.00-66.6
	Large	97.28-112.7	1.00
Disposal of Sewage Sludge	Small	1.00	1.26-8.38
	Large	23.57	1.00
Drinking Water: Lead & Copper	Very Small	1.00	21.25
	Small	118.38	2.17
	Medium	1,733.58	0.92
	Large	48,453.73	1.00
Drinking Water: Phase V Chemicals	0.025 - 0.1[k]	1.00[k]	26.65[k]
	0.1 - 0.5[k]	4.80[k]	12.56[k]
	0.5 - 1.0[k]	12.00[k]	3.90[k]
	1.0 - 3.3[k]	34.40[k]	2.58[k]
	3.3 - 10.0[k]	104.00[k]	2.00[k]
	10.0 - 25.0[k]	280.00[k]	1.31[k]
	25.0 - 50.0[k]	600.00[k]	1.00[k]
SARA Title III	Small	1.00	12.46
	Large	23.00	1.00
FIFRA	Small	1.00	1.03
	Large	14.04	1.00
FDA			
Food Labeling	Small	1.00	2.41-12.74
	Medium	10.88	1.17
	Large	96.88	1.00

[k] Size classes measured in 1,000s of population. Index based on comparison of midpoints of population size classes. The largest systems expected to incur costs serve 25,001 to 50,000 people.

EXHIBIT IV-3: SIZE AND UNIT COST INDICES FOR REGULATIONS (Continued)

Agency/Regulation	**Size Class**	**Size Index**	**Average Total Unit Regulatory Size Cost Index**
USDA			
Pathogen Reduction & HACCP	Small	1.00	16.6-32.6[l]
	Medium	16.80[l]	2.4-4.8[l]
	Large	290.08[l]	1.00
FAUCETT ASSOCIATES			
All Regulations Combined	Small	1.00	2.83
	Medium	3.83	1.35
	Large	11.16	1.00

[1] Values for the first year, "high cost" scenario (which has lower cost ratios than the "low cost" scenario). Ranges for values are as follows:

- Small: 7.1 to 43.3 for the unit cost index under other scenarios.
- Medium: 14.75 to 34.20 for the size index and 2.3 to 5.3 for the unit cost index under other scenarios.
- Large: 112.05 to 310.51 for the size index.

o Median or overall unit costs of the regulation in at least some industry segments (or processes) are at least four times as high for the smallest entities as for the largest entities in regulations on:
  - Electrical safety-related work practices,
  - Permit required confined spaces,
  - Process safety management of highly hazardous chemicals,
  - Asbestos (manufacturing and auto repair),
  - Occupational exposure to cadmium,
  - Acid Rain (coal-fired and oil-fired generators),
  - Phaseout of ozone depleting chemicals,
  - PCE in dry cleaning (existing controls),
  - Disposal of sewage sludge,
  - SARA Title III right to know, and
  - Food Labeling.

o The smallest size class has higher unit costs than the largest size class (but generally to a lower degree than found by Faucett Associates) in regulations on:
  - Electric power generation,
  - Personal protective equipment,
  - Asbestos (construction),
  - Lead exposure in construction,
  - Fuels and fuel additives registration (except atypical products),
  - Air emission standards for hazardous waste facilities, and
  - FIFRA.

o In at least some industry segments (or processes) the smallest size class has lower unit costs than the largest size class in regulations on:
  - Concrete and masonry construction safety,
  - Lockout/Tagout,
  - Acid Rain (gas-fired generators),
  - Fuels and fuel additives registration, (atypical products),
  - PCE in dry cleaning (no controls),
  - OCPSF effluent guidelines (direct dischargers), and
  - Financial responsibility for USTs by local government districts.

3. Comparison With Faucett Associates Results

Exhibit IV-3 includes the size and unit cost indices computed by Faucett Associates in their earlier study. Precise comparison is difficult, because the Faucett report includes only a single average set of indices for all regulations. Compared with the Faucett indices, however:

- All but two of the regulations in this study have size index values for "large" entities that are larger than the Faucett average value (and of the other two, one is about the same and one is indeterminate); and

- Well over half of the regulations in this study have unit cost index values for the smallest size class that are larger than the Faucett average.

D. ASSESSMENT AND CONCLUSIONS

Most of the regulations do show economies of scale in compliance activities, so that small entities bear disproportionately high costs of the regulation. Exhibit IV-4 shows the exceptions indicated by either the regression analysis or the cost index analysis. Most of these exceptions fall into one (or more) of several categories:

- A number of regulations provide full or partial exemptions from full regulatory requirements. These exceptions appear to account for the lower unit cost of the smallest entities in the cases of:
  - Acid rain (EPA),
  - Fuels and fuel additives registration (EPA),
  - PCE in dry cleaning (EPA) for no controls, and
  - OCPSF effluent guidelines (EPA) for direct dischargers.

- In some regulations, small entities can avoid the impacts. This appears to be the explanation in cases of:
  - Concrete and masonry safety (OSHA), where small firms may not do the type of work affected by the regulation, and
  - Financial Responsibility for USTs (EPA), where small local districts can reap substantial absolute savings by closing their USTs.
- In some regulations, questionable assumptions in the analysis appear to be a major factor in these results. This appears to be the case for:
  - Lockout/Tagout (OSHA),
  - Ozone Depleting Chemicals (EPA) for flexible foam, and
  - FIFRA (EPA).

- In some regulations, there may not be much difference in unit cost. This appears to be true for:
  - Lead in construction (OSHA) for low exposures, and
  - Cadmium for most industries.

- In two regulations, the index analysis showed disproportionately high costs, but the regression analysis did not:
  - Lead and copper in drinking water (EPA) seems to be an anomaly of the regression specification. The size range from small to large is far greater than the size range from very small to small, but the change in unit cost from large to small is relatively small (and unit costs are lower for medium than large systems). It appears that, under these circumstances, the linear regression specification on four observations fails to pick up the extraordinarily high unit cost for very small water systems.
  - Personal protective equipment (OSHA) has constant returns to scale in the regression, but this result may be driven by inter-industry differences in compliance costs, which show considerably more variability than cost per employee for different size firms in the same industry.

Most of these exceptions are explained by exemptions, avoidance of regulated situations, or analytical flaws. The regulations where affected small entities do not incur a disproportionately high cost of compliance appear to be rare.

EXHIBIT IV-4: REGULATIONS NOT EXHIBITING ECONOMIES OF SCALE

Regulation	Regression Findings		
	Constant Returns to Scale	Decreasing Returns to Scale	Cost Index Less Than 1.00
Concrete/Masonry Safety		X	X
Lockout/Tagout	X		X
Lead in Construction (Low Exposures)	X		
Acid Rain			X
Ozone Depleting Chemicals (Flexible Foam)	X		
Fuels/Fuel Additives Registration			X
PCE in Dry Cleaning (No Controls)		X	X
Financial Responsibility for USTs (Local Government)	X		X
OCPSF Effluent Guidelines (Direct Dischargers)			X
Lead/Copper in Drinking Water	X		
FIFRA	X		

V. FACTORS CONTRIBUTING TO DISPROPORTIONATE SMALL-ENTITY COSTS

This chapter reviews the findings of the previous case studies by examining individual factors that contribute to disproportionate regulatory costs to small entities. The analysis starts from a typology of factors. It assesses the nature and magnitude of impacts of different types of factors on relative costs of small entities.

This chapter utilizes the small-entity cost ratios estimated in Chapter 2 as a measure of the degree to which impacts on small entities are disproportionate. A small-entity cost ratio is the ratio of cost per employee for entities in the smallest size class to cost per employee for entities in the largest size class. In some instances, cost as a percent of revenue or cost per unit of output is used instead of cost per employee. These ratios are called "cost ratios" for the remainder of the chapter.

A. SPECIFIC FACTORS CONTRIBUTING TO ECONOMIES OF SCALE

1. Technical Economies of Scale

Technical economies of scale are those that are inherent in production when large-scale production has greater efficiency than small-scale production. This is true of compliance activities as well as production itself. The two principal sources of technical economies of scale in regulatory compliance (as in production) are:

- o Physical economies or more efficient technology in large-scale equipment; and
- o Greater efficiency of large-scale processes.

<u>a. Engineering Controls</u>

Economies of scale in engineering control equipment are a common source of disproportionately large costs for small entities. Given the same utilization rates, high-capacity equipment is more efficient than low-capacity equipment. Per unit of capacity, it is less expensive to manufacture, uses less energy, and takes up less space, among other cost advantages. If large and small entities use the same capacity control equipment, on the other hand, lower utilization rates of the small entities will make the equipment more expensive per employee or per unit of output.

A review of the small-entity cost ratios found in the regulations examined in Chapter 2 indicates that economies of scale in engineering controls were generally substantial sources -- and could be extremely large sources -- of disproportionately high compliance costs for small entities:

- o Regulations for which technical economies of scale in equipment caused nearly all of the disproportionately high costs of small entities included:
  - \- EPA's effluent guidelines for organic chemicals, plastics, and synthetic fibers (OCPSF), whose cost ratios were:
    - . 37.9 for direct dischargers (prior to partial exemption), and

- 66.6 for indirect dischargers;

- OSHA's electrical safety-related work practices lockout/tagout provisions, whose cost ratios were:
  - . 17.3 for meat packing, and
  - . 37.9 for household electrical appliances;
- OSHA's cadmium standard, whose overall cost ratio was 5.00 and whose specific cost ratios were:
  - . 1.9 to 9.0 for most industries using cadmium directly,
  - . 1.1 in construction, utilities, and steel, and
  - . 5.3 in other general industry; and
- EPA's acid rain regulations, whose cost ratios were:
  - . 6.0 for oil-fired utilities, and
  - . 6.8 for coal-fired utilities.

o Regulations for which technical economies of scale in engineering controls was one of several factors contributing to the disproportionately high costs of small entities included:
  - OSHA's permit-required confined spaces standard, whose cost ratio:
    - . Had a mean value of 8.6, and
    - . Ranged from 2.7 to 34.6 in specific industries;
  - EPA's drinking water standard for Phase V chemicals, whose cost ratio:
    - . Had a mean value of 8.3, and
    - . Ranged from 0.7 to 23.1 in specific industries;
  - OSHA's asbestos standard, whose cost ratios ranged between:
    - . 4.0 and 9.0 in primary manufacturing and brake/clutch repair, and
    - . 0.8 and 3.9 in construction industries;
  - EPA's regulation of dry cleaning, whose cost ratios ranged from 2.3 to 2.9, depending on the technology and type of controls;
  - OSHA's electric power generation and PPE rule, whose cost ratios were:
    - . 0.55 to 1.7 for electricity generation, and
    - . 0.48 to 0.76 for power line work.

<u>b. Processes</u>

Economies of scale in control equipment may be large enough that it becomes cost-effective for small entities to utilize a different technology. Such a small-entity technology is likely to entail substantially higher unit operating cost but to require less capital outlay, so that there is less fixed cost to spread over a small output. Although such an alternative technology has lower unit costs for the small entity than would the large-scale technology, small entities nevertheless incur higher unit costs than large entities.

A review of the cost ratios found in the regulations examined in Chapter II suggests that cost differentials due to different production processes are likely to be smaller than economies of scale in engineering controls. The picture is less than clear, however, since the explicit cases also involved other factors that contributed to disproportionately high small-entity costs. The clearest cases included the following:

- EPA's drinking water regulations for lead and copper allowed simplified water treatment technologies for very small public water systems. In this case, the cost ratio was 21.3.

