

9 Distributional Analyses: Economic Impact Analyses and Equity Assessment

The detailed study of regulatory consequences allows policymakers to fully understand a regulation's impacts, and to make an informed decision on its appropriateness. Economic information is necessary for the evaluation of at least two types of consequences of a regulatory policy: first, the regulation's efficiency, and second, its distributional effects. In principle, both of these consequences could be estimated simultaneously by a general equilibrium model. In practice, however, they are usually estimated separately, for the reasons discussed in Section 1.3.

This chapter discusses how the distributional effects of environmental regulations can be examined through economic impact analysis (EIA) and equity assessment. An EIA focuses on traditional classifications of affected entities, such as industrial sector classifications.¹⁷⁹ In contrast, an equity assessment addresses the distribution of impacts across subpopulations, and may also address broader concerns such as changes in the national distribution of income or wealth. Disadvantaged or vulnerable groups (e.g., small businesses, low income households, racial or ethnic minorities, and young children) may be of particular concern. Together, EIAs and equity assessments are referred to as distributional analyses.

9.1 Introduction to Economic Impact Analyses

An EIA identifies the specific groups that benefit from or are harmed by a policy, and then estimates the magnitude of their gains and losses. These estimates are derived from a study of the economic changes that occur across broadly defined economic sectors of society, including industry, government, not-for-profit organizations, and consumers. An EIA also examines more narrowly defined sectors within these broad categories, such as the solid waste industry or even an individual solid waste company. Therefore, EIAs may measure a broad variety of impacts, such as direct impacts on private business - including individual plants, whole firms, and industrial sectors - and indirect impacts on consumers and suppliers. The term "impacts" includes changes in profitability, employment, prices, government revenues or expenditures, and trade balances.

For any regulation, it is essential to ensure consistency between the EIA and the Benefit Cost Analysis. If a benefit-cost analysis is conducted, the corresponding EIA must be conducted within the same set of analytical bounds. To the extent possible, the EIA should adopt the same set of assumptions used by the BCA. Adjustments to these assumptions or to the overall modeling framework used for the BCA should only be made when absolutely necessary, and then should be noted clearly in the text of the analysis.

¹⁷⁹ The term "affected" is used throughout this chapter as a general economic term. Analysts should be aware that the authorizing statute for the rule, as well as other applicable statutes and administrative orders noted in this chapter, make more specific use of this term. For example, the Regulatory Flexibility Act includes the clause "subject to the requirements of the rule" when quantifying economic impacts, meaning that the analysis considers only those entities that are directly regulated by the rule. On the other hand, provisions in the Unfunded Mandates Reform Act (UMRA) and Executive Order 12866 address both direct and indirect impacts, and therefore define the affected population more broadly. Care should be taken to avoid double-counting when estimating direct and indirect impacts. See Chapter 8 for more details.

9.2 Introduction to Equity Assessments

An equity assessment examines the distribution of a regulation's costs, benefits, and other economic impacts on specific sub-populations (for an example, see Shadbegian, et al. 2005). An equity assessment may also analyze a regulation's impact on the distribution of national income or wealth.

An equity assessment is generally more concerned with sub-populations that experience net costs or other negative impacts than with those that experience net benefits or positive impacts. Whereas an EIA focuses on traditional classifications of affected entities (e.g., industrial classifications), an equity assessment often focuses on disadvantaged or vulnerable sub-populations, such as low-income households or children. An equity assessment may also focus on the average income of households or other relevant sub-groups (e.g., upper income households).

While an equity assessment may consider a regulation's effects on any sub-population and often starts with an evaluation of the impacts across all groups, it should always consider the effects on disadvantaged or vulnerable groups. Specifically, an equity assessment should examine sub-populations that are physically susceptible to environmental contamination, are less than fully capable of representing their own interests, and/or are economically disadvantaged or vulnerable. Groups such as children, low-income, or minority or ethnic populations, or populations with limited English proficiency, and small businesses, small governments, and small not-for-profit organizations are often included in equity assessments. EPA is frequently required by statute or policy to examine the effects of a rule on one or more of these groups when they are expected to experience a disproportionate, significant, and substantial impact. Finally, as with an EIA, an equity assessment should adopt the same assumptions included in the BCA.

9.3 Statutes and Policies

The following major statutes and executive orders directly concern distributional issues:

- Regulatory Flexibility Act of 1980 (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA);
- Unfunded Mandates Reform Act of 1995 (UMRA);
- E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations";
- E.O. 13045, "Protection of Children From Environmental Health Risks and Safety Risks";
- E.O. 13132, "Federalism"; and
- E.O. 13175, "Consultation and Coordination with Indian Tribal Governments"; and
- E.O. 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use."

Two additional executive orders ask agencies to consider distributional effects under special circumstances. E.O. 12866, "Regulatory Planning and Review," has multiple objectives, including a specific directive for agencies to consider distributive impacts and equity when designing regulations.¹⁸⁰ E.O. 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or

¹⁸⁰ EPA's Regulatory Management Division's Action Development Process Library (<http://intranet.epa.gov/adplibrary/>) is a resource for those who wish to access relevant statutes, executive orders, or Agency policy and guidance documents in their entirety. Accessed 7/14/2004.

1 Use,” requires agencies to provide a statement of energy effects for any significant energy action where
 2 adverse impacts on energy supply and prices are expected. Finally, OMB Circular A-4 provides guidance
 3 on preparing regulatory impact analyses, including a discussion of distributional effects (OMB 2003).¹⁸¹
 4

5 Table 9.1 lists dimensions that may be relevant in an EIA or equity assessment and links each dimension
 6 to a statute, order, or directive; population or entity; and sub-population.
 7

8 **Table 9.1 - Potentially Relevant Dimensions to Distributional Analyses**¹⁸²

Dimension	Statute, Order, or Directive	Population or Entity	Sub-Population
Sector	UMRA; E.O. 13132; OMB Circular A-4	Industry or government	Industries or state, local or tribal governments
Entity size	RFA; UMRA; OMB Circular A-4	Businesses, governments or not-for-profit organizations	Small businesses, small governmental jurisdictions, or small not-for-profit organizations
Minority status, income	E.O. 12898; OMB Circular A-4; E.O. 13175	Individuals or households	Racial or ethnic populations, low-income populations, Tribal populations
Age	E.O. 13045; OMB Circular A-4	Individuals or households	Children or elderly
Gender	OMB Circular A-4	Individuals	Male or female
Time	OMB Circular A-4	Individuals or households	Current or future generations
Geography	OMB Circular A-4; UMRA	Region	Regions, states, counties, or non-attainment areas
Energy	E.O. 13211	Entities that use, distribute, or generate energy	Energy sector

9

10 **9.4 Chapter Summary**

11 The remainder of this chapter is organized as follows. Sections 9.5 and 9.7 discuss economic impact
 12 analyses and equity assessments, respectively, including details regarding the components of each
 13 analysis, screening tools, data sources, and relevant dimensions to consider. Sections 9.6 and 9.8 discuss
 14 potential modeling approaches and frameworks for each type of analysis.
 15

16 It is important to note that the analyses described in this chapter could potentially be incorporated into a
 17 single social welfare function; however, such an approach is rigorous, and often infeasible due to lack of
 18 data or other limitations. Text Box 9.1 discusses this approach in more detail.
 19

¹⁸¹ See Chapter 2 for a brief description of these statutes and executive orders.

¹⁸² Some environmental statutes may also identify sub-populations that merit additional consideration. This document is limited to those statutes with broad coverage.

1 **Text Box 9.1 - Using a Social Welfare Function to Evaluate Efficiency-Equity Tradeoffs**

It is possible to combine the efficiency and distributional effects of a regulation into a single social welfare function. A social welfare function establishes criteria under which efficiency and equity choices are transformed into a single metric, making them directly comparable. The output of such a function is a ranking of policy outcomes that have different aggregate levels and distributions of net benefits. A social welfare function can provide empirical evidence that a policy alternative yielding higher net benefits but a less equitable distribution of wealth, is better or worse than a less efficient alternative that exhibits more equitable distributional consequences. See Sen (1970) and Arrow (1977) for a theoretical discussion of social welfare functions, and Norland and Ninassi (1998) for an application to energy markets.

In practice, a social welfare function requires explicit decisions about society's preferences regarding the distribution of resources. As a consequence, no functions exist that are universally or even widely accepted. As such, their use to evaluate efficiency-equity tradeoffs remains controversial. Nonetheless, future research may result in a set of feasible and practical options for social welfare functions (see Farrow (1998) for a description of potential alternatives). These guidelines do not suggest a particular social welfare function, or even recommend that analysts attempt to use such a function, but the approach merits further consideration as additional research and applications are developed.

2

3 **9.5 Conducting an Economic Impact Analysis**

4 There are three important issues to consider when conducting an EIA.¹⁸³ First, total cost is no longer of
5 primary importance in an EIA. Rather, the main focus is on the components and distribution of the total
6 social cost.

7

8 Second, transfers of economic welfare from one group to another are no longer assumed to cancel each
9 other out, as they do in a BCA. Taxpayers, consumers, producers, governments, and the many sub-
10 categories of these groups are all considered separately. While a BCA relies on estimates of the social
11 costs of a regulation, an EIA focuses on the private costs associated with compliance responses. The
12 same basic engineering or direct compliance cost estimates may be used as a starting point for developing
13 both social and private cost estimates, and are adjusted according to their current purpose.¹⁸⁴

14

15 Finally, there is a greater need for disaggregation in economic impact analyses than in benefit-cost
16 analyses. Results may be presented for specific counties or other geographic units, specific demographic
17 groups, or types of entities, as appropriate, placing heavy demands on the modeling framework.

18

19 **9.5.1 Screening for Potentially Significant Impacts**

20 A comprehensive analysis of all aspects of economic costs associated with a rule can require significant
21 time and resources, and its accuracy and thoroughness depend on the quality and quantity of available
22 data. Thus, screening analyses are often employed to determine data availability, the severity of a rule's
23 anticipated impacts, and the potential consequences of further analysis if undertaking it would require a
24 delay in the regulatory schedule. A screening analysis may be thought of as a "mini-EIA" consisting of a
25 rough examination of the data to identify sectors that may warrant further analysis.¹⁸⁵ Screening is

¹⁸³ Traditionally, EIAs focus on the costs of a particular rule or regulation. However, it is also possible to focus on the distribution of benefits or to calculate the net benefits for particular sub-populations. While this chapter discusses costs only, EIAs can also focus on benefits.

