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FIGURE 3.5
Continued

Law	*Type of controls*	*Threshold finding*	*Basis for controls*
Clean Water Act	sets effluent standards for discharges of toxic pollutants into surface waters	"identifiable effects on health and welfare"	uses best available technology to control discharges with health-based water quality standards as backstop
		HEALTH-BASED STATUTES	
§112 of the Clean Air Act	establishes emission standards for hazardous air pollutants	substance is one of 189 chemicals on initial list specified in statute or added to list on finding that it may present "a threat of adverse human health effects"	sets limits that "provide an ample margin of safety to protect the public health" if technology-based controls fail to do so after 8 years
FDCA	controls levels of added substances in food	"any poisonous or deleterious substance which may render it injurious to health"	reasonable certainty of no harm
FDCA	controls levels of added substances in food	"induce[s] cancer in laboratory animals"	reasonable certainty of no harm

3. *Risk-Benefit Balancing Approaches**

A. INTRODUCTION

Risk-benefit balancing is cost-benefit analysis applied to policy decisions involving risks. See Chapter 1, pages 31-35. Quantitative risk assessments are the backbone of modern risk-benefit balancing. To the maximum extent possible, benefits from a proposed rule reducing exposure to toxic substances are evaluated through a QRA that estimates anticipated adverse health effects and, where applicable, environmental effects in terms of their dollar values. Costs of achieving those benefits are then also calculated by estimating capital and operating expenditures that the regulated community would incur if the rule were adopted.

Implementing a risk-balancing statute for toxics is almost always controversial and difficult. All the problems and uncertainties of QRAs discussed in the previous section—uncertainties of data, the necessity of making assumptions linking data to policy-related conclusions, and decision making on the "frontiers of scientific knowledge"—make toxics-related decision making difficult.

*While the terms "risk-benefit balancing" and "cost-benefit balancing" can almost be used interchangeably, it is easy to get confused by them because they place the word "benefit" on different sides of the balancing equation—the "benefits" in "risk-benefit balancing" are the benefits provided by the substance to be regulated (which are the "costs" in "cost-benefit balancing"); the "benefits" in "cost-benefit balancing" are the gains to health or the environment from regulating the risks (the "risk" in "risk-benefit balancing").

In fact, one student of environmental regulatory policy has remarked that these difficulties have created regulatory structures that "eat up heroic amounts of money, remain information-starved, feature shameless manipulation of the data, face crippling political pressure, and produce little abatement." Oliver A. Houck, Tales from a Troubled Marriage: Science and Law in Environmental Policy 163, 169-170 (2003).

B. Example: The Toxic Substances Control Act

Perhaps the best way to appreciate the pros and cons of risk-benefit analysis is to consider specific instances where agencies employed this approach to regulation writing. In this regard, the Toxic Substances Control Act is a classic example of a risk-benefit balancing statute. In fact, the term "unreasonable risk" appears 35 times in 33 pages of the statute. Rodgers, The Lesson of the Owls and the Crows: The Role of Deception in the Evolution of the Environmental Statutes, 4 J. Land Use & Envtl. L. 377, 379 (1989). TSCA grants EPA broad authority to regulate the manufacture, processing, distribution, use, or disposal of any chemical substance on a finding that there is a "reasonable basis to conclude" that such an activity "presents or will present an unreasonable risk of injury to health or the environment," TSCA §6(a), 15 U.S.C. §2605(a). In determining whether a substance poses an "unreasonable risk," TSCA explicitly requires EPA to make findings concerning not only health and environmental effects, but also the benefits of various uses of the substance, the availability of substitutes for it, and "the reasonably ascertainable economic consequences" of regulation. TSCA §6(c)(1), 15 U.S.C. §2605(c)(1).