- USDA Pathogen Reduction/Hazard Analysis and Critical Control Point (HACCP) standards assumed different decontamination methods for E. coli control. In this case, the cost ratio ranged from 7.1 to 43.3, depending on the time frame (first year or recurring), the type of animal involved, and the scenario.

- OSHA's PPE standard assumed different cleaning and disinfecting processes for high-volume and low-volume users of PPE. Depending on the sector, the cost ratio ranged from 1.2 to 4.0.

2. Administrative and Development Costs

Regulatory compliance includes a number of administrative, development, or start-up activities. Such costs usually involve large economies of scale, and they may actually be fixed costs over a large range of sizes of entity. Categories of this type of cost include:

- Planning and program development costs;

- Hazard assessment;

- Reporting and paperwork activities;

- Size of the work force itself; and

- Product reformulation and repackaging.

<u>a. Familiarization, Planning, and Compliance Program Development</u>

Preparation for compliance with a regulation is an administrative activity that tends to be virtually a fixed cost over a substantial range of sizes of the affected entities. Activities such as familiarization with the regulation, development of a formal compliance program, and other planning are likely to be quite similar unless size differences lead to small-entity exemptions, significantly different management structures, or other organizational differences. Even when large entities do incur greater costs than small entities, economies of scale in these preparation activities are likely to be very large.

The regulations studied in Chapter II were not particularly illuminating with regard to preparation costs. Such costs were often not estimated separately, except when formal compliance plans were required; the costs were always found in conjunction with other activities that imposed disproportionately high costs on small entities; and preparation costs were typically relatively small. The most explicit cases include the following:

- o USDA pathogen reduction/HACCP standards required development and implementation of two types of plan. Depending on the type of animal involved, the first-year cost ratio ranged from:
  - 49.4 to 190.9 for the Sanitation Standard Operating Procedures, and
  - 67.0 to 149.7 for the HACCP Plan.

- o EPA's drinking water regulations for lead and copper had a cost ratio of 21.3.

- o OSHA's asbestos standard had cost ratios ranging between:
  - 4.0 and 9.0 in primary manufacturing and brake/clutch repair, and
  - 0.8 and 3.9 in construction industries;

- o OSHA's electric power generation and PPE rule had cost ratios ranging from:
  - 0.55 to 1.7 for electricity generation, and
  - 0.48 to 0.76 for power line work.

- o EPA's Superfund Amendments and Reauthorization Act (SARA) Title III regulations had a cost ratio of 12.4.

Familiarization costs were also estimated as part of the IRS paperwork burden. One point estimate applies to all filers of any given form, however, regardless of filer size. Thus the IRS has assumed that familiarization is a fixed cost.

<u>b. Hazard Assessment</u>

Hazard assessment is a compliance activity that is explicitly required in some regulations where a hazard is may be widespread to a degree that is unknown. Hazard assessment (unlike monitoring) is a one-time activity. It is virtually a fixed cost, and it has characteristics much like other preparation activities. The degree of disproportionate impacts on small entities is somewhat hard to determine, since other factors are always present and the costs are usually relatively small. The best examples in Chapter II include the following:

- o EPA's SARA Title III regulations had a cost ratio of 12.4.

- o OSHA's permit-required confined spaces standard, which included testing of equipment and spaces, had cost ratios that:
  - . Had a mean value of 8.6, and
  - . Ranged from 2.7 to 34.6 in specific industries;

- o OSHA's standard for process safety management of highly hazardous chemicals had cost ratios in manufacturing that, depending on the industry, ranged from 1.6 to 19.1.

- o OSHA's PPE standard had a cost ratio that, depending on the sector, ranged from 1.2 to 4.0.

<u>c. Paperwork and Reports</u>

Paperwork is one of the most ubiquitous regulatory burdens. It has many characteristics of a fixed cost; unless there are exemptions or tiered requirements, establishments that differ only by size must file the same reports and maintain the same documentation. In reality, larger entities tend to engage in more numerous and more complex activities, with the result that they incur higher paperwork costs. Yet the degree of disproportion in impacts on small entities is high. The regulations from Chapter II with the most explicit paperwork requirements include the following:

- EPA's SARA Title III regulations, which are almost all paperwork, had a cost ratio of 12.4.

- OSHA's permit-required confined spaces standard, which included a permitting system, had cost ratios that:
  - Had a mean value of 8.6, and
  - Ranged from 2.7 to 34.6 in specific industries;

- USDA's pathogen reduction/HACCP standards, which included recordkeeping, had cost ratios that ranged from 7.1 to 43.3, depending on the time frame (first year or recurring), the type of animal involved, and the scenario.

- EPA's regulation of PCE in dry cleaning, which included reporting requirements, had cost ratios that ranged from 2.3 to 2.9, depending on the technology and type of controls;

- EPA's fuels and fuel additives registration regulations, which included substantial regulatory flexibility provisions, had a cost ratio of 1.2 for fuel additive manufacturers.

IRS taxpayer requirements are the epitome of paperwork requirements. The analysis in Chapter 3 was quite different from that in Chapter 2, so that the results are not comparable. Data on IRS costs for various size businesses, however, suggest that a small-business cost ratio would on the order of magnitude of 100.

d. Work Force Size

The size of the work force itself has cost implications for some compliance activities that involve direct interaction with employees. Training is subject to economies of scale up to the number of employees that an instructor can train in one session. Notification and communication with workers is subject to economies of scale in printing and in posting notices, since the larger the work place (whether a factory or field) the fewer the locations that need to be posted. A work crew that is too small may not make efficient use of equipment used in compliance. All of these factors may contribute to disproportionately high compliance costs for a small entity. Examples found in Chapter II include the following:

- Regulations involving explicit training costs included:
  - OSHA's electrical safety-related work practices standard, which had a cost ratio of 3.1 for training activities; and

  - OSHA's standard for process safety management of highly hazardous chemicals, which had cost ratios in manufacturing that, depending on the industry, ranged from 1.6 to 19.1.

- Regulations that required worker notification and communication included:
  - OSHA's standard for process safety management of highly hazardous chemicals, which had cost ratios in manufacturing that, depending on the industry, ranged from 1.6 to 19.1;
  - EPA's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) worker protection standard, which had a cost ratio of 1.03.

- OSHA's standard for lead exposure in construction generally had cost ratios of 1.2 or 1.3. Two industries with mean employment for small firms well below the optimum crew size, however, had cost ratios of 4.6 and 4.9.

<u>e. Reformulation</u>

Several regulations entail changing the product or package. Reformulation is likely to have economies of scale, since it is a partially fixed cost that can be spread over more units the larger the business is. Examples from Chapter II of this type of disproportionately large costs for small entities include the following:

- EPA's phaseout of ozone depleting chemicals required some businesses to reformulate their products, as well as perform related research and development and market the new products. All of these activities can be spread over more units the larger the manufacturer is. Cost ratios were:
  - 1.03 for flexible foam manufacturers, and
  - 1.4 for MCF aerosol manufacturers.

- FDA's food labeling regulations require listing of ingredients and (if health claims are made) nutrition labeling as well. Cost ratios for the administrative activities related to these requirements were:
  - 2.4 for ingredient labeling only, and
  - 12.7 for ingredient labeling and nutrition labeling.

3. Statistical Factors

In some instances, even the statistical properties of large numbers make the regulatory costs for small entities disproportionately large. Some activities are statistically more efficient for bigger entities. These include:

- Monitoring; and

- Risk pooling.

<u>a. Monitoring</u>

Monitoring requires collection of data with some minimal degree of reliability and statistical precision. As a purely statistical matter, there are very large economies of scale in sampling and monitoring. The number of sample observations required to maintain a given degree of precision increases proportionally far less rapidly than the size of the population being sampled. Thus small entities must sample proportionately more than large entities, and consequently they incur higher unit monitoring costs. Chapter II provides several examples of this phenomenon, although monitoring is only a small part of the costs in each of the cases:

- o EPA's drinking water regulations for lead and copper had a cost ratio that was 21.3.

- o EPA's drinking water standard for Phase V chemicals had cost ratios with:
  - A mean value of 8.3, and
  - A range from 0.7 to 23.1.

- o USDA's pathogen reduction/HACCP standards had recurring annual cost ratios that ranged from 7.1 to 33.7, depending on the type of animal involved and the scenario.

<u>b. Risk Pooling</u>

Regulations requiring insurance or financial responsibility provide an even more striking example of statistical economies of scale in action. Larger entities with diversified sources of risk can pool risk and insure far more cheaply than can small entities. The result is very large economies of scale in insurance activities, which impose disproportionately high insurance costs on small entities.

EPA's financial responsibility standards for operators of underground storage tanks (USTs) illustrate this source of economies of scale. Where large and small entities were obtaining the same type of coverage, small-entity cost ratios were as follows:

- o Commercial insurance produced cost ratios of:
  - 4.3 for retail motor fuel marketers, and
  - 36.5 for general industry;

- o State insurance funds produced cost ratios of:
  - 29.9 for general purpose governments, and
  - 52.8 for special districts; and

- o UST closure resulted in a cost ratio of 19.2 for general purpose governments.

Since very large businesses and governments could self-insure, which smaller entities could not, the true overall small-entity cost ratios were an order of magnitude or two higher than these.

4. Population of Small Governmental Entities

Small populations are themselves a source of disproportionately high regulatory compliance costs for a small governmental entity. Small governments face the most disproportionately high costs of any type of entity. Part of the problem is that so many --

and such powerful -- sources of economies of scale are present. Statistical economies of scale, technical economies of scale, and administrative economies of scale all abound in the drinking water and UST financial responsibility regulations.

Part of the problem, however, is the greater size differential among governmental entities. The difference in employment between a very small business and a very large (although not multi-national) business is four, possibly five, orders of magnitude. The difference in population between a very small governmental entity and a very large one is five or six orders of magnitude. This difference itself is a factor in differential compliance costs.

B. SPECIFIC FACTORS OFFSETTING ECONOMIES OF SCALE

Some circumstances offset economies of scale so as to make regulatory costs to small entities disproportionately small. These factors involve reductions in compliance activities. Two principal types of factors are:

- o Tiered requirements and exemptions built into regulations; and
- o Specialization of larger businesses in regulated activities and/or avoidance of regulated situations by small businesses.

1. Tiered Regulations and Exemptions

Regulatory flexibility is designed to reduce the impacts on small entities. Regulations that were tiered, so as to simplify the requirements for small entities, or that exempted the smallest entities had this effect. The net effect on relative cost per employee varied. For some regulations reviewed in Chapter II, where only a small portion of the costs was affected by tiering or exemption, small entities continued to have disproportionately large costs. For other regulations, where tiering or exemptions affected major provisions in the regulation, small entities had disproportionately small costs. In a few instances, exemptions meant no costs at all.