¹⁸⁴ For example, the tax status of a required piece of equipment is considered in private costs, but not in social costs.

¹⁸⁵ The screening analysis discussed in this section is distinct from the screening analysis required to comply with the Regulatory Flexibility Act (as referred to in Section 9.4.1.1).

1 effective for identifying the magnitude of the overall level of impacts on the regulated industry, but may
2 fail to identify potentially large impacts on a single sector, region, or facility.
3

4 There are no established definitions for what constitutes a large or a small impact. However, screening
5 analysis is a tiered approach that initially captures most of the possible impacts (i.e., allows for many false
6 positives) followed by a more detailed analysis that weeds out unfounded impacts. In this way, the
7 screening analysis will eventually balance the risk of identifying “false positives” and “false negatives.”
8

9 **9.5.2 Profile of Affected Industry Entities**

10 Analysts should consider changes imposed by the rule in the regulated industry, as well as how related
11 industries may be affected. Some industries may benefit from the regulation, while others may be subject
12 to significant costs. If the regulation causes a firm to use different inputs or new technologies, then the
13 producers of the new inputs will gain, while the producers of the old inputs will suffer. Developing a
14 detailed industry profile will identify those industries that may be affected positively and negatively by
15 the regulation.
16

17 **9.5.2.1 *Compiling an Industry Profile and Projected Baseline***

18

19 To determine the impacts of a particular regulation the analyst must understand the underlying structure
20 of the affected industry and its various linkages throughout the economy.¹⁸⁶ This includes an
21 understanding of the condition of the industry in terms of its finances and structure in the absence of the
22 rule, also called a baseline. A rule may impose different requirements and costs on new versus existing
23 entities. Such rules may affect industry competition, growth, and innovation by raising barriers to new
24 entry or encouraging continued use of outdated technology. Thus, a substantial portion of an EIA
25 involves characterizing the state of the affected firms and industries in the absence of the rule as a basis
26 for evaluating economic impacts.
27

28 The following are important inputs to defining an industry profile:
29

- 30 • **North American Industrial Classification System (NAICS) industry codes.** NAICS has
31 replaced the U.S. Standard Industrial Classification (SIC) system in the U.S. Department of
32 Commerce Economic Census and other official U.S. Government statistics. NAICS was
33 developed to provide comparable statistics about business activity across North America. It
34 identifies hundreds of new, emerging, and advanced technology industries and reorganizes
35 existing industries into more meaningful sectors, particularly in the service sector.¹⁸⁷
- 36 • **Industry summary statistics.** Summary statistics of total employment, revenue, number of
37 establishments, number of firms, and size of firms are available from U.S. Department of
38 Commerce Economic Census or the Small Business Administration.¹⁸⁸
- 39 • **Baseline industry structure.** Industry-level impacts depend on the competitive structure and
40 organization of the industry and the industry’s relationship to other economic entities. In
41 addition, the number and size distribution of firms/facilities and the degree of vertical integration

¹⁸⁶ Generally, analysts should initially assume a perfectly competitive market structure. One of the primary purposes of developing an industry profile is to confirm this assumption or discover evidence to the contrary.

¹⁸⁷ For more information see www.census.gov/epcd/www/naics.html, which includes a NAICS/SIC correspondence.

¹⁸⁸ See www.sba.gov/advo/stats/data.html for more information.

1 within the industry are important aspects of industry structure that affect the economic impact of
2 regulations.

- 3 • **Baseline industry growth and financial condition.** Industries and firms that are relatively
4 profitable in the baseline will be better able to absorb new compliance costs or take advantage of
5 potential benefits without experiencing financial distress. Industries that are enjoying strong
6 growth may be better able to recover increased costs through price increases than they would if
7 there were no demand growth. Section 9.2.3 provides suggestions for using financial ratios to
8 assess the significance of economic impacts on a firm's financial condition.
- 9 • **Characteristics of supply and demand.** Assessing the likelihood of changes in production and
10 prices requires information on the characteristics of supply and demand in the affected industries.
11 The relevant characteristics are reflected in price elasticities of supply and demand, which, if
12 available, allow direct quantitative analysis of changes in prices and production. Often, reliable
13 estimates of elasticities are not available and the analysis of industry-level adjustments must rely
14 on simplifying assumptions and qualitative assessments. See Appendix A for a discussion of
15 elasticities.

16 **9.5.2.2 Profile of Government Entities, Not-for-profit Organizations, and Households**

17 Analysts should carefully consider whether a particular rule will directly affect government entities, not-
18 for-profit organizations, or households.¹⁸⁹ For example, air pollution regulations that apply to power
19 plants may affect government entities such as municipally-owned electric companies; air regulations that
20 apply to vehicles may affect municipal buses, police cars, and public works vehicles; and effluent
21 guidelines for machinery repair activities may affect municipal garages. The profile of these affected
22 entities should include a brief description of relevant factors or characteristics.

23 Relevant factors for *government entities* may include:
24

- 25 • Number of people living in the community;
- 26 • Household income levels (e.g. median, income range);
- 27 • Number of children;
- 28 • Number of elderly residents;
- 29 • Unemployment rate;
- 30 • Revenue amounts by source; and
- 31 • Credit or bond rating of the community.

32 If property taxes are the major revenue source, then the assessed value of property in the community and
33 the percentage of this assessed value represented by residential versus commercial and industrial property
34 should be determined. If a government entity serves multiple communities, such as a regional water or
35 sewer authority, then relevant information should be collected for all the communities covered by the
36 government entity.

37 Data on community size, income, number of children and elderly, and unemployment levels are available
38 from the U.S. Census Bureau. Data on property values, amount of revenue collected from each revenue
39 source, and credit rating may be available from the community or state finance agencies. Depending on
40

¹⁸⁹ Government entities that may be affected include states, cities, counties, towns, townships, water authorities, villages, Indian Tribes, special districts, and military bases. Not-for-profit entities that may be affected include not-for-profit hospitals, colleges, universities, and research institutions.

1 the number of communities affected and the level of detail warranted, the analysis may rely on generally
2 available aggregate data only. In other cases, a survey of affected communities may be necessary.¹⁹⁰
3

4 Relevant characteristics of *not-for-profit entities* include:
5

- 6 • Entity size and size of community served;
- 7 • Goods or services provided;
- 8 • Operating costs; and
- 9 • Amount and sources of revenue.

10
11 If the entity is raising its revenues through user fees or charging a price for its goods/services (such as
12 university tuition), then the income levels of its clientele are relevant. If the entity relies on contributions,
13 then it would be helpful to know the financial and demographic characteristics of its contributors and
14 beneficiaries. If it relies on government funding (such as Medicaid) then possible future changes in these
15 programs should be identified.
16

17 Relevant features of *households* include standard socioeconomic and demographic characteristics, such
18 as:
19

- 20 • Income level;
- 21 • Household size;
- 22 • Number of children and elderly;
- 23 • Education level; and
- 24 • Ethnic composition.

25
26 Section 9.2.4 discusses the unique characteristics that should be considered when estimating impacts on
27 government and not-for-profit entities. Section 9.4 discusses households.
28

29 **9.5.2.3 Data Sources for Profiles**

30
31 Profiles generally rely on information from the following sources: economic journals, working papers,
32 dissertations, and industry trade publications as well as quantitative data describing the characteristics of
33 the industry.¹⁹¹ Relevant literature can be useful in characterizing industry activities and markets as well
34 as regulations that already affect the industry and can usually be efficiently identified through a
35 computerized search using on-line services such as Dialog, BRS/Search Services, Dow Jones
36 News/Retrieval, or EconLit. These on-line services contain over 800 databases covering business,
37 economic, and scientific topic areas. Table 9.2 describes some commonly used data sources for retrieving
38 quantitative data.
39

40 The industry profile may also identify situations where insufficient data are available through standard
41 sources. These situations often arise when the affected industry is one of many product lines or activities
42 of the identified facilities. In addition, for some industries, identification of the appropriate NAICS code
43 for all the firms or facilities included in the industry may be difficult if the industry can be categorized in
44 multiple ways. In these cases, and particularly if facility-level data are required to estimate economic

¹⁹⁰ In cases where a survey is needed, care should be taken to comply with the requirements of the Paperwork Reduction Act (PRA) (44 U.S.C. § 3501).

¹⁹¹ Academic literature may or may not contain quantitative data.

1 impacts, a survey of either a statistical sample or a census of affected facilities may be required to provide
 2 sufficient data for analysis.

3
 4

Table 9.2 - Commonly Used Profile Sources for Quantitative Data

Source	Data
Trade Publications and Associations	Market and technological trends, sales, location, regulatory events, ownership changes
U.S. Department of Commerce, <i>Economic Census</i> (www.census.gov/econ/census02/)	Sales, receipts, value of shipments, payroll, number of employees, number of establishments, value added, cost of materials, capital expenditures by sector
U.S. Department of Commerce, <i>U.S. Industry & Trade Outlook</i> (http://www.ita.doc.gov/td/industry/OTEA/outlook/ or http://outlook.gov/)	Description of industry, trends, international competitiveness, regulatory events
U.S. Department of Commerce, <i>Pollution Abatement Costs and Expenditures Survey</i> (www.census.gov/mcd)	Pollution abatement costs for manufacturing facilities by industry, state, and region
United Nations. <i>International Trade Statistics Yearbook</i>	Foreign trade volumes for selected commodities, major trading partners
Risk Management Association, <i>Annual Statement Studies</i> (www.rmahg.org/ann_studies/asstudies.html)	Income statement and balance sheet summaries, profitability, debt burden and other financial ratios, all expressed in quartiles and available for recent years (based on loan applicants only)
Dun & Bradstreet Information Services (www.dnb.com/us/)	Type of establishment, NAICS code, address, facility and parent firm revenues and employment
Standard & Poors (www.standardandpoors.com)	Publicly-held firms, prices, dividends, and earnings, line-of-business and geographic segment information, S&P ratings, quarterly history (10 years), income statement, ratio, cash flow and balance sheet analyses and trends
Securities and Exchange Commission Filings and Forms (EDGAR System Database) (www.sec.gov/edgar.shtml)	Income statement and balance sheet, working capital, cost of capital, employment, outlook, regulatory history, foreign competition, lines of business, ownership and subsidiaries, mergers and acquisitions
Value Line <i>Industry Reports</i>	Industry overviews, company descriptions and outlook, performance measures

5
 6

9.5.3 Detailing Impacts on Industry

7 This section explains how to determine the impact on individual plants or businesses so as to identify
 8 whether a particular plant or industry is likely to bear a disproportionate portion of the costs or benefits of
 9 a regulation.