Although TSCA does not specify how this risk-benefit balancing is to be performed, it directs EPA to regulate "to the extent necessary to protect adequately against such risk using the least burdensome requirements." TSCA §6(a), 15 U.S.C. §2605(a). This suggests that EPA is to determine what constitutes adequate protection and then to determine the least burdensome means of achieving it. While TSCA explicitly requires EPA to consider the economic impact of regulation and the benefits of the substance to be regulated, the legislative history of TSCA indicates that Congress did not envision that EPA would be required to perform quantitative risk assessments followed by formal cost-benefit analyses. The House Committee report on the legislation explained that the balancing required by section 6 "does not require a formal benefit-cost analysis" because "such an analysis would not be very useful" given the difficulty of assigning monetary values to benefits and costs of chemical regulation. Toxic Substances Control Act, Report by the Comm. on Interstate and Foreign Commerce, U.S. House of Representatives, H.R. Rep. 94-1341, 94th Cong., 2d Sess. 14 (1976). The Senate Committee report emphasized that while section 6(c) required some balancing, "it is not feasible to reach a decision just on the basis of quantitative comparisons" because "[i]n comparing risks, costs, and benefits . . . one is weighing noncommensurates." It stressed that EPA also must give "full consideration" to the extraordinary "burdens of human suffering and premature death." Toxic Substances Control Act, Report of the Senate Comm. on Commerce, S. Rep. 94-698, 94th Cong., 2d Sess. 13 (1976).

After TSCA's enactment, however, QRAs became routine under all statutes, even if they are not risk-benefit balancing statutes. Presidential Executive Orders have for decades required QRAs to be performed for all major rules,

regardless of whether or not the statute under which the rule is to be issued requires risk-benefit balancing. See pages 168-169. The *Benzene* decision pushed threshold findings of significant risk in the direction of QRAs, too. See pages 199-209. In such a regulatory environment, it was inevitable that statutes requiring risks to be weighed against benefits would end up relying upon QRAs.

PRINCIPAL PROVISIONS OF THE TOXIC SUBSTANCES CONTROL ACT

Section 4 authorizes the EPA administrator to require the testing of any chemical substance or mixture on finding that such testing is necessary because there are insufficient data from which the chemical's effects can be predicted and the chemical either "may present an unreasonable risk of injury to health or the environment" or the chemical is produced in substantial quantities or may result in substantial human exposure.

Section 5 prohibits any person from manufacturing any new chemical substance or from processing any chemical substance for a significant new use unless the person notifies the EPA administrator at least 90 days in advance and submits any data that the person believes show that the chemical will not present an unreasonable risk. The EPA administrator may prohibit or limit the manufacturing, processing, distribution, use, or disposal of any chemical if he or she determines that the information is insufficient to permit a reasoned evaluation of the effects of the chemical and that it either may present an unreasonable risk or that it may result in significant human exposure.

Section 6 authorizes the EPA administrator, to the extent necessary to protect adequately against such risk using the least burdensome requirements, to prohibit the manufacture, processing, or distribution in commerce of a chemical substance; to limit the amounts, concentrations, or uses of it; to require labeling or record-keeping concerning it; or to prohibit or otherwise regulate any manner or method of disposal of it, on a finding that there is a reasonable basis to conclude that the chemical "presents or will present an unreasonable risk of injury to health or the environment."

Section 7 authorizes the EPA administrator to sue to seize or to obtain other relief to protect against imminently hazardous chemical substances.

Section 8 authorizes the EPA administrator to require record-keeping or the submission of reports concerning the manufacture or processing of chemical substances.

Section 9 requires the EPA administrator to refer chemicals to other federal agencies for regulation or to use other laws administered by EPA to regulate the chemical if he or she determines that the risks posed by the chemical may be sufficiently prevented or reduced by action taken under other laws.

Section 19 authorizes judicial review of EPA regulations issued under TSCA.

Section 20 authorizes citizen suits against any person alleged to be in violation of TSCA or against the EPA administrator for failure to perform nondiscretionary duties.

Section 21 authorizes citizen petitions for the commencement of rulemaking proceedings.

The best illustration of how EPA performs risk-benefit analysis is the story of the Agency's efforts to regulate asbestos risks under section 6 of TSCA. Acutely aware of the enormous difficulty of protecting the public from asbestos in schools and buildings, EPA announced in 1979 that it would consider banning all remaining uses of asbestos. 44 Fed. Reg. 60,061 (1979). It took EPA nearly ten years to promulgate such a rule, after developing a 45,000-page record. EPA's rationale for the rule is described in the following excerpt from the Federal Register notice that accompanied it.