- o Regulations whose tiered provisions reduced small-entity costs but still left cost ratios greater than unity included the following:
  - \- EPA's regulations for lead and copper in drinking water allowed simplified water treatment procedures. Nevertheless, the cost ratio was 21.3.
  - \- USDA's pathogen reduction/HACCP standards included somewhat less frequent and less intensive testing and simplified E. coli decontamination procedures. Nevertheless, cost ratios ranged from 7.1 to 43.3, depending on the time frame, industry, and scenario.
  - \- FDA's food labeling regulations exempted small manufacturers from nutrition labeling if they did not make health claims for their products. Cost ratios were:
    - . 2.4 for small manufacturers that received the exemption, and
    - . 12.7 for small manufacturers that did not receive the exemption.

- o Regulations whose tiered provisions reduced small-entity costs sufficiently to lower cost ratios below unity included the following:
  - \- EPA's acid rain regulations exempted small utilities with under 250 MW capacity from many of the provisions. Compared with small utilities with over 250 MW, these exemptions lowered cost ratios:
    - . From 6.8 to 1.2 for coal-fired utilities, and
    - . From 6.0 to 0.9 for oil-fired utilities.
  - \- EPA's fuel and fuel additives registration regulations included tiered requirements for smaller manufacturers. The reductions in requirements were more extensive for baseline fuels and fuel additives (F/FAs) than for atypical F/FAs. The result was:
    - . A cost ratio of 1.2 for fuel additives (where many F/FAs were atypical), and
    - . A cost ratio of 0.55 for fuels (where most F/FAs were baseline).

- EPA's regulation of PCE in dry cleaning exempted very small dry cleaners from vent controls. For very small dry cleaners that initially had no controls, the cost ratios were:
  - . 0.51 for the dry-to-dry process (compared with 2.0 for small dry cleaners that were not exempt), and
  - . 0.24 for the transfer process (compared with 1.2 for small dry cleaners that were not exempt).

o Regulations that provided total exemptions that completely eliminated costs for some small entities included the following:
  - EPA's financial responsibility standards for USTs exempted farm USTs.
  - EPA's OCPSF effluent guidelines set BAT equal to BPT for small direct dischargers, which produced a cost ratio of 0.0, whereas BAT required of large direct dischargers would have produced a cost ratio of 37.9.

o EPA's SARA Title III regulations exempted facilities on the basis of thresholds for substances, rather than establishment size. The resulting cost ratios for exempt and non-exempt establishments were virtually indistinguishable.

2. Specialization and Avoidance of Regulated Situations

In a few of the regulations, small entities in some industries tended to avoid lines of work to which regulatory provisions applied (or large entities specialized in these lines of work). In such cases, small entities had disproportionately small costs because they did not have to comply with some (or all) provisions of the regulation or did not have to comply as consistently. Regulations where this apparently occurred include the following:

o OSHA's concrete and masonry construction safety standards had a cost ratio of 0.33. It appears that small construction firms were less likely to be involved on projects where bracing was required and overhead loads occurred.

o OSHA's asbestos standard had a number of construction industries with cost ratios less than unity, including:
  - Heavy construction, except Highways (0.9),
  - Plastering, drywall, insulation (0.9),
  - Electrical work (0.8), and
  - Floor work (0.2).

  It appears that in such industries small firms may do relatively little work where there are exposures to asbestos.

o OSHA's standard for process safety management of highly hazardous chemicals produced cost ratios in manufacturing ranging from 1.6 to 25.1. For wholesale trade industries, however, the cost ratios were 0.75 (chemical and allied products) and 0.4 (farm supplies). It appears that small wholesalers handle relatively few highly hazardous chemicals.

o EPA's regulations for lead and copper in drinking water had an extremely high cost ratio (21.3). The urban environment, however, makes lead pipe removal extremely expensive. For this one compliance action, therefore, very large public water systems had much higher costs than smaller ones.

C. FACTORS CONDUCIVE TO CONSTANT RETURNS TO SCALE

A number of compliance costs have roughly constant returns to scale because they are essentially proportional either to the number of workers or the output. Where such costs predominate, small entities have proportionately much the same costs as large entities. Examples of this type of cost include the following:

- o Costs of personal protective equipment (as opposed to related planning and training) are essentially proportional to the number of workers equipped. Examples of PPE regulations include:
  - OSHA's electric power generation and electrical protective equipment regulation, where cost ratios for electric utilities and contractor power line workers range from 0.8 to 1.9,
  - OSHA's standard for PPE in general industry, where cost ratios for oil and gas extraction, manufacturing, FIRE, and services are 1.7 or less,
  - OSHA's standard for lead exposure in construction, where cost ratios for almost all construction industries are less than 1.3, and
  - EPA's FIFRA worker protection standards, whose cost ratio was 1.03.

- o Costs related to production inputs tend to be proportional to output. Examples of such regulations include the following:
  - EPA's phaseout of ozone depleting chemicals required reformulation of products, but unit manufacturing costs of reformulated products were similar so that cost ratios were below 1.4,
  - EPA's air emission standards for hazardous waste facilities were estimated to involve costs that were largely proportional to output, with the result that the cost ratio was 1.08.

The problem with identifying such regulations is that RIA's tend to <u>assume</u> proportionality of costs and employment or output. Of the examples noted above, EPA's FIFRA regulations and air emission standards for hazardous waste facilities came suspiciously close to making such assumptions. Thus these cost ratios are probably too low.

D. CONCLUSIONS

The different types of factors that contribute to disproportionately high regulatory costs for small entities come in different mixes that can make them difficult to assess. Nevertheless, there appear to be some discernable patterns:

- o In their pure form, the types of costs that impose the most disproportionately high burden on small entities are:
  - Statistical properties of risk pooling and monitoring,
  - Fixed administrative costs, such as paperwork and hazard assessment, and

- Technical economies of scale.

- In terms of absolute disproportionate impacts on small entities, engineering costs are generally the largest source of burdens on small entities. If it is the dominant cost, however, paperwork (e.g., IRS burdens) and statistical risk pooling (e.g., financial responsibility) can be absolutely quite large.
- Administrative costs are generally a relatively moderate source of disproportionate impacts on small entities. In most cases they are:
  - Rather small costs in absolute terms and/or
  - Proportionately not much larger for small entities than for large ones.

- Costs related to the work force itself (as is particularly likely for OSHA regulations) or to output tend not to create disproportionately large burdens for small entities.

- Regulatory flexibility in the form of tiered requirements or exemptions can be extremely effective in mitigating or eliminating disproportionately large burdens on small entities.

- When regulations affect only some activities of an industry, small businesses may be able to minimize regulatory burdens by specializing away from those activities.

VI. ANALYTICAL ISSUES

A. DEFINITIONS OF SMALL ENTITIES

1. Units of Size

The different regulations use various measures of size in estimating impacts on small entities. As shown in Exhibit VI-1, these include:

- Number of employees;

- Revenue;

- Physical measures (principally of output), including:
  - Megawatts of electricity,
  - Millions of pounds,
  - Millions of gallons,
  - Thousands of head of animals, and
  - Number of retail outlets; and

- Population.

All OSHA regulations measure size in employment; EPA regulations use all four types of measure; and the other regulations use employment or physical output. The reasons for the choice of measure, however, are less diverse than the measures themselves.

a. Basis for Costs

The principal reason for choosing a measure of size is that it is related to compliance costs of the regulation. This reason cuts across measures:

- o Many of the regulations have benefits and costs that are related to the number of employees. These include:
  - OSHA regulations in general, and
  - EPA's FIFRA regulation.

- o Some regulations have benefits and costs that are rather directly related to the physical output. These include:
  - EPA regulations covering:
    - . Acid rain,
    - . OCPSF effluent, and
    - . Disposal of sewage sludge, as well as
  - USDA's pathogen reduction and HACCP regulations.

- o Other regulations have benefits and/or costs that are related to output, but use another measure than physical output that is closely related to physical output or number of products. These include:
  - Revenue as a proxy for output of
    - . Dry cleaning establishments (EPA), and
    - . Hazardous waste facilities (EPA),

EXHIBIT VI-1a
SIZE CLASSES USED IN ANALYSIS OF IMPACTS ON SMALL ENTITIES
Size Measured in Terms of Employment

Agency/Regulation	Number of Size Classes	Employment Size Class Boundaries
OSHA		
Concrete & Masonry Construction Safety	4	10, 50 & 100
Electrical Safety-Related Work Practices	2	10[a]
Electric Power Generation and Protective Equipment	2	20
Lockout/Tagout	4	20, 100 & 250
Permit-Required Confined Spaces	2	20
PPE (General Industry)	4	10, 100 & 500
Process Safety Management of Highly Hazardous Chemicals	2	20
Asbestos Final Revisions	2	20
Occupational Exposure to Cadmium	2	20
Lead Exposure in Construction	2	20
EPA		
Underground Petroleum Storage Tanks Financial Responsibility (General Industry)	2	20
SARA Title III	2	20
FIFRA	2	20
FDA		
Food Labeling	3	10 & 100

[a] Costs based on model plants with 3 and 19 employees trained.

EXHIBIT VI-1b

SIZE CLASSES USED IN ANALYSIS OF IMPACTS ON SMALL ENTITIES

Size Measured in Terms of Revenue

Agency/Regulation	Number of Size Classes	Revenue Size Class Boundaries
EPA		
Fuels and Fuel Additives Registration	2	$50,000,000
Dry Cleaning (PCE)	3	$75,000 & $100,000
Air Emission Standards for Hazardous Waste Facilities	2	$3,500,000

EXHIBIT VI-1c
SIZE CLASSES USED IN ANALYSIS OF IMPACTS ON SMALL ENTITIES
Size Measured in Terms of Capacity or Physical Output

Agency/Regulation	Number of Size Classes	Unit of Measurement	Size Class Boundaries
EPA			
Acid Rain Implementing Regulations	2	MW	250
Phaseout of Ozone Depleting Chemicals	2	MTF Cans	[b] [c]
Underground Petroleum Storage Tanks Financial Responsibility (Retail Motor Fuel)	3	Retail Outlets	6 & 25
OCPSF Effluent Guidelines	2	Million Pounds	5
Disposal of Sewage Sludge	2	Dry Metric Tons Gallons per Day	1,000,000
USDA			
Pathogen Reduction & HACCP	3		
Cattle Slaughter		Thousand Head	6 & 78
Hog Slaughter		Thousand Head	20 & 260
Poultry Slaughter			
Chickens		Thousand Head	440 & 5,720
Turkeys		Thousand Head	60 & 780

[b] Costs based on model plants with annual outputs of 500 MTF and 5,000 MTF.

[c] Costs based on model production lines with output of 40 cans/minute and 140 cans/minute.

EXHIBIT VI-1d
SIZE CLASSES USED IN ANALYSIS OF IMPACTS ON SMALL ENTITIES
Size Measured in Terms of Population

Agency/Regulation	Number of Size Classes	Population Size Class Boundaries
EPA		
Underground Petroleum Storage Tanks Financial Responsibility (Local Government)	2	2,500, 10,000 & 50,000
Drinking Water: Lead & Copper	7	100, 500, 3,300, 10,000, 100,000 & 1,000,000
Drinking Water: Phase V Chemicals	8	100, 500, 1,000, 3,300, 10,000, 25,000 & 50,000[d]

[d] Costs are based on gallons of drinking water supplied.

- Population as a proxy for output of drinking water systems (EPA), and
- Revenue as a proxy for the number of fuel and fuel additive products to be registered (EPA).