10

9.5.3.1 Impacts on Prices

12

13 Predicted impacts on prices form the basis for determining how compliance costs are distributed between
 14 the directly-affected firms, their customers, and other related parties in a typical market. At one extreme,
 15 regulated firms may not be able to raise prices at all, and would consequently bear the entire burden of the
 16 added costs in the form of reduced profits. Reduced profits may result from reduced earnings on

1 continuing production, lost profits on products or services that are no longer produced, or some
2 combination of the two. In addition, suppliers to the directly-affected firms might bear part of the burden
3 in lost earnings if the regulation results in a decline in demand for particular products.¹⁹² At the other
4 extreme, firms may be able to raise prices enough to recover costs fully (depending on the elasticity of
5 demand). In this case, there is no impact on the profitability of the directly-affected firms but their
6 customers bear the burden of increased prices.

7
8 In general, the likelihood that price increases will occur can be evaluated by considering whether
9 competitive conditions allow the affected facilities to pass their costs on to consumers. The methods used
10 to conduct the analysis of the directly-affected markets depends on the availability of appropriate
11 estimates of supply and demand elasticities.¹⁹³ As noted above, in cases where reliable estimates of
12 elasticities are not available, the analyst must rely on a more basic investigation of the characteristics of
13 supply and demand in the affected market to reach a conclusion about the likelihood of full or partial
14 pass-through of costs via price increases. For example, an examination of the number of firms, quantity
15 of a product produced, and industry size will provide basic information about supply and demand.

16 17 **9.5.3.2 Impacts on Production and Employment**

18
19 As noted above, regulations may sufficiently increase the cost of doing business to make some or all
20 production unprofitable, or may reduce the quantity of product demanded as producers raise their prices
21 to maintain profitability. The associated reductions in output may result from lower operating rates at
22 existing plants, closure of some plants, or reduced future growth in production relative to what would
23 have occurred in the absence of regulation. Losses in employment are typically associated with these
24 reductions. However, regulations may cause a rise in output and employment in other sectors. When
25 determining the distribution of impacts of a regulation, both contractions and expansions should be noted.

26
27 EPA uses a variety of methods to assess changes in production and employment. In some cases, demand
28 and supply elasticities are used directly to calculate changes in output and prices that would result from a
29 supply curve shift associated with new compliance costs. Because the shape of the supply curve is often
30 not known, assumptions are made about its shape in the relevant region. General or partial equilibrium
31 models can also be used, as discussed in Chapter 8.

32
33 In other cases, analysts may assess the impacts of rules on the profitability of specific firms or industry
34 segments and identify potential plant closures based on a financial analysis. If partial or full plant
35 closures are projected, then it is important to consider whether the production lost at the affected facilities
36 will be shifted to other existing plants or to new sources, or simply vanish. If excess industry capacity
37 exists in the baseline and facilities are able to operate profitably while complying with the rule, then these
38 facilities may expand production to meet the demand created by the loss of plants that are no longer able
39 to operate profitably.¹⁹⁴

40
41 Therefore, total employment and production may not decline, but instead shift from higher cost plants to
42 more efficient competitors. Where appropriate, such changes in output and employment are addressed in

¹⁹² For example, regulations limiting sulfur emissions may result in reduced demand for high-sulfur coal, which results in a fall in the price of such coal and lost profits for its producers.

¹⁹³ See Appendix A for a more complete discussion of elasticity.

¹⁹⁴ Some surviving plants could experience increases in production, capacity utilization, and profits even though they are subjected to regulatory requirements, if their competitors face even greater cost increases.

1 the EIA. This is especially the case for rules that may have a strong regional impact.¹⁹⁵ Data on the ratio
2 of production or sales to employment can help predict the number of jobs lost as a result of reductions in
3 production. The regional distribution of job losses (and gains) can be calculated based on plant locations,
4 if they are known.

6 **9.5.3.3 Impacts on Profitability and Plant Closures**

8 The availability of financial information used to assess profitability varies greatly, depending on the
9 industry in question and the extent to which EPA is able to collect new information by surveying affected
10 entities. With limited exceptions, detailed financial information is generally unavailable from published
11 sources for individual plants or for privately-held companies. Financial data for publicly-held companies
12 may be too aggregated to allow analysis of the specific business practices affected by the rule. In the
13 absence of a new data collection by EPA, analysts may need to rely on financial profiles constructed for
14 model plants, or on industry-average data provided by the Census Bureau and other sources.¹⁹⁶ In some
15 cases, financial profiles used in the analysis of a previous rule-making might be adapted and updated to
16 analyze the impacts of the rule in question.

18 The severity of financial impacts to firms from a rule can range from no impact (if all costs are recovered
19 through price increases, for example) to a modest reduction in profits (closure of a production line or
20 plant) to bankruptcy of the firm. Criteria for assessing the degree of financial distress and for predicting
21 when a production line or plant would be shut down are not clear-cut.¹⁹⁷ If detailed financial profiles can
22 be developed, including revenues, costs, income statements, and balance sheets, a variety of financial
23 tests can be used to assess the likelihood of financial distress or closure. These tests address the following
24 issues:

- 26 • Do the costs of the regulation result in a negative discounted after-tax cash flow?¹⁹⁸
- 27 • Does the facility or firm's profitability fall below acceptable levels (as measured by some
28 industry standard)?
- 29 • Is the facility's or firm's ability to finance its operations and pay its obligations jeopardized?

31 Plants or firms that fail these tests are potentially at risk for closure.¹⁹⁹ A variety of considerations affect
32 a firm's decision to close a production line or a plant. These include the following:²⁰⁰

¹⁹⁵ UMRA Section 202 requires regional impact analysis as an element of the UMRA cost analysis when "accurate estimates are reasonably feasible."

¹⁹⁶ Some sources of financial data are listed in Table 9.2.

¹⁹⁷ As stated above, most analyses assume a perfectly competitive market, which in practice may not correctly characterize the market structure. In these cases, analyses should be adapted to the relevant market structure.

¹⁹⁸ If after-tax cash flow is negative under baseline conditions (before considering compliance costs), the facility is a likely candidate for closure even in the absence of additional compliance costs. These closures should not be attributed to the rule, but rather should be classified as baseline closures.

¹⁹⁹ If it is possible to estimate plant liquidation values, another test can be added under the assumption that plants may close if the value of continuing to operate is less than the liquidation value.

²⁰⁰ Micro-economic principles dictate shutdown when price is less than marginal cost at the point where marginal cost is increasing. It is unlikely that analysts will have the data necessary to conduct this type of analysis, but it is important to note.

- 1 • **The profitability of the plant** itself provides insight into whether the operation will be continued
2 if the plant represents a stand-alone business. This also assumes that it is possible to construct a
3 financial profile of that business.
- 4 • **The role the plant plays in a larger operation** may influence closure decisions. For example,
5 some plants may be part of a vertically or horizontally integrated operation. Such plants might
6 not be viable as stand-alone operations but may continue to operate based on their contribution to
7 the business line as a whole. It is therefore important to analyze impacts on the firm as a whole
8 and not just on individual plants.
- 9 • **A negative discounted cash flow** indicates that returns are below the rate required to provide an
10 adequate return on equity and payment of interest. Closures in the short-run are likely to occur if
11 earnings do not cover variable costs plus the amortized cost of compliance. Divestment and
12 closures occur over the longer term if earnings are not sufficient to justify investment in the plant
13 and equipment.

14
15 Where closures and reduced production are likely for some but not all plants, firms may face complex
16 decisions about which plants to close. These decisions reflect relative operating costs, age of equipment,
17 tax and other incentives offered by local communities and states to retain business, and logistical
18 considerations. It is important to note that analyses of plant closures identify candidates for closure,
19 rather than provide reliable predictions of which specific plants will close. The available information on
20 plant-level operating costs and contributions to earnings is generally too uncertain to allow a more precise
21 prediction of plant closures.

22
23 Short of closure, financial distress may occur. Financial distress measures a continuum from mild to
24 severe financial weakness, and may result in difficulty obtaining financing and attracting capital.²⁰¹
25 Although in practice analysts may use a variety of measures of financial distress, using financial ratios
26 has the advantage that it mirrors analyses of investment and lending institutions. Particular measures
27 include impacts on profitability (such as return on equity or assets) and measure of liquidity (such as
28 interest coverage ratio).²⁰²

29 30 **9.5.3.4 Impacts on Related Industries and Households**

31
32 The economic and financial impacts of regulatory actions spread to industries and communities that are
33 linked to the regulated industries, resulting in indirect business impacts. These indirect impacts may
34 include employment and income losses, as well as changes in the competitiveness and efficiency of
35 related markets. Compliance-related industries may also yield offsetting gains in employment and
36 income when a regulated industry purchases equipment, facilities, or labor to comply with a regulation.

37
38 Although in principle every economic entity can be thought of as having a connection with every other
39 entity, practical considerations usually require an analysis of indirect impacts for a manageable subset of

²⁰¹ Researchers have developed various composite measures that are designed to assess the potential for bankruptcy. The most commonly cited is the ZETA model or “Z-score” developed by Altman (1993). This model uses a weighted average of five variables to predict potential for bankruptcy. The ratios include working capital/total assets, retained earnings/total assets, earnings before interest and taxes (EBIT)/total assets, market value of equity/par value of debt, and sales/total assets. The model includes levels for this composite score that represent clear potential for bankruptcy, low or no potential for bankruptcy, and an uncertain grey area.

²⁰² The interest coverage ratio is a ratio of earnings before interest and taxes (EBIT) divided by interest. It measures the number of times a company can make its interest payments with EBIT. The lower the ratio the higher the debt burden of the company.