In each of these instances, the size measure chosen probably makes more sense in terms of regulatory costs than any other measure.

b. Basis for Impacts

Financial responsibility for underground storage tanks has quite distinctive impacts that are related to the financial capacity of owners. USTs themselves are distinctive, because the number of tanks will not change much for extremely large variations of size of a facility -- whether it is a retail motor fuel outlet, a municipal vehicle maintenance facility, or an industry facility. Financial capacity is best represented by a measure of the owner's size. For retail motor fuel, the number of outlets reflects the number of tanks (to some degree) and generally the size of the company. For municipal governments, population is the best measure.

c. Other Factors

Some regulations cut across different industries. EPA's UST regulations for general industry and SARA Title III are both examples of this, as are many OSHA regulations. In such a case, employment is a more stable measure of firm size than revenue. Availability of comparable data generally makes employment a default measure, when no other clear basis for deciding is available.

In some instances, as in SARA Title III, the statute includes a partial exemption. When the statute defines a size class, this measure is basically dictated for the regulation as a whole. Since environmental impacts are a critical consideration for full or partial exemptions from EPA regulations, EPA tends to use output (Acid Rain, OCPSF), revenues as a proxy for output (Fuels and Fuel Additives, PCE in Dry Cleaning), or population (Drinking Water) as a measure of size when utilizing full or partial exemptions.

2. Cutoff for "Small"

"Small" is typically defined by a cutoff size. Smaller is "small;" larger is "large." There are several ways that this issue is approached. One background consideration, however, is the availability of data. Census data on employment use size classes: 1-4 employees; 5-9; 10-19; 20-49; 50-99; etc. Similar classes are used for revenue and (for local government) population. Where general data sources are used, the cutoff has to be one of these break points.

a. Single Employment Cutoff

Where employment is the measure of size and a single cutoff is used, 20 employees is the usual cutoff. A fair amount of experience suggests that this is generally a reasonable place to draw the line. The alternatives are 50 employees (which is not used in these regulations as a single cutoff) and 10 employees (which sometimes is used). In terms of the way costs behave, 10 employees should probably receive more attention as a cutoff, but 20 is a not unreasonable default.

b. Range of Size Classes

Some analyses address the issue by considering a range of size classes. EPA's drinking water regulations, which have over a half a dozen size classes, are the best example of this approach. Several OSHA regulations use four size classes, the smallest of which is fewer than 20 or fewer than 10 employees. EPA's PCE regulation and FDA's food labeling regulation use three size classes. This approach provides better information on how costs vary with size than does a single cutoff. It is difficult to fit this information into regulatory flexibility analysis, since the statute refers to "small" as a class. In some regulations, particularly those of EPA (drinking water and PCEs in dry cleaning), however, the multiple size classes are used to provide more than one layer of regulatory flexibility.

c. Industry Analysis

In some cases, more detailed industry information allows specification of a cutoff that is tailored to the way costs or impacts behave. This strategy is generally used in the regulations that use revenue or physical measures for size. The most detailed and precise use of this approach was the UST Financial Responsibility regulation for retail motor fuel. Others (e.g., OCPSF) were less successful in identifying a fully appropriate cutoff.

d. "Small" and SBREFA

The Small Business Regulatory Enforcement Act of 1996 (SBREFA) mandates use of the same definition of "small" as section 3 of the Small Business Act. These size cutoffs are quite large; a common employment size cutoff for "small" is 500 employees. All of the regulations reviewed in this study were promulgated prior to passage of SBREFA, so that its requirements did not apply to them. As noted above, these regulatory analyses used far smaller size cutoffs; when employees were used, 20 employees was the usual size cutoff for "small."

The SBREFA definition of "small" is unfortunate because such a large size cutoff is generally inappropriate for regulatory flexibility analysis. As the analysis in Chapter 2 shows, the truly serious disproportionalities in regulatory costs usually set in only at quite small sizes of establishment or governmental entity. These very small size classes nevertheless include majorities or very large minorities of establishments in an industry. Since these very small establishments bear the highest unit costs of regulatory compliance, they need to be analyzed separately. Averaging them in with all of the medium-sized establishments considered "small" under section 3 of the Small Business Act obscures the degree to which costs for the truly small entities are disproportionately high.

SBREFA does allow alternative definitions of "small" if an agency consults with the SBA's Office of Advocacy, allows opportunity for public comment, and publishes the definition(s) in the Federal Register. Although this procedure is somewhat cumbersome, it has the potential to enhance the regulatory analysis process by forcing consideration of "small" and requiring collaboration with SBA at an early stage of the analytical process. The findings of this study strongly indicate that this procedure should routinely be used to develop alternate definitions of "small" for virtually every regulation.

3. Summary

The measures and defining cutoffs for "small" vary considerably. The logic of the choice of units is more consistent than the variety of measures would suggest, however, and constraints in available data are responsible for much of the arbitrariness in the choice of cutoffs. A universal definition of "small" does not appear to be desirable. For purposes of regulatory analysis, the very small end of the size spectrum is the area to focus, since this is where the unit costs become quite high.

B. IMPACT ISSUES

1. "Significant Impacts"

Disproportionately large impacts on small entities may or may not have much practical significance. The critical issue is whether the impacts are minimal or significant. Measuring impacts as a percent of revenue is one way of assessing their significance.

A common rule of thumb is that an impact is significant if the costs exceed one percent of revenues. It must be emphasized, however, that this is only a rule of thumb. A complete assessment of significance of impacts includes consideration of impacts on profits (not just revenues) and closures; consideration of related industry characteristics such as profit margins and rates of entry and exit; and examines the more vulnerable parts of the industry, rather than just mean values. Nevertheless, this simplistic rule of thumb will suffice for our purpose, which is to assess the relationship between gross differences in significance of impacts and the degree of disproportionality of regulatory costs to small entities.

Exhibit VI-2 shows the impact of each of the regulations as a percent of revenue. This exhibit reflects the maximum impact or a regulation in several respects:

- o Data are shown for the smallest size class only;
- o Data are shown for the initial year, if costs in the initial year are projected to be larger than in subsequent years;
- o Data include impacts of each regulation on all industries for which the estimated impact exceeds 0.5 percent of revenue;
- o Where no impacts on any industry were estimated to be more than 0.5 percent of revenue, or where "Other" industries with impacts less than 0.5 percent of revenue are included, the number shown is the highest impact of the regulation on any affected industry.

EXHIBIT VI-2: SIGNIFICANCE OF IMPACTS ON SMALL FIRMS

Agency/Regulation	Greatest Impact[a] as a Percent of Revenue	Industry Segment
OSHA		
Concrete & Masonry Construction Safety	1.84 %	Masonry and Stonework
Electrical Safety-Related Work Practices	0.13 %	
Electric Power Generation and Protective Equipment	0.55 %	Tree Trimming
Lockout/Tagout	N.A.[b]	
Permit-Required Confined Spaces	0.34 %	
Personal Protective Equipment	N.A.[c]	
Process Safety Management of Highly Hazardous Chemicals	2.03 %	Paints, Varnishes...
	1.05 %	Asphalt Materials
	0.92 %	Miscellaneous Chem.
	0.57 %	Detergents, Perfumes
	0.33 %	Others
Asbestos Final Revisions	1.10 %	Gaskets/Packings
	0.60 %	Coatings/Sealants
	0.23 %	Construction
Occupational Exposure to Cadmium	N.A.[d]	

[a] Largest impact of any industry segment. All industry segments with impacts over 0.05% of revenues are listed separately.

[b] Estimates first-year costs for very small firms are $119.63.

[c] Estimates annual costs for small firms are $15.00 or less.

[d] Estimates annual costs for small firms are $15.03.

EXHIBIT VI-2: SIGNIFICANCE OF IMPACTS ON SMALL FIRMS (Continued)

Agency/Regulation	Greatest Impact[a] as a Percent of Revenue	Industry Segment
OSHA		
Lead Exposure in Construction	14.24 %	Structural Steel
	3.77 %	Painting
	3.65 %	Wrecking/Demolition
	2.54 %	Highway/Street
	2.23 %	Bridge/Tunnel
	1.16 %	Carpentry
	1.10 %	Other Building Opers.
EPA		
Acid Rain Implementing Regulations	7.42 %	Coal-Fired; > 250 MW
	6.57 %	Oil-Fired; > 250 MW
	1.34 %	Coal-Fired; < 250 MW
	1.10 %	Gas-Fired; < 250 MW
	0.94 %	Oil-Fired; < 250 MW
Phaseout of Ozone Depleting Chemicals	0.61 %	MCF Aerosol
Fuels/Fuel Additives Registration	0.012%	
PCE: Dry Cleaning		
Very Small	0.78 %	
Small	5.64 %	No Controls[e]
	0.95 %	Refrig. Condenser[e]
Air Emissions Standards for Hazardous Waste Facilities	0.28 %	
OCPSF Effluent Guidelines	N.A.[f]	
Disposal of Sewage Sludge	0.365%	

---

[e] Impacts are somewhat lower for firms with the larger units.

[f] Although financial impacts were not presented, impacts were estimated to be significant because closures were analyzed.

EXHIBIT VI-2: SIGNIFICANCE OF IMPACTS ON SMALL FIRMS (Continued)

Agency/Regulation	Greatest Impact[a] as a Percent of Revenue	Industry Segment
EPA		
SARA Title III	0.207%	
FIFRA	N.A.[g]	
FDA		
Food Labeling	0.616%	Health Claims Made
USDA		
Pathogen Reduction & HACCP	2.95 %[h]	Poultry Slaughter
	2.08 %[i]	Raw Ground Processing
	2.04 %[j]	Cattle/Hog Slaughter

[g] Estimated annual costs are the highest for small:
- Commercial Handlers ($1,490),
- Nurseries ($1,280), and
- Greenhouses ($1,023).

[h] First-year costs; estimated recurring costs were 1.33 percent of revenue.

[i] First-year costs; estimated recurring costs were 0.96 percent of revenue.

[j] First-year costs; estimated recurring costs were 1.01 percent of revenue.

Exhibit VI-2 shows a mixed record of significant impacts. Of the 21 regulations[121] for which data are shown:

- o No significant impacts (costs less than 0.5 percent) occur in six regulations:
  - Electrical safety-related work practices,
  - Permit-required confined spaces,
  - Fuels and fuel additives registration,
  - Air emission standards for hazardous waste facilities,
  - Disposal of sewage sludge, and
  - SARA Title III.

- o Although no revenue data were available, the average cost to the smallest entities is so small that impacts are clearly non-significant in three regulations:
  - Lockout/Tagout,
  - Personal protective equipment, and
  - Occupational exposure to cadmium.

- o Impacts exceeded 0.5 percent of revenues, but not 1.0 percent of revenues, in one industry or product in three regulations:
  - Electric power generation and protective equipment,
  - Phaseout of ozone depleting chemicals, and
  - Food labeling.

- o Impacts were significant (costs 1.0 to 3.0 percent of revenue) in one or two industries; costs were between 0.05 and 1.0 percent of revenue in one or two more industries; and costs were below 0.5 percent of revenue elsewhere in four regulations:
  - Process safety management of highly hazardous chemicals,
  - Asbestos final revisions,
  - PCE in dry cleaning, and
  - FIFRA.

- o Overall impacts were significant but in the range of 1.0 percent to 3.0 percent of revenue in two regulations:
  - Concrete and masonry construction safety, and
  - Pathogen reduction and HACCP.

- o Impacts were significant and large -- costs over 5.0 percent of revenues -- in at least some industries or groups of firms in two regulations:

---

[121] Exhibit VI-2 omits three regulations because they affect local governmental entities, and/or revenue data were not available. All three of these regulations, however, have large impacts on small entities. These regulations are:
- EPA's financial responsibility standard for USTs,
- EPA's regulations on lead and copper in drinking water, and
- EPA's regulations on Phase V chemicals in drinking water.

- Lead exposure in construction, and
- Acid rain implementing regulations.

- o Costs could not be computed as a percent of revenue, but impacts were probably significant and large in four regulations:
  - OCPSF effluent guidelines,
  - Financial responsibility standard for USTs,
  - Lead and copper in drinking water, and
  - Phase V chemicals in drinking water.

Specific industry-regulation pairs in which impacts were significant or nearly so include the following:

- o Cost as a percent of revenue exceed 10.0 percent for structural steel in lead exposure in construction (14.2 percent).

- o Costs are between 5.0 percent and 10.0 percent of revenue for:
  - Coal-fired plants over 250 MW, acid rain regulations (7.4 percent), and
  - Oil-fired plants over 250 MW, acid rain regulations (6.6 percent).

- o Costs are between 3.0 percent and 5.0 percent of revenue for:
  - Painting, lead exposure in construction (3.8 percent), and
  - Wrecking/demolition, lead exposure in construction (3.7 percent).

- o Costs are between 2.0 percent and 3.0 percent of revenue for:
  - Poultry slaughter, pathogen reduction & HACCP (2.95 percent),
  - Highway/street work, lead exposure in construction (2.5 percent),
  - Bridge/tunnel work, lead exposure in construction (2.2 percent),
  - Raw ground processing, pathogen reduction & HACCP (2.1 percent),
  - Cattle/hog slaughter, pathogen reduction & HACCP (2.04 percent), and
  - Paints and varnishes, process safety management (2.03 percent).

- o Costs are between 1.0 percent and 2.0 percent of revenue for:
  - Masonry & stonework, concrete & masonry construction (1.8 percent),
  - Small dry cleaners with no controls, PCE regulations (5.6 percent),
  - Coal-fired plants under 250 MW, acid rain regulations (1.3 percent),
  - Carpentry, lead exposure in construction (1.2 percent),
  - Other building operators, lead exposure in construction (1.1 percent),
  - Gas-fired plants under 250 MW, acid rain regulations (1.1 percent),
  - Gaskets & packings, asbestos final revisions (1.1 percent), and
  - Asphalt materials, process safety management (1.05 percent).

- o Costs are between 0.5 percent and 1.0 percent of revenue for:
  - Oil-fired plants under 250 MW, acid rain regulations (0.94 percent),
  - Miscellaneous chemicals, process safety management (0.92 percent),
  - Health claims made, food labeling (0.62 percent),
  - MCF aerosol, phaseout of ozone depleting chemicals (0.61 percent),
  - Coatings and sealants, asbestos final revisions (0.60 percent),
  - Detergents and perfumes, process safety management (0.57 percent), and

- Tree trimming, electric power generation and protective equipment (0.55 percent).

2. Economies of Scale and Significant Impacts

When impacts of a regulation on small entities are significant, two issues merit consideration:

- o To what extent do economies of scale and the resulting disproportionately large costs on small entities contribute to the significant impacts?
- o What regulatory flexibility activities were or could have been utilized to minimize the significant impacts?

Exhibit VI-3 presents data to address these issues. It includes all of the industry-regulation pairs for which a significant impact was estimated, either by the indicator of compliance cost as a percent of revenue or by review of the RIA. For these industry-regulation pairs, Exhibit VI-3 presents:

- o Compliance cost as a percent of revenue for the smallest size class;
- o The average unit regulatory cost index for the smallest size class; and
- o Summary notation on the status of regulatory flexibility measures.

<u>a. Absence of Economies of Scale</u>

In several of the regulations, economies of scale in regulatory compliance plays little or no apparent role in the significant impacts of the regulation on small firms. These cases include:

- o Lead exposure in construction;
- o Concrete and masonry construction safety; and
- o Asbestos final revisions.

Lead in construction illustrates this situation most clearly. The construction industries that incur significant impacts have high costs for all sizes of firm. The costs are high because the potential for lead exposure is high, particularly in structural steel, painting, wrecking and demolition, and work on highways and streets and on bridges and tunnels. The potential for high exposure also limits the available regulatory flexibility measures that might be taken.

<u>b. Economies of Scale and Absence of Exemptions</u>

In several regulations, parts of the industry were exempted from part or all of the regulation, but other parts were not. In such cases, the difference in significance of impacts is quite clear. These cases include the following.

EPA's Acid Rain Implementing Regulations. Compliance activities for electric generation are subject to large economies of scale. In order to address this issue, electric generation plants with a capacity of under 250 MW were given extra emissions allowances. For coal and oil, the impacts are much larger for plants of over 250 MW, which did not receive exemptions. For coal-fired plants, for example, the costs and

EXHIBIT VI-3:
ECONOMIES OF SCALE AND SIGNIFICANCE OF IMPACTS ON SMALL FIRMS

Agency/Regulation/Industry	Cost as a Percent of Revenue	Average Unit Regulatory Cost Index	Regulatory Flexibility Measures
OSHA			
Concrete & Masonry Construction Safety			
Masonry and Stonework	1.84 %	0.33	None
Process Safety Management of Highly Hazardous Chemicals			
Paints, Varnishes	2.03 %	2.95	
Asphalt Materials	1.05 %	2.74	
Asbestos Final Revisions			
Gaskets/Packings	1.10 %	0.87	None
Lead Exposure in Construction			
Structural Steel	14.14 %	4.89	None
Painting	3.77 %	1.25	None
Wrecking/Demolition	3.65 %	0.24	None
Highway/Street	2.54 %	1.25	None
Bridge/Tunnel	2.23 %	1.25	None
Carpentry	1.16 %	1.27	None
Other Building Opers.	1.10 %	2.33	None
EPA			
Acid Rain Implementing Regulations			
Coal-Fired; > 250 MW	7.42 %	6.76	None
Oil-Fired; > 250 MW	6.57 %	5.99	None
Coal-Fired; < 250 MW	1.34 %	1.22	Exemption
Gas-Fired; < 250 MW	1.10 %	1.00	Exemption
OCPSF Effluent Guidelines, Indirect Dischargers	N.A.[a]	66.64	Considered
PCE: Dry Cleaning			
Small: No Controls	1.64 %	3.02	Very Small Exempt

[a] Closures were analyzed in the RIA.

EXHIBIT VI-3:
ECONOMIES OF SCALE AND SIGNIFICANCE OF IMPACTS ON SMALL FIRMS
(Continued)

Agency/Regulation/Industry	Cost as a Percent of Revenue	Average Unit Regulatory Cost Index	Regulatory Flexibility Measures
EPA			
Underground Petroleum Storage Tanks Financial Responsibility			
Retail Motor Fuel	N.A.	4.47	Options
General Industry	N.A.	36.50	Options
Local General Government	N.A.	19.28	Options
Drinking Water: Lead & Copper			
Public Water Systems	N.A.	24.09	Several
USDA			
Pathogen Reduction & HACCP			
Poultry Slaughter	2.95 %	15.31	Several
Raw Ground Processing	2.08 %	31.19	Several
Cattle/Hog Slaughter	2.04 %	12.74	Several

impacts of the over-250-MW plants are 5.5 times as great as the costs and impacts of the under-250-MW plants, although impacts on the smaller exempt plants are still significant. Exemptions cushioned the economies of scale -- but only where they were available.

EPA's OCPSF Effluent Guidelines. The role of exemptions is even clearer in the OCPSF guidelines. Economies of scale are quite large. Indirect dischargers had to incur high enough impacts to make some of them close, because EPA determined that the environmental damage from exemptions would be unacceptably high. Direct dischargers, by contrast, effectively received a total exemption from new compliance measures. As a result, they incurred zero compliance costs.

EPA's Regulation of PCE in Dry Cleaning. Very small dry cleaners (under $75,000 in revenue) were exempt from installing controls. Slightly larger "small" dry cleaners ($75,000 to $100,000) were not exempt, however, and incur significant impacts as a result. Impacts on very small dry cleaners without controls were not significant because of the exemption. Impacts on large dry cleaners without controls were not significant because of economies of scale in compliance.

c. Large Economies of Scale With Regulatory Flexibility

In several of the regulations, very large economies of scale impose significant and disproportionately large impacts on small entities despite the use of regulatory flexibility measures. These cases include the following.

UST Financial Responsibility. Economies of scale inherent in risk pooling are enormous. EPA attempted to mitigate impacts on small entities by allowing a wide variety of financial responsibility options. Except for tank closure, however, none of these really was successful in making costs proportional to size.

Lead and Copper in Drinking Water. Economies of scale arose from practically every conceivable source, including statistics, technical economies of scale, paperwork, and fixed-cost start-up activities. EPA allowed less rigorous sampling, cheaper treatment techniques, reduced paperwork, and provisions that made it less necessary to take some expensive actions. Nevertheless, the impacts on small entities were disproportionately quite high.

Pathogen Reduction & HACCP. Economies of scale arise from a number of sources, including start-up activities and technical economies of scale. EPA allowed (or assumed) some simpler processes for small firms. Moreover, the general regulatory approach was intended to be sufficiently flexible that firms could tailor their compliance to their circumstances. Significant impacts and disproportionately high costs for small firms nevertheless remained.

3. Initial Costs

Initial one-time costs, particularly capital investment, can make impacts have more force at the outset than subsequently. The analysis in this chapter has addressed this issue by using initial costs rather than subsequent costs whenever the RIA indicated that costs in the initial year(s) were higher than costs in subsequent years. In some cases, the significance of impacts dissipates over time.

Pathogen Reduction & HACCP. Costs in the out years are roughly half of costs in the first year, which are the basis for Exhibit VI-3 (See Exhibit VI-2, notes h, i, and j). These costs were also taken from the high-cost scenario, rather than the low-cost scenario. Thus long-run impacts are substantially lower, and possibly not significant, in the out years.

EPA's Regulation of PCE in Dry Cleaning. The costs associated with this regulation are almost entirely initial paperwork and retrofitting of machines. When the machines wear out, new equipment will come with controls. Once this occurs, compliances costs will fall to minimal levels.

4. Summary and Conclusions

The disproportionately high costs to small entities do not necessarily mean that the impacts on those small entities will be significant. Costs on small entities may be disproportionately high but absolutely quite small. Conversely, economies of scale may be small, and other factors may make impacts significant. Exemptions or other regulatory flexibility measures can protect small entities from substantial economies of scale that would otherwise impose significant impacts. In some cases, however, economies of scale in compliance costs may overwhelm the regulatory flexibility alternatives that can be used without defeating the purpose of the regulation.

As these last outcomes indicate, the fact that a regulation has significant and disproportionately large impacts on small entities does not necessarily mean that regulatory flexibility analysis and small-entity alternatives were not effective. Regulations are a mechanism of social choice, and it is a policy decision whether the social benefits of a regulation outweigh its impacts, including impacts on small entities. The purpose of a regulatory flexibility analysis is to insure that such a policy decision is well informed and based on economically efficient trade-offs between benefits and small-entity impacts. This purpose is best accomplished when identification and minimization of significant and disproportionately large impacts on small entities is integrated into the regulatory analysis from the outset. Looking at small-entity impacts only as an afterthought, or ignoring them altogether after deciding that an average impact does not exceed an abstract benchmark of "significance" does not accomplish this purpose and is not good analytical practice.