1 economic entities that are most strongly linked to the regulated entity. In addition to considering major
2 customers and specialized suppliers of the affected industry, it is also important to consider less obvious
3 but potentially significant links, such as basic suppliers like electricity generators.
4

5 Features of households relevant to economic impacts include standard socioeconomic and demographic
6 characteristics such as income and education level, household size and age distribution. These factors
7 play a role in determining the ultimate effect of changes in employment and income generated from a
8 regulatory action.
9

10 For these reasons, the analysis of linkages should use a framework that thoroughly measures indirect as
11 well as direct linkages. Whatever the approach, the goal of the analysis is to measure how employment,
12 competitiveness, and income are likely to change for related entities and households given a certain
13 amount of employment, competitiveness, and income in a regulated market.²⁰³
14

15 ***9.5.3.5 Impacts on Economic Growth and Technical Inefficiency***

16

17 While regulatory interventions can theoretically lead to macroeconomic impacts, such as growth and
18 technical efficiency, such impacts may be impossible to observe or predict. In some cases, however, it
19 may be feasible to use macroeconomic models to evaluate the regulatory impact on gross domestic
20 product, factor payments, inflation, and aggregate employment. For regulations that are expected to have
21 significant impacts in a particular region, use of regional models - either general equilibrium or other
22 regionally-based models - may be valuable.
23

24 Typically in regulatory impact analyses some macroeconomic regulatory effects go unquantified due to
25 analytic constraints. For example, price changes induced by a regulation can lead to technical
26 inefficiency because firms are not choosing the production techniques that minimize the use of labor and
27 other resources in the long run. However, measuring these effects can be difficult due to data or other
28 analytical limitations.
29

30 ***9.5.3.6 Impacts on Industry Competitiveness***

31

32 Regulatory actions that substantially change the structure or conduct of firms can produce indirect
33 impacts by changing the competitiveness of the regulated industry, as well as that of linked industries.²⁰⁴
34 An analysis of impacts on competitiveness begins by examining barriers to entry and market
35 concentration, and by answering the following two key questions:
36

- 37 • **Does the regulation erect entry barriers that might reduce innovation by impeding new**
38 **entrants into the market?** High sunk costs associated with capital costs of compliance or
39 compliance determination and familiarization would be an entry barrier attributable to the
40 regulation. Sunk costs are fixed costs that cannot be recovered in liquidation; they can be
41 calculated by subtracting the liquidation value of assets from the acquisition cost of assets facing
42 a new entrant, on an after-tax basis.²⁰⁵ Lack of access to debt or equity markets to finance fixed
43 costs of entering the market can also present entry barriers, even if none of the fixed costs are
44 sunk costs. However, if financing is available and fixed costs are recoverable in liquidation, the
45 magnitude of fixed costs alone may not be sufficient to be a barrier to entry.

²⁰³ Approaches to measuring these effects are discussed in Section 9.3.

²⁰⁴ See Jaffe, et al. (1995) for an overview.

²⁰⁵ Sunk costs are sometimes referred to as exit barriers.

- 1 • **Does the regulation tend to create or enhance market power and reduce the economic**
2 **efficiency of the market?** Important measures of competitiveness of an industry are degrees of
3 horizontal and vertical integration (i.e., concentration) between both buyers and sellers in the
4 baseline compared to post-compliance. If an industry becomes more concentrated as a result of
5 the regulation then there are fewer firms within the industry. In this case, market power will be
6 concentrated in the hands of a few entities, which may result in a less efficient market than before
7 the regulation. Closely related to concentration, product differentiation may occasionally either
8 increase or decrease due to a regulatory action. A regulation may result in less product
9 differentiation due to restrictions on production. This could mean that market power is more
10 concentrated among the firms that manufacture the product.

11
12 **9.5.3.7 Impacts on Energy Supply, Distribution, or Use**

13
14 Executive Order 13211 requires agencies to prepare a Statement of Energy for “significant energy
15 actions,”²⁰⁶ which are defined as significant regulatory actions (under Executive Order 12866) that also
16 are “likely to have a significant adverse effect on the supply, distribution, or use of energy.” These
17 significant adverse effects are defined as

- 18 1. Reductions in crude oil supply in excess of 10,000 barrels per day;
19 2. Reductions in fuel production in excess of 4,000 barrels per day;
20 3. Reductions in coal production in excess of 5 million tons per year;
21 4. Reductions in natural gas production in excess of 25 million mcf per year;
22 5. Reductions in electricity production in excess of 1 billion kilowatt-hours per year or in excess of
23 500 megawatts of installed capacity;
24 6. Increases in energy use required by the regulatory action that exceed any of the thresholds above;
25 7. Increases in the cost of energy production in excess of one percent;
26 8. Increases in the cost of energy distribution in excess of one percent; or
27 9. Other similarly adverse outcomes.

28 For actions that may be significant under EO 12866, particularly for those that impose requirements on
29 the energy sector, analysts must be prepared to examine the energy effects listed above.

30
31 **9.5.4 Detailing Impacts on Governments and Not-for-Profit Organizations**

32 Section 9.2.3 discusses how to measure the impact of regulations and requirements on private entities,
33 such as firms and manufacturing facilities. When dealing with private entities, an important focus is on
34 measures that assess changes in profits (or proxy measures of profit). This section describes impact
35 measures for situations where profits and profitability are not the focus of the analysis. Rather, the
36 ultimate measure of impacts is the ability of the organization or its residents to pay for the requirements.
37 Many of the same questions apply:

- 38 • Which entities are affected and what are their characteristics?
39

²⁰⁶ See section 2.1.6 for EPA and OMB’s guidance on EO 13211.

- 1 • To what extent does the regulation increase operating costs?
- 2 • To what extent does the regulation impact operating procedures?
- 3 • Does the regulation change the amount and/or quality of the goods and services provided?
- 4 • Can the entity raise the necessary capital to comply with the regulation?
- 5 • Does the regulation change the entity's ability to raise capital for other projects?

6
7 EPA regulations may affect governments and not-for-profit organizations in at least three significant
8 ways. First, they may directly impose requirements on the entity, such as water pollution requirements
9 for publicly-owned wastewater treatment works or air pollution restrictions that affect municipal bus
10 systems or power plants. Second, they may impose costs on government agencies associated with
11 implementing and enforcing regulations. Finally, they may impose indirect costs, such as increased
12 unemployment (and thus less tax revenues) in a community because a regulation has resulted in reduced
13 production (or even closure) at a plant in the community.

14 **9.5.4.1 Direct Impacts on Government and Not-for-Profit Entities**

15
16 Direct impact measures can fall into two categories:

- 17 • Those that measure the impact itself in terms of the relative size of the costs and the burden it
18 places on residents; and
- 19 • Those that measure the economic and financial conditions of the entity that affect its ability to
20 pay for the requirements.

21
22 For each category, there are several types of measures that can be used either as alternatives or jointly to
23 illuminate various aspects of the direct impacts.

24 **Measuring the Relative Cost and Burden of the Regulations**

25
26 There are three commonly used approaches to measuring the direct burden of the rule; all involve
27 calculating the annualized costs of complying with the regulation. For *government entities*, the three
28 approaches are:

- 29 • **Annualized compliance costs as a percentage of annual costs for the affected service .** This
30 measure defines the impact as narrowly as possible and measures impacts according to the
31 increase in costs to the entity. In practice, EPA has often defined compliance costs that are less
32 than one percent of the current annual costs of the activity as placing a small burden on the entity.
- 33 • **Annualized compliance costs as a percentage of annual revenues of the governmental unit.**
34 The second measure corresponds to the commonly used private-sector measure of annualized
35 compliance costs as a percentage of sales. Referred to as the "Revenue Test", it is one of the
36 measures suggested in the RFA Guidance (U.S. EPA 2006b).
- 37 • **Per household (or per capita) annualized compliance costs as a percentage of median
38 household (or per capita) income.** The third measure compares the annualized costs to the
39 ability of residents to pay for the cost increase. The ability of residents to pay for the costs affects
40 government entities because fees and taxes on residents fund these entities. To the extent that
41 residents can (or cannot) pay for the cost increases, government entities will be impacted.
42 Commonly referred to as the "Income Test," this measure is described in the RFA Guidance (U.S.
43 EPA 2006b) and the EPA Office of Water *Interim Economic Guidance for Water Quality*

1 *Standards: Workbook* (U.S. EPA 1995a).²⁰⁷ Costs can be compared to either median household
2 or median per capita income. In calculating the per household or per capita costs, the actual
3 allocation of costs needs to be considered. If the costs are paid entirely through property taxes,
4 and the community is predominately residential, then an average per household cost is probably
5 appropriate. If, however, some or all of the costs are allocated to users (e.g., fares paid by bus
6 riders or fees paid by users for sewer, water, or electricity supplied by municipal utilities), then
7 this needs to be taken into account and a more narrow measure may be appropriate. In addition,
8 if some of the costs are borne by local firms, then that portion of the costs should be handled
9 separately.

10
11 There are two commonly used impact measures for *not-for-profit entities*: annualized compliance costs as
12 a percentage of annual operating costs, and annualized compliance costs as a percentage of total assets.
13 The first is equivalent to the first of the impact measures described for government entities, measuring the
14 percentage increase in costs that would result from the regulation being analyzed. The second is a more
15 severe test, measuring the impacts if the annualized costs are paid out of the institution's assets.

16 17 ***Measuring the Economic and Financial Health of the Community or Government Entity***

18
19 The second category of direct impact measures examines the economic and financial health of the
20 community involved, since this affects its ability to finance or pay for expenditures required by a program
21 or rule. A given cost may place a much heavier burden on a poor community than on a wealthy one of
22 the same size. As with the impact measures described above, there are three categories of economic and
23 financial condition measures:

- 24
25 • **Indicators of the community's debt situation.** Debt indicators are important because they
26 measure both the ability of the community to absorb additional debt (to pay for any capital
27 requirements of the rule) and the general financial condition of the community. While several
28 debt indicators have been developed and used, this section describes two common indicators.
29 One measure is the government entity's bond rating. Awarded by companies such as Moody's
30 and Standard & Poor's (see Table 9.3), bond ratings evaluate a community's credit capacity and
31 thus reflect the current financial conditions of the government body.²⁰⁸ A second frequently used
32 measure is the ratio of overall net debt to the full market value of taxable property in the
33 community, i.e., debt to be repaid by property taxes. Overall net debt should include the debt of
34 overlapping districts. For example, a household may be part of a town, regional school district,
35 and county sewer and water district, all of which have debt that the household is helping to
36 pay.²⁰⁹ See Table 9.3 for interpretations of the values for these measures.

²⁰⁷ For example, in the water guidance and other EPA Office of Water analyses compliance costs are considered to have little impact if they are less than 1 percent of household income. Compliance costs over 2 percent are categorized as a large impact, and a range from 1 to 2 percent fall into a gray area and are considered to have an indeterminate impact.