APPENDIX: DETAILED REGRESSION EQUATION RESULTS

Regulation Data

Regulation Equations

Industry Data

Industry Equations

(see the NTIS report)

BIBLIOGRAPHY

Abt Associates, Inc. "Economic Impact Analysis of Effluent Limitations and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," prepared for the U.S. Environmental Protection Agency, Office of Water Regulation and Standards, September 1987.

________. "Preliminary Regulatory Flexibility Analysis for Effluent Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," prepared for the U.S. Environmental Protection Agency, Office of Water Regulation and Standards, November 1986.

________. "Regulatory Flexibility Analysis for Effluent Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," prepared for the U.S. Environmental Protection Agency, Office of Water Regulation and Standards, September 1987.

Alm, James; Jackson Betty R.; and McKee, Michael. "Estimating the Determinants of Taxpayer Compliance with Experimental Data," National Tax Journal 45(1): 107-114.

American Institute of Certified Public Accountants. "Blueprint for Tax Simplification," April 1992.

________. "Survey of Practitioner Attitudes Toward the IRS," November 1989.

________. "Tax Complexity Index," April 1993.

Apelquist, Krystal P. "Form 1040C -- A New Way to Reduce Taxpayers' Burden and Ours Too!" The IRS Research Bulletin (1992): 73-76.

Arthur Anderson & Co. "Analysis of Regulatory Cost on Establishment Size," prepared for the U.S. Small Business Administration, Office of Advocacy, October 1979.

Arthur D. Little, Inc. "Development of Methodology for Estimating the Taxpayer Paperwork Burden," Final Report to Department of the Treasury, Internal Revenue Service, Washington, D.C., June 1988.

Bartel, Ann P. and Thomas, Lacy Glenn. "Predation Through Regulation: The Wage and Profit Effects of the Occupational Safety and Health Administration and the

Environmental Protection Agency," Journal of Law & Economics 30 (October 1987): 239-264.

Beilock, Richard and Freeman, James. "The Impact of the Motor Carrier Act of 1980 on Small and Medium Sized Freight Carriers," prepared for the U.S. Small Business Administration, Office of Advocacy, March 1991.

Berkery, Peter M. "The Impact of Government Regulations on Small Business." The National Public Accountant 37 (June 1992): 14, 37.

Berkery, Peter M. Jr., and Knell, Steven F. "Small Business Non-Compliance: A View from the Trenches," The National Public Accountant (February 1992): 14-19.

Berney, Robert E. "The Cost of Government Regulation on Small Business: An Update," prepared for the U.S. Small Business Administration, Office of Advocacy, September 1980.

Berney, Robert E., and Swansom, James. "The Regressive Impact of Government Regulations: Some Theoretical and Empirical Evidence," American Journal of Small Business 6(3) (January-March 1982): 16-27.

Bitner, Larry N., and Powell, Judith D. "Small Business Accounting Systems: Is Automation Necessary," The National Public Accountant (December, 1989): 20-24.

Blumenthan, Marsha, and Slemrod, Joel. "The Compliance Cost of the U.S. Individual Income Tax System: A Second Look After Tax Reform," National Tax Journal 45(2): 185-202.

Booz Allen & Hamilton, Inc. "Impact of Environmental Regulations on Small Business," prepared for the U.S. Small Business Administration, Office of Advocacy, May 1982.

Brashares, Edith. "Literature Review on Business Compliance Costs with Federal Income Taxes," (Washington, D.C.: Internal Revenue Service, June 15, 1995).

Brock, William A., and Evans, David S. "The Economics of Regulatory Tiering, RAND Journal of Economics 16(3) (Autumn 1985): 398-409.

Brown Associates, Inc. "FICA: Federal Tax Deposits," prepared for the U.S. Small Business Administration, Office of Advocacy, March 1986.

________. "Survey of Erroneous Penalties Imposed by IRS Relative to Employment Returns," prepared for the U.S. Small Business Administration, Office of Advocacy, April 1988.

Cash, L. Stephen; Dickens, Thomas L.; and Hagan, Joseph M. "Current Tax Laws Increase Compliance Concerns," The National Public Accountant (January 1993): 18-25, 43-44, 47.

Casimir, James J. "Appeals in the 1990s: New Directions," The National Public Accountant (July 1992): 24-38.

Chumley, Delbert W., and Smolinski, Harold C. "Problems Created by the Alternative Minimum Tax," The National Public Accountant (December 1993): 22-24, 47.

Clark, Lyman H. "Economic Impact Criteria for FRA Analysis," Report to the Economic Studies Branch, Office of Regulatory Management and Evaluation, U.S. Environmental Protection Agency, July 1990.

Cohen, Neiland. "IRS Takes Steps to Improve Service," The National Public Accountant (June 1991): 22-24.

Cohen, Neiland. "Warning! IRS TAXLINK is Here!" The National Public Accountant (December 1994): 12.

CONSAD Research Corporation. "Development of Industry Profile Data for OSHA's Draft Proposed Standard for Permit Entry Confined Spaces," prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, 1989.

________. "Economic Analysis of the Proposed Revisions to the OSHA Asbestos Standards for Construction and General Industry," final report prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, July 1990.

________. "Economic Analysis of OSHA's Interim Final Standard for Lead in Construction," final report prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, April 1993.

Crews, Clyde Wayne, Jr. "Ten Thousand Commandments: Regulatory Trends 1981-92 and the Prospects for Reform," Report prepared for the Citizens for a Sound Economy Foundation (Washington, D.C. February 1993).

DPRA Incorporated. "Impact Assessment for Worker Protection Standard Training Provisions," prepared for the U.S. Environmental Protection Agency, Office of Pesticide Programs, August 1994.

Dalton, Tom. "Navigating the Revised Nanny Tax," The National Public Accountant (November 1995): 17-19, 37-38.

Dean, Thomas J. "Pollution Regulation as a Barrier to the Formation of Small Manufacturing Establishments: A Longitudinal Analysis," prepared for the U.S. Small Business Administration, Office of Advocacy, June 1994.

Eastern Research Group, Inc. "Preparation of an Economic Impact Study for the Proposed OSHA Regulation Covering Electric Power Generation, Transmission, and Distribution," prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, June 1986.

________. "Economic Analysis of the Revised General Industry Personal Protection Equipment Standard," draft final report prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, December 1988.

________. "Regulatory Impact Analysis of the Part 503 Sewage Sludge Regulation," prepared for the U.S. Environmental Protection Agency, Office of Water, November 1992.

Evans, David S. "An Analysis of the Differential Impact of EPA and OSHA Regulations Across Firm and Establishment Size in the Manufacturing Industries," prepared for the U.S. Small Business Administration, Office of Advocacy, July 1985.

________. "The Differential Effect of Regulation Across Plant Size: Comment on Pashigian," Journal of Law and Economics 29 (April 1986): 187-199.

Feinstein, Jonathan S. "An Econometric Analysis of Income Tax Evasion and Its Detection," RAND Journal of Economics 22(1) (Spring 1991): 14-35.

Fisher, Vickie I. "Recent Innovations in State Tax Compliance Programs," National Tax Journal 37(3): 365-371.

Food and Drug Administration. "Food Labeling; General Provisions; Nutrition Labeling; Nutrient Content Claims; Health Claims; Ingredient Labeling; State and Local Requirements; and Exemptions; Proposed Rules," Federal Register 56(229) (November 27, 1991): 60366-60878.

________. "Regulatory Impact Analysis of the Final Rules to Amend the Food Labeling Regulations; Regulatory Impact Analysis Statement," Federal Register 58(3) (January 6, 1993): 2070-2078.

________. "Food Labeling: Establishment of Date of Application; Final Rule," Federal Register 58(3) (January 6, 1993): 2927-2941.

________. "Prior Labeling Approval System; Final Rule," Federal Register 60(250) (December 29, 1995): 67444-67469.

Geiman, Russell. "Selected Impacts of the Tax Reform Act of 1986 on Individual Returns," (Washington D.C.: Internal Revenue Service, n.d.).

Glover, Jere W. Testimony Before the Committees on Small Business of the United States Senate and House of Representatives, October 31, 1995.

Goldstein, Benson S. "The Omnibus Taxpayer Bill of Rights Act," The National Public Accountant (February, 1989): 20-24.

Graetz, Michael J., and Louis I. Wilde. "The Economics of Tax Compliance: Fact and Fantasy," National Tax Journal 37(3): 355-363.

Gray, Wayne B. "The Cost of Regulation: OSHA, EPA and the Productivity Slowdown," American Economic Review 77(5) (December 1987): 998-1006.

Hahn, Robert W., and Hird, John A. "The Costs and Benefits of Regulation: Review and Synthesis." Yale Journal on Regulation 8(1) (Winter 1991): 233-78.

Hall, Arthur P. "The High Cost of Tax Compliance for U.S. Business," Tax Foundation special report 25 (Washington, D.C.: The Tax Foundation, November 1993).

________. "Accounting Costs, Another Tax," The Wall Street Journal (December 9, 1993).

________. "The Growth of the Federal Government Tax 'Industry,'" Tax Foundation special report 38 (Washington, D.C.: The Tax Foundation, September 1994.

________. "Growth of Federal Government Tax 'Industry' Parallels Growth of Federal Tax Code," Tax Foundation special report (Washington, D.C.: The Tax Foundation, September 1994).

________. "The Cost of Unstable Tax Laws," Tax Foundation special report (Washington, D.C.: The Tax Foundation, October 1994).

________. "The Compliance Costs and Regulatory Burden Imposed by the Federal Tax Laws," Testimony before the House Ways & Means Committee, Government Oversight Subcommittee, December 9, 1994 (Washington, D.C.: The Tax Foundation, January 1995).

________. " Compliance Costs of Alternative Tax Systems," Testimony before the House Ways & Means Committee (Washington, D.C.: The Tax Foundation, June 1995).

________. "An Analysis of the Tax Burden and Compliance Costs of the Armey-Shelby Flat Tax," Tax Foundation special report (Washington, D.C.: The Tax Foundation, July 1995).

Harper, Lucinda. "Many Flout the Law on Reporting Taxes for Domestic Help," The Wall Street Journal (April 15, 1992): 1.

Hershey, Robert D., Jr. "Obeying the Tax Laws: Small Business' Burden," New York Times (January 30, 1994).

Hincken, Barbara E. "Advertising and the Use of IRS Services by the Small Business Taxpayer," The IRS Research Bulletin (1992): 70-72.

Hite, Peggy A.; Stock, Toby, and Cloyd; C. Bryan. "Reasons for Preparer Usage by Small Business Owners: How Compliant Are They?" The National Public Accountant (February, 1992): 20-26.

Hopkins, Thomas D. "Costs of Federal Regulation: Filling the Gaps," Report prepared for the Regulatory Information Service Center, (Washington, D.C. August 1992).

________. "Federal Regulatory Burdens and Overview," RIT Public Policy Working Paper, Rochester Institute of Technology, 1993.

________. "Statement Before the Subcommittee on Oversight and Investigations," U.S. House of Representatives, Subcommittee on Oversight and Investigations of the Committee on Economic and Educational Opportunities and the Subcommittee on Regulation and Paperwork of the Committee on Small Business (February 2, 1995).

________. "A Survey of Regulatory Burdens," prepared for the U.S. Small Business Administration, Office of Advocacy (Springfield, VA: National Technical Information Service, June 1995).

________. "Profiles of Regulatory Costs," Report to the U.S. Small Business Administration, Office of Advocacy, November 1995.

ICF Incorporated. "Regulatory Impact Analysis: Compliance With Section 604 of the Clean Air Act for the Phaseout of Ozone Depleting Chemicals," prepared for the U.S. Environmental Protection Agency, Office of Air and Radiation, July 1992.

________. "Regulatory Impact Analysis of the Final Acid Rain Implementation Regulations," prepared for the U.S. Environmental Protection Agency, Office of Atmospheric and Indoor Air Programs, October 1992.

________. "Background Document in Support of Financial Self-Test for Local Governments Subject to the Financial Responsibility Requirements of Subtitle I of the Resource Conservation and Recovery Act," prepared for the U.S. Environmental Protection Agency, Office of Underground Storage Tanks, November 1992.

________. "Economic Impact Analysis of Additional Mechanisms for Local Government Entities to Demonstrate Financial Responsibility for Underground Storage Tanks," prepared for the U.S. Environmental Protection Agency, Office of Underground Storage Tanks, December 1992.

________. "Small Business Impact Analysis of the Fuel and Fuel Additive Registration Program," prepared for the U.S. Environmental Protection Agency, Office of Mobile Sources, January 1994.

Internal Revenue Service, "IRS Outreach to Small Business," (1995).

________, "Simplified Tax and Wage Reporting System: Focus Group Report," (n.d.).

________. "1993 Value Tracking: Focus Groups with Taxpayers," (Washington, D.C.: Internal Revenue Service, 1994).

________. "1995 IRS Customer Satisfaction Survey: Final Report," (Washington, D.C.: Internal Revenue Service, 1996).

________. "1995 IRS Small Business Customer Satisfaction Survey: Final Report," (Washington, D.C.: Internal Revenue Service, 1996).

Iocozzia, James T., and Shear, Garrick R. "Trends in Taxpayer Paperwork Burden," (Washington D.C.: Internal Revenue Service, n.d.).

JACA Corporation. "Regulatory Assessment of the Impact of the Proposed Electrical Safety-Related Work Practices Standard for General Industry," final report prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, January 1984.

________. "Comments on EPA's Effluent Limitation Guidelines for the Organic Chemicals, Plastics and Synthetic Fibers Industries," prepared for the U.S. Small Business Administration, Office of Advocacy, December 1985.

________. "Economic Impact Analysis of the Proposed Revision to the Cadmium Standard," final report prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, March 1988.

Jack Faucett Associates. "Economies of Scale in Regulatory Compliance: Evidence of the Differential Impacts of Regulation by Firm Size," prepared for the U.S. Small Business Administration, Office of Advocacy, December 1984.

________. "Environmental Concerns for Small Business," prepared for the U.S. Small Business Administration, Office of Advocacy, January 1993.

Karnes, Allan J.; King, James B., II; and Welker, Robert B. "GAAS and the Small Business Audit," The National Public Accountant (August 1991): 42-46.

Kearney/Centaur. "Proposed OSHA Rule for the Process Hazards Management of Highly Hazardous Chemicals: An Industry Profile, Cost Assessment and Benefits Analysis," final report prepared for the Occupational Safety and Health Administration, Office of Regulatory Analysis, January 1990.

Lear, Jeffrey A. "Reinventing the Internal Revenue Service: IRS and the National Performance Review," The National Public Accountant (November 1993): 8, 16.

________. "Regulating EROs: Will This Solve Electronic Filing Troubles?" The National Public Accountant (December, 1994): 7, 15.

Lear, Jeffrey A. "Small Businesses and Federal Regulation," The National Public Accountant, (October, 1995), 8, 11; (November, 1995), 8, 14.

Magat, Wesley A., and Viscusi, Kip W. "Effectiveness of EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards." Journal of Law and Economics 33 (October 1990): 331-360.

Malanga, Frank. "The Relationship Between IRS Enforcement and Tax Yield," National Tax Journal 37(3): 333-337.

Mason, Robert, and Calvin, Lyle D. "Public Confidence and Admitted Tax Evasion," National Tax Journal 37(4): 489-496.

Meridian Research. "Regulatory Impact Analysis of Proposed Financial Responsibility Requirements for Underground Storage Tanks Containing Petroleum," prepared for the U.S. Environmental Protection Agency, Office of Underground Storage Tanks, March 1987.

________. "Regulatory Impact Analysis for Financial Responsibility Requirements for Petroleum Underground Storage Tanks," prepared for the U.S. Environmental Protection Agency, Office of Underground Storage Tanks, October 1988.

Meta Systems, Inc. "Economic Impact Analysis of Effluent Limitations and Standards for the Notice of Data Availability for the Organic Chemicals, Plastics and Synthetic Fibers Industry," prepared for the U.S. Environmental Protection Agency, Office of Water Regulations and Standards, June 1985.

O'Connor, Michael R. and Noble, Helene M. "Reduce Unnecessary Filings (RUF) Project," The IRS Research Bulletin (1992): 62-64.

Okolo, Timothy Omaliko, "Business Recordkeeping: Has the Burden Increased?" The National Public Accountant (December 1987): 36-41.

Pashigian, B. Peter. "The Effect of Environmental Regulation on Optimal Plant Size and Factor Shares," Center for the Study of the Economy and the State Working Paper 25 (Chicago: April 1983).

Payne, James L. Costly Returns: The Burdens of the U.S. Tax System (San Francisco: Institute for Contemporary Studies, 1993).

________. "Unhappy Returns: The $600-Billion Tax Ripoff," Policy Review 59 (Winter 1992): 18-24.

Perng, Shien, and Mannion, Jack. "The Effect of Taxpayer Assistance on Compliance: A Laboratory Test," The IRS Research Bulletin (1992): 41-49.

Petersen, Jim. "Get With the Program! The IRS ELF," The National Public Accountant (November, 1993): 42-44.

Pitt, Mark M., and Slemrod, Joel. "The Compliance Cost of Itemizing Deductions: Evidence from Individual Tax Returns," American Economic Review 79(5): 1224-1232.

Rappaport, Robin B., and Riley, Fred J. "A Look at the Paperwork Burden on Individual Return Filers," The IRS Research Bulletin (1992): 65-69.

Robinson, James C. "The Impact of Environmental and Occupational Regulation on Productivity Growth in U.S. Manufacturing," Yale Journal on Regulation 12(2) (Summer 1995): 387-418.

Rutledge, Gary L., and Vogan, Christine R. "Pollution Abatement and Control Expenditures, 1972-92." Survey of Current Business (May 1994): 36-49.

Scherer, Robert F.; Kaufman, Daniel J.; and Ainina, M. Fall. "Complaint Resolution by OSHA in Small and Large Manufacturing Firms," Journal of Small Business Management (January 1993): 73-82.

Shanahan, John C., and Thierer, Adam D. "How to Talk About Risk: How Well-Intentioned Regulations Can Kill," Heritage Talking Points No. 13 (Washington D.C.: The Heritage Foundation, April 1996).

Skinner, Jonathan, and Joel Slemrod, "An Economic Perspective on Tax Evasion," National Tax Journal 37(3): 345-353.

Slemrod, Joel, and Blumenthal, Marsha. "The Income Tax Compliance Cost of Big Business," (Washington, D.C.: Tax Foundation, November 1993).

Slemrod, Joel, and Nikki Sorum, "The Compliance Cost of the U.S. Individual Income Tax System," National Tax Journal (March 1984): 461-474.

Srinivasan, S., and Walter, Richard M. "Electronic Tax Filing: How Is It Working?" The National Public Accountant (April 1995): 22-25, 44.

Temple, Barker & Sloane, Inc. "Comments on EPA's December 8,1986 Notice of Availability in Support of Effluent Limitations Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," (February 1987).

Thomas, Lacy Glenn. "Regulation and Firm Size: FDA Impacts on Innovation," RAND Journal of Economics 21(4) (Winter 1990): 497-517.

U.S. Department of Agriculture. "Preliminary Regulatory Impact Assessment for Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) System," (n.d.).

________. "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems, Proposed Rule," Federal Register 60(23) (February 3, 1995): 6774-6889.

________. "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems, Final Rule," Federal Register 61(155) (July 25, 1996): 38806-38989.

U.S. Department of Labor, Occupational Safety and Health Administration. "Concrete and Masonry Construction Safety Standards; Final Rule," Federal Register 53(116) (June 16, 1988): 22612-22646.

________. "Control of Hazardous Energy Sources (Lockout/Tagout); Final Rule," Federal Register 54(169) (September 1, 1989): 36644-36696.

________. "Electrical Safety-Related Work Practices; Final Rule," Federal Register 55(151) (August 6, 1990): 31984-32020.

________. "Process Safety Management of Highly Hazardous Chemicals; Final Rule," Federal Register 57(36) (February 24, 1992): 6356-6417.

________. "Occupational Exposure to Cadmium; Final Rule," Federal Register 57(178) (September 14, 1992): 42102-42463.

________. "Final Regulatory Impact and Regulatory Flexibility Analysis of the Final Permit-Required Confined Space Standard," (December 1992).

________. "Permit-Required Confined Spaces for General Industry; Final Rule," Federal Register 58(9) (January 14, 1993): 4462-4563.

________. "Lead in Construction; Interim Final Rule," Federal Register 58(84) (May 4, 1993): 26590-26649.

________. "Electric Power Generation, Transmission, and Distribution; Electrical Protective Equipment; Final Rule," Federal Register 59(20) (January 31, 1994): 4320-4476.

________. "Personal Protective Equipment for General Industry; Final Rule," Federal Register 59(66) (April 6, 1994) 16334-16364.

________. "Occupational Exposure to Asbestos; Final Rule," Federal Register 59(153) (August 10, 1994): 40964-41158.

U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis. "Preliminary Regulatory Impact and Regulatory Flexibility Analysis of the Proposed Electrical Safety-Related Work Practices Standard for General Industry," (October 1987).

________. "Final Regulatory Impact Assessment of the Standard on Concrete and Masonry Construction," (May 1988).

________. "Preliminary Regulatory Impact and Regulatory Flexibility Analysis of the Occupational Safety Standard for Electrical Generation, Transmission, and Distribution," (November 1988).

________. "Preliminary Regulatory Impact and Regulatory Flexibility Analysis of the Confined Spaces Standard," (June 1989).

________. "Regulatory Impact and Regulatory Flexibility Analysis of the Control of Hazardous Energy Sources (Lockout/Tagout)," (August 1989).

________. "Preliminary Regulatory Impact and Regulatory Flexibility Analysis for the Proposed 5 ug/m^3 Cadmium Standard," (January 1990).

________. "Preliminary Regulatory Impact and Regulatory Flexibility Analysis of the Proposed Standard for Process Safety Management of Highly Hazardous Chemicals," (April 1990).