²⁰⁸ The indicators and benchmark values in Table 9.3 are drawn from a document, "Combined Sewer Overflows - Guidance for Financial Capability Assessment and Schedule Development," which discusses how to assess the feasibility of systems being able to comply with rules (U.S. EPA 1997). These are general benchmarks that may prove useful in assessing financial stability in an EIA.

²⁰⁹ An alternative to the net debt as percent of full market value of taxable property is the net debt per capita. Commonly used benchmarks for this measure are net debt per capita less than \$1,000 indicates a strong financial condition, between \$1,000 and \$3,000 indicates a mid-range or gray area, and greater than \$3,000 indicates a weak financial condition.

- 1 • **Neither of these two debt measures is always appropriate.** Some communities, especially
 2 small ones, may not have a bond rating. This does not necessarily mean that they are not
 3 creditworthy; it may only mean that they have not had an occasion recently to borrow money in
 4 the bond market. Also, if the government entity does not rely on property taxes, as may be the
 5 case for a state government or an enterprise district, then the ratio of debt to full market value of
 6 taxable property is not relevant. Information on debt and assessed property values are available
 7 from the financial statement of each community. The state auditor’s office is likely to maintain
 8 this information for all communities within a state.
- 9 • **Indicators of the economic/financial condition of the households in the community.** There
 10 are a wide variety of household economic and financial indicators. Two commonly used
 11 measures are the unemployment rate and median household income. Unemployment rates are
 12 available from the Bureau of Labor Statistics. Median household income is available from the
 13 U.S. Census Bureau; some states maintain more up-to-date databases on income levels.
 14 Benchmark values for these (and other) measures are presented in Table 9.3.
- 15 • **Financial management indicators.** This category consists of indicators that gauge the general
 16 financial health of the community, as opposed to the general financial health of the residents.
 17 Because most local communities rely on property taxes as their major source of revenues, there
 18 are two ratios that provide an indicator of financial strength. First, property tax revenues as a
 19 percentage of the full market value of taxable property indicates the burden that property taxes
 20 place on the community. Second, the property tax collection rate gauges the efficiency with
 21 which the community’s finances are managed, and indirectly whether the tax burden may already
 22 be excessive. As the property tax burden on taxpayers increases, they are more likely to avoid
 23 paying their taxes or to pay them late.

24 **Table 9.3 - Indicators of Economic and Financial Well-Being of Government Entities**

Indicator	Weak	Mid-Range	Strong
Bond rating	Below BBB (S&P) Below Baa (Moody's)	BBB (S&P) Baa (Moody's)	Above BBB (S&P) Above Baa (Moody's)
Overall net debt as percent of full market value of taxable property	Above 5%	2% - 5%	Below 2%
Unemployment rate	More than 1 percentage point above national average	Within 1 percentage point of national average	More than 1 percentage point below national average
Median household income	More than 10% below the state median	Within 10% of the state median	More than 10% above the state median
Property tax revenue as percent of full market value of taxable property	Above 4%	2% - 4%	Below 2%
Property tax collection rate	Less than 94%	94% - 98%	More than 98%

26 Source: U.S. EPA 1997b.

27
 28 Measuring the financial strength of *not-for-profit* entities includes assessing:
 29

- 1 • How many reserves the entity has;
- 2 • How much debt the entity already has and how its annual debt service compares to its annual
- 3 revenues; and
- 4 • How the entity's fees or user charges compare with the fees and user charges of similar
- 5 institutions.

6
7 As with government entities, this analysis is meant to judge whether the entity is in a strong or weak
8 financial position to absorb additional costs.

9 10 **9.5.4.2 Administrative, Enforcement, and Monitoring Burdens on Governments**

11
12 Many EPA programs require effort on the part of different levels of government for administration,
13 enforcement, and monitoring. These costs must be included when estimating impacts of a regulation to
14 comply with UMRA and to calculate the full social costs of a program or rule. See Chapter 8 for more
15 information on government regulatory costs.

16 17 **9.5.4.3 Induced Impacts on Government Entities**

18
19 The induced impacts on government entities should also be considered. For example, a manufacturing
20 facility may reduce or suspend production in response to a regulation, thus reducing the income levels of
21 its employees. In turn, these reductions will spread through the economy by means of changes in
22 household expenditures. These induced impacts include the familiar multiplier effect, in which loss of
23 income in one household results in less spending by that household and therefore less income in
24 households and firms associated with goods previously purchased by the first household.

25
26 Decreased household and business income can affect the government sector by reducing tax revenues and
27 increasing expenditures on income security programs (the automatic stabilizer effect), employment
28 training, food and housing subsidies, and other fiscal line items. Due to wide variation in these programs
29 and in tax structures, estimating public sector impacts for a large number of government jurisdictions can
30 be prohibitively difficult.

31
32 On the other hand, compliance expenditures increase income for businesses and employees that provide
33 compliance-related goods and services. These income gains also have a multiplier effect, offsetting some
34 of the induced losses in tax revenue and increases in government expenditures identified above. As some
35 linkages may be more localized than others, it is important to clearly identify where the gains and losses
36 occur.

37 38 **9.6 Approaches to Modeling in an Economic Impact Analysis**

39 This section returns to the methods for estimating social costs covered in Chapter 8, adding more insight
40 on their application to EIA. As noted above, the analytic methods used for the distributional analysis of a
41 particular regulation should be consistent with those used for the corresponding BCA.

42 43 **9.6.1 Direct Compliance Costs**

44 The simplest approach to measuring the distribution of impacts is to estimate and verify the private costs
45 of compliance. This is necessary regardless of whether the entities affected are for-profit, governmental,
46 communities, or not-for-profit entities. Direct compliance costs are considered the most conservative
47 estimate of private costs and include annual costs (e.g., operation and maintenance of pollution control
48 equipment), as well as any capital costs, but do not include implicit costs.

1
2 Verifying the compliance cost estimates entails two steps. First, the full range of responses to the rule
3 needs to be identified, including pollution prevention alternatives and any differences in response across
4 sub-sectors and/or geographic regions. Second, the costs for each response need to be checked to
5 determine if all elements are included and the costs are consistent within a given base year. To ensure
6 consistency across years, either a general inflation factor, such as the Gross Domestic Product (GDP)
7 implicit price deflator, or various cost indices specific to the type of project should be used.²¹⁰ The base
8 year and indexing procedure should be stated clearly.
9

10 Implicit costs that do not represent direct outlays may be important. The cost estimates should include
11 such elements as production lost during installation, training of operators, and education of users and
12 citizens (e.g., programs involving recycling of household wastes). The cost of acquiring a permit is not so
13 much the permit fee as it is the lost opportunities during the approval process. Likewise, the cost of
14 having a car's emissions inspected is not so much the fee as it is the value of registrants' time.
15

16 There are several issues analysts should consider when estimating the direct compliance costs of
17 environmental polices for an EIA. These include:
18

- 19 • **Before- versus After-Tax Costs.** For businesses, the cost of complying with regulations is
20 generally deductible as an expense for income tax purposes. Therefore, the effective burden is
21 reduced for taxable entities because they can reduce their taxable income by the amount of the
22 compliance costs. The effect of a regulation on profits is therefore measured by after-tax
23 compliance costs. Operating costs are generally fully deductible as expenses in the year incurred.
24 Capital investments associated with compliance must generally be depreciated.²¹¹ In most cases,
25 communities, not-for-profits, and governments do not benefit from reduced income taxes that can
26 offset compliance costs. Therefore, adjustments to cost estimates, annualization formulas, and
27 cost of capital calculations required to calculate after-tax costs should not be used in analyses of
28 impacts on governments, not-for-profits, and households.
- 29 • **Transfers.** Some types of compliance costs incurred by the regulated parties may represent
30 transfers among parties. Transfers, such as payments for insurance or payments for marketable
31 permits, do not reflect use of economic resources. However, individual private cost estimates
32 used in the EIA include such transfers.²¹²
- 33 • **Discounting.** Compliance costs often vary over time, perhaps requiring initial capital
34 investments and then continued operating costs. To estimate impacts, the stream of costs is
35 generally discounted to provide a present value of costs that reflects the time value of money.²¹³
36 In contrast to social costs and benefits, which are discounted using a social discount rate, private

²¹⁰ The GDP implicit price deflator is reported by the U.S. Department of Commerce, Bureau of Economic Analysis in its *Survey of Current Business* (www.bea.gov/bea/pubs.htm). The annual *Economic Report of the President*, Executive Office of the President, is another convenient source for the GDP deflator (www.gpoaccess.gov/eop/).

²¹¹ Current federal and state income tax rates can be obtained from the Federation of Tax Administrators, *State Tax Rates & Structure*, available from <http://www.taxadmin.org/fta/rate/default.html>. Accessed 5/12/2004.

²¹² These transfers cancel out in a BCA. In an EIA the distribution of results is important, therefore the transfers are included.

²¹³ The present value of costs may then be annualized to provide an annual equivalent of the uneven compliance cost stream. Annualized costs are also discussed in Chapter 6.

1 costs are discounted using a rate that reflects the regulated entity's cost of capital.²¹⁴ The
2 private discount rate used will generally exceed the social discount rate by an amount that reflects
3 the risk associated with the regulated entity in question.²¹⁵ For firms, the cost of capital may
4 also be determined by their ability to deduct debt from their tax liability.

- 5 • **Annualized Costs.** Annualizing costs involves calculating the annualized equivalent of the
6 stream of cash flows associated with compliance over the period of analysis. This provides a
7 single annual cost number that reflects the various components of compliance costs incurred over
8 this period. The annual value is the amount that, if incurred each year over the selected time
9 period, would have the same present value as the actual stream of compliance expenditures.
10 Annualized costs are therefore a convenient compliance cost metric that can be compared with
11 annual revenues and profits. It is important to remember that using annualized costs masks the
12 timing of actual compliance outlays. For some purposes, using the underlying compliance costs
13 may be more appropriate. For example, when assessing the availability of financing for capital
14 investments, it is important to consider the actual timing of capital outlays.
- 15 • **Fixed versus Variable Costs.** Some types of compliance costs vary with the size of the
16 regulated enterprise, such as quantity of production. Other components of cost may be fixed with
17 respect to production or other size measures, such as the costs involved in reading and
18 understanding regulatory requirements. Requirements that impose high fixed costs will impose a
19 higher cost per unit of production on smaller firms than on larger firms. It is important that the
20 effects of any economies of scale are reflected in the compliance costs used to analyze economic
21 impacts.²¹⁶ Using the same average annualized cost per unit of production for all firms may
22 mask the importance of such fixed costs and understate impacts on small entities.

23 9.6.2 Partial Equilibrium Models

25 A partial equilibrium framework limits a distributional analysis to impacts on entities associated with a
26 few directly and indirectly affected output markets only. Partial equilibrium models can range in size
27 from an analysis that estimates compliance costs for the affected industry only (i.e., direct compliance
28 costs) to multi-market models encompassing several directly and indirectly affected sectors.

29
30 If a single market partial equilibrium model is the only information source available for an analysis of
31 distributional outcomes, then it may be possible to adopt further assumptions and acquire additional data
32 to approximate distributional consequences of concern. This may include deriving ratios to aggregate
33 changes in order to distribute these changes to specific regions or sectors. These new assumptions should
34 be consistent with those used for the corresponding BCA.

35
36 Multi-market models consider the interactions between a regulated market and other important related
37 markets (outputs and inputs), requiring estimates of elasticities of demand and supply for these markets as
38 well as cross-price-elasticities (also found in computable general equilibrium models). These models are
39 best used when potential distributional effects on related markets might be considerable, but more
40 complete modeling using a computable general equilibrium (CGE) framework may not be available or

²¹⁴ While the discount rate differs, the formula used to discount private costs is the same as used for social costs.
See Chapter 6 for details.

²¹⁵ Risk adjusted rates for different industries can be obtained from Ibbotson Associates (2004).

²¹⁶ Economies of scale characterize costs that decline on a per unit basis as the scale of an operation increases.

1 practical. Partial equilibrium models may also be more appropriate for regionally-based or resource
2 specific regulations which are too specific for more aggregated CGE models.²¹⁷

4 **9.6.3 Computable General Equilibrium Models**

5 CGE models are particularly effective in assessing resource allocation and welfare distribution effects.
6 These effects include the allocation of resources across sectors (e.g., employment by sector), the
7 distribution of output by sector, the distribution of income among factors, and the distribution of welfare
8 across different consumer groups, regions, and countries. By design, the basic capacity to describe and
9 evaluate these sorts of distributional impacts exists to some extent within every CGE model. More
10 detailed impacts (e.g., affects on a particular facility) or impacts of a particular kind (e.g., affects on
11 drinking water) will require a more complex and/or tailored model formulation and the data to support it.

12
13 The simplest CGE models generally include a single, representative consumer, a few production sectors,
14 and a government sector, all within a single-country, static framework. Additional complexities may be
15 specified for the model in a variety of ways. Consumers may be divided into different groups by income,
16 occupation, or other socioeconomic criteria. Producers may be disaggregated into dozens or even
17 hundreds of sectors, each producing a unique commodity. The government, in addition to implementing a
18 variety of taxes and other policy instruments, may provide a public good or run a deficit. CGE models
19 may be international in scope, consisting of many countries or regions linked by international flows of
20 goods and capital. The behavioral equations that characterize economic decisions may take on simple or
21 complex functional forms. The model may be solved dynamically over a long time horizon,
22 incorporating inter-temporal decision-making on the part of consumers or firms. These choices have
23 implications for the treatment of savings, investment, and the long-term profile of consumption and
24 capital accumulation.

25
26 As effective as CGE models can be for looking at long-term resource allocation issues, they have
27 limitations for the kinds of distribution analysis described above. CGE models assume that markets clear
28 in every period and often do not consider short-term adjustment costs, such as lingering unemployment.
29 The analyst should be careful to select a model that does not assume away the underlying issue addressed
30 by the distribution analysis. Moreover, a CGE model may not be feasible or practical to use when data
31 and resources are limited or when the scope of expected significant market interactions is limited to a
32 subset of economic sectors. In such instances a partial equilibrium model can be adopted as a more
33 appropriate alternative to a CGE model.²¹⁸

35 **9.7 Conducting an Equity Assessment**

36 This section discusses various subpopulations or other groups that may be disproportionately affected by
37 the benefits or costs of a policy and addresses how to consider these groups in an analysis. Note that the
38 term “subpopulations” refers to portions of the population, such as small businesses or socially or
39 economically disadvantaged people, as well as populations at different ages, such as children or elderly.

41 **9.7.1 Impacts on Small Entities**

42 The Regulatory Flexibility Act, as amended by the Small Business Regulatory Fairness Act of 1996
43 (RFA), and Section 203 of the Unfunded Mandates Reform Act of 1995 (UMRA) require agencies to

²¹⁷ See the discussion of multi-market modeling in Chapter 8 and Just, Hueth, and Schmitz (1982).

²¹⁸ For a discussion of CGE analysis see Chapter 8 and Dixon, et al. (1992).

1 consider a proposed regulation’s economic effects on small entities, specifically, small businesses, small
2 governmental jurisdictions, or small not-for-profit organizations. The definition of “small” for each of
3 these entities is described below. For guidance on when it is necessary to examine the economic effects
4 of a regulation under the RFA or UMRA, analysts should consult EPA guidelines on these administrative
5 laws (U.S. EPA 2006b and U.S. EPA 1995b, respectively). In general, the Agency must fulfill certain
6 procedural and/or analytical obligations when a rule has a “significant impact on a substantial number of
7 small entities” (abbreviated as SISNOSE) under the RFA or when a rule might “significantly“ or
8 ”uniquely“ affect small governments under Section 203 of UMRA.

9
10 **9.7.1.1 Small Businesses**

11
12 The RFA requires agencies to begin with the definition of small business that is contained in the Small
13 Business Administration’s (SBA) small business size standard regulations.²¹⁹ The RFA also authorizes
14 any agency to adopt and apply an alternative definition of small business “where appropriate to the
15 activities of the agency” after consulting with the Chief Counsel for Advocacy of the SBA and after
16 opportunity for public comment. The agency must also publish any alternative definition in the *Federal*
17 *Register* (U.S. EPA 2006b).

18
19 The analytical tasks associated with complying with the RFA include a screening analysis for SISNOSE.
20 If the screening analysis reveals that a rule *cannot* be certified as having no SISNOSE, then the RFA
21 requires a regulatory flexibility analysis be conducted for the rule, which includes a description of the
22 economic impacts on small entities. The impacts on small businesses are generally assessed by
23 estimating their direct compliance costs and comparing them to sales or revenues. Because an estimate of
24 direct compliance costs tends to be a conservatively low estimate of a regulation’s impact, further analysis
25 examining the impacts discussed in section 9.2.3 (specifically in relation to small businesses) may
26 provide additional information for decision-makers.²²⁰

27
28 **9.7.1.2 Small Governmental Jurisdictions**

29
30 The RFA defines a small governmental jurisdiction as the government of a city, county, town, school
31 district, or special district with a population of less than 50,000. Similar to the definition of small
32 business, the RFA authorizes agencies to establish alternative definitions of small government after
33 opportunity for public comment and publication in the *Federal Register*. Any alternative definition must
34 be “appropriate to the activity of the agency” and “based on such factors as location in rural or sparsely
35 populated areas or limited revenues due to the population of such jurisdiction” (U.S. EPA 2006b). Under
36 the RFA, economic impacts on small governments are included in the SISNOSE screening analysis, and
37 if required, the regulatory flexibility analysis for a rule.

38
39 UMRA uses the same definition of small government as the RFA with the addition of tribal governments.
40 Section 203 of UMRA requires the Agency to develop a “Small Government Agency Plan” for any
41 regulatory requirement that might “significantly” or “uniquely” affect small governments. In general,
42 “impacts that may significantly affect small governments include – but are not limited to – those that may
43 result in the expenditure by them of \$100 million [adjusted annually for inflation] or more in any one
44 year.” Other factors indicating that small governments are uniquely affected may include whether they
45 would incur the higher per-capita costs due to economies of scale, a need to hire professional staff or

²¹⁹ The current version of SBA’s size standards can be found at <http://www.sba.gov/size>. Accessed 5/18/2004.

²²⁰ See Agency guidance (U.S. EPA 1999) for details on complying with the RFA.

1 consultants for implementation, or requirements to purchase and operate expensive or sophisticated
2 equipment.²²¹ See Section 9.2.4 for information on measures of impacts to governments in general.

3 4 **9.7.1.3 Small Not-for-Profit Organizations**

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6 The RFA defines a small not-for-profit organization as an “enterprise which is independently owned and
7 operated and is not dominant in its field.” Examples may include private hospitals or educational
8 institutions. Here again, agencies are authorized to establish alternative definitions “appropriate to the
9 activities of the agency” after providing an opportunity for public comment and publication in the *Federal*
10 *Register*. Under the RFA, economic impacts on small not-for-profit organizations are included in the
11 SISNOSE screening analysis, and if required, the regulatory flexibility analysis for a rule. See Section
12 9.2.4 for more information on measuring impacts on not-for-profit organizations in general.

13 14 **9.7.2 Socially and Economically Disadvantaged Populations**

15 The impact of a rule or regulation on the human health or the environment of socially or economically
16 disadvantaged groups (including racial or ethnic minorities or low-income populations) raises issues of
17 environmental justice.

18
19 Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and
20 Low-Income Populations” and its accompanying memorandum²²² have the primary purpose of ensuring
21 that “each Federal agency ...make[s] achieving environmental justice part of its mission by identifying
22 and addressing, as appropriate, disproportionately high and adverse human health or
23 environmental effects of its programs, policies, and activities on minority populations and low-
24 income populations ...”²²³ The Executive Order also applies equally to Native American programs.²²⁴

25
26 For current information on EPA’s environmental justice guidance, guidelines, policies, practices and
27 other resources, see EPA’s Office of Environmental Justice homepage:
28 <http://www.epa.gov/compliance/environmentaljustice/index.html>.

29
30 There are many different types of impacts that may be considered when examining the effects of a
31 regulation, and many factors that can contribute to these impacts. Among the factors to be considered are
32 (1) proximity and exposure to environmental hazards,²²⁵ (2) the existence of susceptible populations,²²⁶

²²¹ Guidance on complying with Section 203 of UMRA, “Interim Small Government Agency Plan,” is available on EPA’s intranet site, “Action Development Process Library” at <http://intranet.epa.gov/adplibrary/statutes.htm>. Accessed 6/3/04.