________. "Final Regulatory Impact and Regulatory Flexibility Analysis of the Final Standard for Process Safety Management of Highly Hazardous Chemicals<" (February 1992).

________. "Final Regulatory Impact and Regulatory Flexibility Analysis of the Permit-Required Confined Space Standard," (December 1992).

U.S. Environmental Protection Agency. "Organic Chemicals and Plastics and Synthetic Fibers Category Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards; Final Rule," Federal Register 52(214) (November 5, 1987): 42522-42584.

________. "Emergency and Hazardous Chemical Inventory Forms and Community Right-to-Know Reporting Requirements, Part IV; Final Rule," Federal Register 52(199) (October 15, 1987): 38344-38377.

________. "Drinking Water Regulations; Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Proposed Rule," Federal Register 53(160) (August 18, 1988): 31516-31577.

________. The Municipal Sector Study: Impacts of Environmental Regulation on Municipalities. September 1988.

________. The Small Business Sector Study: Impacts of Environmental Regulation on Small Business. September 1988.

________. "Underground Storage Tanks Containing Petroleum; Financial Responsibility Requirements; Proposed Rule," Federal Register 55(117) (June 18, 1990): 24692-24720.

________. "Emergency and Hazardous Chemical Inventory Forms and Community Right-to-Know Reporting Requirements, Part III; Final Rule," Federal Register 55(144) (July 26, 1990): 30632-30656.

________. "Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Final Rule," Federal Register 56(110) (June 7, 1991): 26460-26564.

________. "Protection of Stratospheric Ozone; Final Rule," Federal Register 57(135) (July 14, 1992): 31242-31262.

________. "National Primary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals; Final Rule," Federal Register 57(138) (July 17, 1992) 31776-31849.

________. "Protection of Stratospheric Ozone; Final Rule," Federal Register 57(147) (July 30, 1992): 33754-33798.

________. "[FIFRA] Worker Protection Standard; Final Rule," Federal Register 57(163) (August 21, 1992): 38102-38166.

________. "Acid Rain Program: General Provisions and Permits, Allowance System, Continuous Emissions Monotoring, Excess Emissions and Administrative Appeals; Final Rule," Federal Register 58(6) (January 11, 1993): 3591-3766.

________. "Underground Storage Tanks Containing Petroleum; Financial Responsibility Requirements; Final Rule," Federal Register 58(31) (February 18, 1993): 9026-9060.

________. "Standards for the Use or Disposal of Sewage Sludge; Final Rules," Federal Register 58(32) (February 19, 1993): 9242-9415.

________. "Organic Chemicals, Plastics and Synthetic Fibers Category; Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards; Final Rule; Amendments," Federal Register 58(130) (July 9, 1993): 36872-36894.

________. "Protection of Stratospheric Ozone; Notice of Final Rulemaking," Federal Register 58(236) (December 10, 1993): 65018-65082.

________. "National Emission Standards for Hazardous Air Pollutants for Source Categories: Perchloroethylene Dry Cleaning Facilities; Amendments; Final Rule," Federal Register 58(242) (December 20, 1993): 66287-66289.

________. "Underground Storage Tanks Containing Petroleum; Financial Responsibility Requirements; Final Rule," Federal Register 59(39) (February 28, 1994): 9604-9060.

________. "Fuels and Fuel Additives Registration: Changes in Requirements, and Applicability to Blenders of Deposit Control Gasoline Additives; Proposed Rule (Draft)," (n.d.).

________. "Fuels and Fuel Additives Registration Regulations; Final Rule," Federal Register 59(122) (June 27, 1994): 33042-33142.

________. "Hazardous Waste Treatment, Storage, and Disposal Facilities and Hazardous Waste Generators; Organic Air Emission Standards for Tanks, Surface Impoundments, and Containers; Final Rule," Federal Register 59(233) (December 6, 1994): 62896-62953.

________. "Pesticide Programs; Worker Protection Standards; Final Rules and Proposed Rules," Federal Register 60(85) (May 3, 1995): 21944-21968.

U.S. Environmental Protection Agency, Office of Air and Radiation. "Regulatory Support Document and Regulatory Flexibility Analysis [for Fuels and Fuel Additives]," (May 1994).

U.S. Environmental Protection Agency, Office of Air Quality. "Petroleum Dry Cleaners - Background Information for Proposed Standards," (Research Triangle Park, NC: November, 1982).

________. "Hazardous Waste TSDF-Background Information for Proposed RCRA Air Emission Standards (Preliminary Draft), (Research Triangle Park, NC: March 1988).

________. "Hazardous Waste TSDF-REGULATORY Impact Analysis for Proposed RCRA Air Emission Standards (Preliminary Draft)," (Research Triangle Park, NC: March 1988).

________. "Economic Impact Analysis of Regulatory Controls in the Dry Cleaning Industry (Draft)," (Research Triangle Park, NC: October, 1991).

________. "Preliminary Economic Impact Assessment of Transfer Enclosure Requirements in the Dry Cleaning Industry," (Research Triangle Park, NC: April, 1992).

________. "Dry Cleaning Facilities - Final Background Information; EIS for Promulgated Standards," (Research Triangle Park, NC: September, 1993).

________. "Economic Impact Analysis of Regulatory Controls in the Dry Cleaning Industry; Final," (Research Triangle Park, NC: September, 1993).

________. "Hazardous Waste TSDF Regulatory Impact Analysis for Promulgated Air Emission Standards for Tanks, Surface Impoundments, and Containers," (Research Triangle Park, NC: November, 1994).

U.S. Environmental Protection Agency, Office of Drinking Water. "Information Collection Request for National Primary Drinking Water Regulations for Lead and Copper," n.d.

U. S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. "UPDATE: Underground Storage Tank Financial Responsibility," (Washington, D.C.: March 1990).

________. "State Program Approval Handbook," (Washington, D.C.: May 1992).

________. "Response to Comments on the June 18, 1990 Proposed Rule to Provide Additional Mechanisms for Local Government Entities to Demonstrate Financial Responsibility for Underground Storage Tanks," (Washington, D.C.: November 1992).

________. "Guide to Materials on Underground Storage Tanks," (Washington, D.C.: September 1994).

________. "Dollars And Sense: Financial Responsibility Requirements for Underground Storage Tanks," (Washington, D.C.: July 1995).

________. "UST Program Facts: Implementing Federal Requirements for Underground Storage Tanks," (Washington, D.C.: August 1995).

U.S. Environmental Protection Agency, Office of Water. "Sewage Sludge Use and Disposal Rule (40 CFR Part 503) -- Fact Sheet," (November 1992).

________. "Re-evaluation of the Economic Impact Analysis of Effluent Limitations Guidelines for the Organic Chemicals, Plastics, and Synthetic Fibers Industry," (Washington, D.C.: May 1993).

U.S. General Accounting Office. "Information Management: Status of Formerly Approved Paperwork Requests," GAO/IMTEC-87-22 (Washington, D.C.: U.S. General Accounting Office, June 1987).

________. "SUPERFUND: Insuring Underground Petroleum Tanks," (GA)/RCED-88-39 (Washington, D.C.: U.S. General Accounting Office, January 1988).

________. "Paperwork Reduction: Mixed Effects on Agency Decision Processes and Data Availability," GAO/PEMD-89-20 (Washington, D.C.: U.S. General Accounting Office, September 1989).

________. "Extent and Causes of Erroneous Levies," GAO/GGD-91-9 (Washington, D.C.: U.S. General Accounting Office, December 1990).

________. "IRS Can Improve Its Program to Find Taxpayers Who Underreport Their Income," GAO/GGD-91-49 (Washington, D.C.: U.S. General Accounting Office, March 1991).

________. "IRS' Efforts to Improve Corporate Compliance," GAO/GGD-92-81BR, (Washington, D.C.: U.S. General Accounting Office, April 1992).

________. "Regulatory Burden: Recent Studies, Industry Issues, and Agency Initiatives," GAO/GGD-94-28 (Washington, D.C.: U.S. General Accounting Office, December 1993).

________. "Workplace Regulation," GAO/HEHS-94-138, Vol. I (Washington, D.C.: U.S. General Accounting Office, June 1994).

________. "Tax Compliance Burden Faced by Business Taxpayers," Testimony before the Subcommittee on Oversight, Committee on Ways and Means, House of Representatives, GAO/T-GGD-95-42 (Washington, D.C.: U.S. General Accounting Office, December 1994).

________. "Regulatory Reform: Information on Costs, Cost-Effectiveness and Mandated Deadlines for Regulations," GAO/PEMD-95-18BR (Washington, D.C.: U.S. General Accounting Office, March 1995).

________. "Experience With the Corporate Alternative Minimum Tax," GAO/GGD-95-88, (Washington, D.C.: U.S. General Accounting Office, April 1995).

________. "IRS Partnership Compliance Activities Could Be Improved," GAO/GGD-95-151, (Washington, D.C.: U.S. General Accounting Office, June 1995).

________. "Information on IRS' Taxpayer Compliance Measurement Program, GAO/GGD-96-21, (Washington, D.C.: U.S. General Accounting Office, October 1995).

________. "Estimates of the Tax Gap for Service Providers," GAO/GGD-95-59 (Washington, D.C.: U.S. General Accounting Office, December 1995).

________. "IRS Performance Indicators Provide Incomplete Information About Some Problems," GAO/GGD-96-48 (Washington, D.C.: U.S. General Accounting Office, December 1995).

U.S. Small Business Administration, Office of Advocacy. "The Changing Burden of Regulation, Paperwork, and Tax Compliance on Small Business: A Report to Congress," (Washington, D.C.: October 1995).

Van De Verg, Eric. "Environmental Concerns for Small Business," Small Business Research Summary Number 137 (Washington, D.C.: U.S. Small Business Administration, July 1993).

Wade Miller Associates, Inc. "Regulatory Impact Analysis of Proposed National Primary Drinking Water Regulations for Lead and Copper," prepared for the U.S. Environmental Protection Agency, Office of Drinking Water, June 1988.

________. "Final Regulatory Impact Analysis of National Primary Drinking Water Regulations for Lead and Copper," prepared for the U.S. Environmental Protection Agency, Office of Drinking Water, April 1991.

________. "Addendum to Draft Regulatory Impact Analysis of National Primary Drinking Water Regulations for Inorganic Chemicals," prepared for the U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water, October 1990.

________. "Regulatory Impact Analysis National Primary Drinking Water Regulations: Phase V Synthetic Organic and Inorganic Chemicals," prepared for the U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water, February 1992.

Warren, Melinda and Jones, Barry. "Reinventing the Regulatory System: No Downsizing in Administration Plan," Center for the Study of American Business Occasional Paper 155, (St. Louis, June 1995).

The White House Conference on Small Business. "Foundation for a New Century," Report to the President and Congress (Washington, D.C.: September 1995).

Williams, John R. "A New Look at the Delinquent Taxpayer Issue," The National Public Accountant (December 1993): 38-39.

Williams, L. K.; Chen, Richard C.; and Tearney, Michael G. "Accounting Standards: Overkill for Small Business?" The National Public Accountant (June 1989): 40-43.

Wilson, E. Lee, Metcalf; Richard W.; and Lieberman, Alvin H. "Electronic Filing: A Case Study," The National Public Accountant (May 1990): 32-35.

Zimmerman, Fred. "A Small Business Environmental Primer," The National Public Accountant (June 1992): 18-23, 31.