²²² Memorandum, Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, http://www.epa.gov/compliance/resources/policies/ej/clinton_memo_12898.pdf (accessed June 24, 2008).

²²³ Executive Order 12898, Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, http://www.epa.gov/compliance/resources/policies/ej/exec_order_12898.pdf (accessed June 24, 2008)

²²⁴ Id. at Sec. 6-606. In addition, E.O. 13084, *Consultation and Coordination with Indian Tribal Governments*, requires regulations that “significantly or uniquely” affect the communities of Indian tribal governments and that impose substantial direct compliance costs on such communities to either refund the direct costs incurred, or consult with elected officials and other representatives of the Indian tribal governments and provide a description of the consultation and/or communication to the Office of Management and Budget.

²²⁵ Adverse human health and environmental impacts may occur from proximity and exposure in lead, air pollution, including toxic air emissions, groundwater contamination; mining waste; uncontrolled leachate or stormwater

1 (3) unique exposure pathways,²²⁷ (4) multiple and cumulative effects;²²⁸ (5) inability to participate in the
2 decision-making process;²²⁹ and (6) vulnerable infrastructure.²³⁰ A disproportionately high and adverse
3 human health or environmental effect may result from a combination of several of the above factors. In
4 some circumstances, even one or two of these factors could, in and of themselves, disproportionately
5 expose a population to environmental harms and risks.²³¹

6
7 Many studies exist in the academic literature that attempt to identify and characterize human health or
8 environmental inequities. The approach to be used in analyzing whether a disproportionately high and
9 adverse human health or environmental impacts currently exist, or could be impacted by a proposed
10 action, depends upon the circumstances (see Textbox 2 for examples of approaches that may be useful,
11 although not exclusively.) E.O. 12898 does not identify particular approaches that could be used for the
12 identification of potentially disproportionate impacts. To properly screen and conduct more targeted
13 analyses to evaluate such impacts, the analyst may consider a number of methodological issues,
14 including:

- 15
16 • Measurement issues (e.g., how to properly define the impacted neighborhood or sub-population; the
17 threshold for a disproportionate impact; and the proper comparison population);

runoff from municipal landfills or abandoned toxic waste sites; vehicle emissions from adjacent transportation thoroughfares and ports; agricultural chemicals and pesticides; contaminated fish and shellfish; and off-site migration of hazardous wastes from Superfund sites.

²²⁶ Certain conditions could render different groups less able to resist, or tolerate, an environmental stressor. These susceptibility factors may be intrinsic to the group, based on age, sex or other factors. Or, they may be acquired, such as chronic medical conditions, health-care access, nutrition, fitness, other pollutant exposures, and drug and alcohol use. An evaluation of the susceptibility of a subpopulation should include an assessment of pre-existing health conditions, lack of access to health care, psychosocial stress, and/or lack of social capital

²²⁷ Some communities sustain unique environmental exposures because of practices linked to their cultural background or socioeconomic status. For example, some indigenous peoples and immigrant populations rely on subsistence fishing. This subsistence fishing diet could present a different exposure scenario to consider when proposing regulations. Alternatively, economic deprivation, rather than cultural factors, may result in a subsistence diet or other pathways for increased exposure. For examples, pica is a habit among malnourished young children of eating dirt or paint chips, thus increasing exposures to lead.

²²⁸ Disadvantaged and vulnerable populations may suffer a wide range of environmental burdens. The chemical-specific focus to assessing environmental risks may not always account for the multitude of contaminants.

²²⁹ Conditions which could contribute to the ability of a community to participate fully in the decision-making process include, among others, (1) lack of trust; (2) lack of information; (3) language barriers; (4) socio-cultural issues; (5) inability to access traditional communication and information exchange channels; and (6) limited capacity to access scientific, technical, and legal resources.

²³⁰ The physical infrastructure in a community, such as poor housing or poorly maintained public buildings (e.g. schools), is a significant factor that may contribute to make a community more vulnerable to environmental hazards.

²³¹ Likely to be of particular interest or concern are exposures to toxins and adverse health impacts, such as asthma and blood lead poisoning. Impacts could also be cultural, such as degraded ecosystems that prevent people from engaging in subsistence hunting and fishing. It is important to identify the features of the population of concern that may be adversely impacted. For example, if individuals live in primarily urban areas then they may be adversely exposed to air pollution and hence disproportionately suffer adverse health impacts

- 1 • How to determine the extent and nature of potential impacts (e.g., how does a Regional or Program
- 2 Office determine the appropriate level of analysis that is warranted);
- 3 • How to properly frame the question (e.g., whether the key concern is facility location, multiple or
- 4 cumulative risk, or a specific health impact, for example, cancer, asthma, and developmental or
- 5 neurological disorders);
- 6 • How to incorporate measures of population or community vulnerability;
- 7 • How to incorporate measures of health or environmental impacts (e.g., differential exposure,
- 8 differential preparedness or ability to recover);
- 9 • What methodologies can be used for evaluation (e.g., comparison of summary statistics, regression
- 10 analysis, or multi-level analysis); and
- 11 • How to select the appropriate methodology.

12
13 One example of an approach for considering potential disproportionate impacts of federal agency actions
14 under the National Environmental Policy Act (NEPA) is found in *Final Guidance for Incorporating*
15 *Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (US EPA, 1998a)²³² According
16 to the guidance, the environmental impact assessment should include an analysis of “interrelated social
17 and economic effects, ...scaled according to the severity of the impacts.” It is recommended that
18 potentially disproportionate impacts be identified through a screening exercise designed to address two
19 basic questions:

- 20
- 21 • To what extent does the potentially affected population include racial or ethnic minorities and/or
- 22 low-income residents?
- 23 • Are the environmental impacts likely to fall disproportionately on racial or ethnic minority and/or
- 24 low-income members of the population and/or tribal resources?
- 25

26 In the event that no disproportionate impacts on minority or low-income populations are identified, the
27 guidance suggests that the steps and results of the scoping process be properly documented and included
28 in the environmental impact assessment.

29
30 While this chapter does not recommend a particular approach, the analyst should keep these issues in
31 mind and carefully document the way in which each is addressed throughout the course of an equity
32 analysis.²³³

²³² U.S. EPA, *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (1998), http://www.epa.gov/compliance/resources/policies/ej/ej_guidance_nepa_epa0498.pdf

²³³ For EPA's most current environmental justice guidance, guidelines, policies, practices and other resources, see EPA's Office of Environmental Justice homepage: <http://www.epa.gov/compliance/environmentaljustice/index.html>

1 **Text Box 9.2 - Environmental Justice: Examples of Environmental Equity Assessment**

The approaches that have been used by both EPA and entities outside of EPA to assess disproportionate impacts are as varied as environmental exposures and risks to consider. For example, some approaches use simple screening tools and descriptive statistics. Other approaches involve multiple linear regression modeling. Below is a discussion of three types of disproportionality analyses that have commonly been used, listed here in order of increasing complexity: (1) proximity to hazards; (2) cancer risk/cumulative risk analysis; and (3) epidemiological or health outcome analysis.

Proximity-to-hazards studies evaluate how the distribution and proximity of hazards (e.g., Superfund sites, toxic emissions, existing waste facilities) relate to population demographics. Residential proximity to a waste site or other hazard is often used as a surrogate measure for exposure to contaminants found at those sites (see Anderton, et al. 1997; Davidson and Anderton 2000; Mantaay 2001; Perlin, et al. 2001; Wilson, et al. 2002).

Cancer risk/cumulative risk analysis uses exposure (e.g., model estimates of ambient levels of pollutants) combined with toxicity information to derive estimates of health risks following EPA's standard risk assessment methodology (see Morello-Frosch, et al. 2002). If modeling coefficients are provided by race, ethnicity, and/or income, or allow inferences to be made about such subpopulations, equity analyses are then conducted.

Finally, epidemiological or health outcome analysis uses individual level data on health status or health effects that may be related to or exacerbated by environmental exposures/conditions to look for differences by income and racial/ethnicity (see Gwyn and Thurston 2001). Regression techniques are sometimes employed.

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9.7.2.1 Socially Disadvantaged Populations

Socially disadvantaged populations are classified by the Office of Management and Budget's *Statistical Policy Directive* 15 (Federal Register 1997). This directive defines five categories for race: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White. In addition there are two categories for ethnicity: Hispanic or Latino and Not Hispanic or Latino. Traditionally, a socially disadvantaged population is identified where either: (1) the population of concern in the affected area exceeds 50 percent or (2) the percentage of the population of concerns in the affected area is meaningfully greater than its corresponding percentage in the general population (or other appropriate unit of geographic analysis). A socially disadvantaged population also exists if there is more than one group of concern present and the percentage calculated by aggregating all socially disadvantaged persons meets one of these thresholds. In identifying socially disadvantaged populations the Agency may consider as a population either: (1) a group of individuals living in geographic proximity to one another or (2) a geographically dispersed/transient set of individuals (such as migrant workers, children), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected socially disadvantaged population. The selection of the appropriate unit of geographic analysis may also be influenced by the accuracy and precision of environmental quality models (see Text Box 3).²³⁴

²³⁴ For EPA's most current environmental justice guidance, guidelines, policies, practices and other resources, see EPA's Office of Environmental Justice homepage: <http://www.epa.gov/compliance/environmentaljustice/index.html>

1 **9.7.2.2 Economically Disadvantaged Populations**
2

3 Low income or economically disadvantaged populations in an affected area can be identified with the
4 annual statistical poverty thresholds defined by the Census Bureau, *Current Population Reports, Series P-*
5 *60 on Income and Poverty*.²³⁵ In conjunction with Census data, the analysis should also consider state
6 and regional low-income and poverty definitions as appropriate. As with minority population, in
7 identifying low-income populations, the Agency may consider as a population either a group of
8 individuals living in geographic proximity to one another, or a geographically dispersed/transient set of
9 individuals (such as migrant workers children), where either type of group experiences common
10 conditions of environmental exposure or effects.²³⁶
11

12 **Text Box 9.3 - Environmental Justice: Methods for Consideration in Defining an Impacted Population**

EPA's *Final Guidance for Incorporating Environmental Justice Concerns in EPA's Compliance Analyses* (U.S. EPA 1998a) recognizes that "environmental effects are often realized in inverse proportion to the distance from the location or site of the proposed action."

The analyst's definition of the neighborhood may affect the results of a study. Broad neighborhood definitions may hide important relationships between environmental impacts and socioeconomic status, while narrow definitions may exclude areas that should be included (see Anderton, et al. (1994)). The ideal way to define the neighborhood is based on the exact potential exposure of the surrounding population to pollution from the plant or site.²³⁷ It is nearly impossible to acquire such precise data, however, and so many have alternative definitions of the affected population.. Early environmental justice work used fairly broad neighborhood proxies in the form of counties or zip codes (see UCC (1987) or GAO(1983)). More recent studies have defined the relevant neighborhood more precisely based on concentric circles surrounding a site, distance to the site, or the census tract.

The use of circles approximates the distance at which a resident is concerned about the location of a hazardous facility. Concentric circles may be preferred to a census-based neighborhood definition for several reasons. First, a census-based definition ignores how households or different socioeconomic groups are distributed within the neighborhood; this is problematic when assuming broad neighborhood definitions. Second, a census-based definition often reflects topographical features such as rivers and highways that may exclude a large portion of those who, although separated by some physical feature, receive a large portion of the negative externalities or the potential effect of a regulation from the site or plant.

One reason for not employing the concentric circle technique is the arbitrary choice of a radius: the circles drawn are unlikely to reflect population-defined borders between neighborhoods. Most studies in the literature that use these techniques select a range of radii to examine how sensitive results are to alternative definitions. Also, the technique of drawing circles around a site usually involves the use of the Geographic Information System (GIS), which is difficult to apply to anything other than the most recent census.²³⁸

²³⁵ *Current Population Reports*, Series P-60 are available on line at:
<http://www.census.gov/prod/www/abs/income.html>

²³⁶ For EPA's most current environmental justice guidance, guidelines, policies, practices and other resources, see EPA's Office of Environmental Justice homepage:
<http://www.epa.gov/compliance/environmentaljustice/index.html>

²³⁷ RSEI considers the following information in calculating risk-weighted air and water releases: the amount of chemical released, the location of the release, the toxicity of the chemical, its fate and transport through the environment, the route and extent of human exposure, and the number of people affected. More information on RSEI is available at <http://www.epa.gov/opptintr/rsei/>. Accessed 5/18/04.

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9.7.3 Children and the Elderly

Two subpopulations that may be disproportionately impacted by a rule are children and the elderly. Both groups may experience differential exposures to environmental contaminants compared to the rest of the population due to either developing (in the case of children) or weakened (in the case of elderly) biological systems and different activity patterns.

9.7.3.1 Children

E.O. 13045, *Protection of Children From Environmental Health Risks and Safety Risks*, states that each Federal agency: (1) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and (2) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

The order also states that each “covered regulatory action”²³⁹ submitted to OMB, unless prohibited by law, should be accompanied by “. . . an evaluation of the environmental health or safety effects of the planned regulation on children.” The term “children” is not defined. The EPA’s Office of Children’s Health Protection, established in response to this Executive Order, does not use a single definition of child, but instead suggests that the definition will vary depending upon the issue(s) of concern. The Children’s Health Valuation Handbook (U.S. EPA 2003b) defines a child as any person less than 18 years of age. This definition should be applied when conducting an equity assessment.

9.7.3.2 Elderly

In October 2002, EPA announced plans for an *Aging Initiative*. One goal of this initiative is to study the relationship between the elderly and environmental health hazards. As part of this announcement EPA also proposed to develop a *National Agenda for the Environment and the Aging*, including public participation in the process.²⁴⁰ There are three components to the National Agenda:

- Identify research gaps in environmental health hazards to older persons;
- Prepare for an aging society in a smart growth context; and
- Encourage older persons to become involved in communities to reduce environmental hazards and protect the environment.

While there are no standard procedures for including the elderly in an impact analysis, EPA stresses the importance of addressing environmental issues that may adversely impact the elderly.

²³⁸ The Neighborhood Change Database (NCDB) provides Census data over time using a common tract definition. See <http://www.geolytics.com/USCensus.Neighborhood-Change-Database-1970-2000.Products.asp>. Accessed 12/2/04.

²³⁹ A “covered regulatory action” is any substantive action in a rule making that is likely to result in a rule that may be economically significant (have an annual effect on the economy of \$100 million or more or would adversely affect in a material way the economy, a sector of the economy, or the environment) and concern an environmental health risk that an agency has reason to believe may disproportionately affect children.

²⁴⁰ See www.epa.gov/aging/agenda/index.htm#naea for more information on the National Agenda. Accessed May 2, 2008.

9.7.4 Disproportionately High and Adverse Exposure or Human Health Effects

When determining whether human health effects are disproportionately high and adverse for a minority or low-income population, consider the following factors:²⁴¹

- What is the proximity to the environmental or health hazard(s)?
- Are there unique exposure pathways?
- Are specific subpopulations highly susceptible and/or highly exposed?
- Are exposures known to be associated with an adverse health effect?
- Have the synergistic effects of multiple or cumulative exposures been assessed and addressed by a reasonable margin of safety?
- Are the potential health effects upon the population significant, unacceptable, or above generally accepted norms?

The definition of adverse health effects, risk, or rate of hazard exposure contained in specific environmental statutes under whose authority a regulation is being developed may also guide consideration in the equity assessment.

9.8 Framework for Assessing Equity Considerations

The following is a very general framework to guide analysts conducting equity assessments. For each component, choosing to measure the equity-related consequences of a regulation involves balancing costs of data acquisition and analysis against the value of improved accuracy. The framework attempts to conserve resources by screening out situations for which any of the equity impacts are unlikely. This permits analytical and empirical efforts to focus on circumstances with a higher probability of creating significant equity-related effects. The three components should not necessarily be viewed as sequential steps. Instead, at the outset of a particular regulatory analysis, all aspects of the suggested approach should be considered. This will ensure that the data gathered and the analyses performed are well suited to measuring the equity impacts of concern.

9.8.1 Equity Screening Analysis

An equity screening analysis consists of several tasks described below in the order in which they would be implemented.

- **Determine which sub-populations are within the scope of the analysis.** In certain cases, some sub-populations may not be connected closely enough to the regulation to be meaningfully affected. For example, governmental entities might not be involved in activities affected by the regulation. If so, then no further analysis is necessary for these groups.
- **Determine whether the rule or regulatory alternative imposes costs, offers benefits, or results in other economic effects too small to warrant further analysis.**²⁴² When considering costs it might be possible to argue that incremental unemployment or impacts on small businesses, for example, resulting from even small regulatory costs cannot be distinguished from

²⁴¹ For EPA's most current environmental justice guidance, guidelines, policies, practices and other resources, *see* EPA's Office of Environmental Justice homepage:
<http://www.epa.gov/compliance/environmentaljustice/index.html>

²⁴² An economic impact analysis is inapplicable in screening actions that are health, rather than technology, based.

1 the underlying economic variability inherent in these activities. This also applies when a
2 regulation imposes one burden on an entity, but reduces another on the same entity, so that the net
3 effect is small. While some equity impacts are dismissed on the basis of this screening analysis,
4 others may require further analysis.

- 5 • **Identify which equity dimensions require further analysis.** Negative impacts on small
6 entities, low income or minority populations, and children are important to consider in all cases
7 because of statutory and other mandates. In addition to equity dimensions that must always be
8 considered for distributional analysis, efforts should be made to determine whether other
9 dimensions listed in Table 9.1 are relevant. Analysts should collect readily accessible
10 information on the characteristics of affected entities and populations to make this determination,
11 paying special attention to who is expected to receive the benefits of the regulation as well as who
12 will pay the costs.
- 13 • **Prioritize relevant equity dimensions.** Assuming there is more than one relevant equity
14 dimension, each should be prioritized according to which dimension seems to warrant greatest
15 concern. The level of concern should be determined by how strongly analysts expect a regulation
16 to affect a particular sub-population.

17 **9.8.2 Distributional Variables**

19 The next step in assessing impacts on certain subpopulations is to define distributional variables
20 associated with the equity dimensions identified from the screening step (section 9.5.1). For example, if a
21 regulation's potential impact on poor neighborhoods is of concern, then a classification system for "poor"
22 versus "not-poor" neighborhoods should be developed. The established definitions reviewed in Section
23 9.4.2 may be used, or appropriate alternatives may be developed. Sensitivity to a specific definition
24 might be examined. In either event, the methods employed and their rationale should be well documented.

25 **9.8.3 Measuring Equity Consequences**

27 Finally, specific economic effects must be measured across the carefully defined subpopulations from the
28 screening step. In some cases, estimating the equity-related effects of a regulation will involve
29 disaggregating costs and benefits across these subpopulations and tabulating or otherwise accounting for
30 their distribution. In other cases, new impacts may need to be estimated. This process should be
31 consistent with the assumptions made in the BCA.

32 **9.8.4 Data**

34 The U.S. Census Bureau collects household data in forms that may be useful for environmental justice
35 matters. Data are available on population distributions by race/ethnicity, age, household income,
36 education,, language (to determine populations with limited English proficiency) at the state, county,
37 metropolitan statistical area, or census tract level. An additional Census web site allows one to view a
38 map of any part of the U.S., at the desired scale, that shows data on population distributions by family
39 income, or a specified race (e.g., percent white, or percent black).²⁴³ Income data collected by the
40 Internal Revenue Service and made available in aggregated form on the Internet may be useful for some
41 analyses.²⁴⁴

²⁴³ The address for this site is <http://www.census.gov/geo/www/tiger/index.html>. Accessed May 2, 2008.

²⁴⁴ The address of the website providing these data is <http://trac.syr.edu/tracirs/>. Note that a user ID and password are necessary to access the data. Registration at <http://trac.syr.edu/register/registration.html>. Accessed May 2, 2008.

1
2 In addition, EPA has identified five federally-recognized or managed databases to aid in the identification
3 of areas with potentially disproportionately high and adverse environmental and public health burdens.
4 These include the following environmental databases: (1) National Air Toxics Assessment (NATA)
5 cancer risk; (2) NATA noncancer neurological and respiratory hazard index; (3) NATA noncancer diesel
6 particulate matter (PM); (4) toxic chemical emissions and transfers from industrial facilities, as modeled
7 using the Risk-Screening Environmental Indicators (RSEI) tool; 5) population weighted ozone monitoring
8 data; and 6) population weighted PM 2.5 monitoring data.²⁴⁵