EPA, Asbestos: Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions

54 Fed. Reg. 29,460 (1989)

EPA is issuing this final rule under section 6 of the Toxic Substance Control Act (TSCA) to prohibit, at staged intervals, the future manufacture, importation, processing, and distribution in commerce of asbestos in almost all products, as identified in this rule. EPA is issuing this rule to reduce the unreasonable risks presented to human health by exposure to asbestos during activities involving these products. . . .

Section 6 of TSCA authorizes EPA to promulgate a rule prohibiting or limiting the amount of a chemical substance that may be manufactured, processed, or distributed in commerce in the U.S. if EPA finds that there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use, or disposal of the chemical substance, or any combination of these activities, presents or will present an unreasonable risk of injury to human health or the environment. . . .

To determine whether a risk from activities involving asbestos-containing products presents an unreasonable risk, EPA must balance the probability that harm will occur from the activities against the effects of the proposed regulatory action on the availability to society of the benefits of asbestos. EPA has considered these factors in conjunction with the extensive record gathered in the development of this rule. EPA has concluded that the continued manufacture, importation, processing, and distribution in commerce of most asbestos-containing products poses an unreasonable risk to human health. This conclusion is based on information summarized [below].

EPA has concluded that exposure to asbestos during the life cycles of many asbestos-containing products poses an unreasonable risk of injury to human health. EPA has also concluded that section 6 of TSCA is the ideal statutory authority to regulate the risks posed by asbestos exposure. This rule's pollution

prevention actions under TSCA are both the preferable and the least burdensome means of controlling the exposure risks posed throughout the life cycle of asbestos-containing products. Findings supporting this conclusion include the following:

1. Exposure to asbestos causes many painful, premature deaths due to mesothelioma and lung, gastrointestinal, and other cancers, as well as asbestosis and other diseases. Risks attributable to asbestos exposure and addressed by this rule are serious and are calculated for this rule using direct evidence from numerous human epidemiological studies. Studies show that asbestos is a highly potent carcinogen and that severe health effects occur after even short-term, high-level or longer-term, low-level exposures to asbestos. Asbestos exposure is compatible with a linear, no-threshold dose-response model for lung cancer. In addition, there is no undisputed evidence of quantitative differences in potency based on fiber size or type.

For the quantitative risk assessment performed as part of this rule-making, EPA used dose-response constants for lung cancer and mesothelioma that were the geometric means of the "best estimates" from a number of epidemiological studies. If EPA had instead used an upper bound estimate, as is normally done by the scientific community and in EPA regulatory risk assessment when only data from animal studies is available to extrapolate human health risk, predicted lung cancer deaths could increase by a factor of 10 and mesothelioma deaths could increase by a factor of 20.

2. People are frequently unknowingly exposed to asbestos and are rarely in a position to protect themselves. Asbestos is generally invisible, odorless, very durable, and highly aerodynamic. It can travel long distances and exist in the environment for extended periods. Therefore, exposure can take place long after the release of asbestos and at a distant location from the source of the release.

3. Additions to the current stock of asbestos-containing products would contribute to the environmental loading of asbestos. This poses the potential for an increased risk to the general population of asbestos-related disease and an increased risk to future generations because of asbestos' longevity.

4. Asbestos fibers are released to the air at many stages of the commercial life of the products that are subject to this rule. Activities that might lead to the release of asbestos include mining of the substance, processing asbestos fibers into products, and transport, installation, use, maintenance, repair, removal, and disposal of asbestos-containing products. EPA has found that the occupational and nonoccupational exposure existing over the entire life cycles of each of the banned asbestos-containing products poses a high level of individual risk. EPA has determined that thousands of persons involved in the manufacture, processing, transport, installation, use, repair, removal, and disposal of the asbestos-containing products affected by this rule are exposed to a serious lifetime asbestos exposure risk, despite OSHA's relatively low workplace PEL. In addition, according to the EPA Asbestos Modeling Study, millions of members of the general U.S. population are exposed to elevated levels of lifetime risk due to asbestos released throughout the life cycle of asbestos-containing products. EPA believes that the exposures quantified for the analyses supporting this rule represent an understatement of actual exposure.

5. Release of asbestos fibers from many products during life cycle activities can be substantial. OSHA stated in setting its PEL of 0.2 f/cc that remaining exposures pose a serious risk because of limitations on available control technologies. Even with OSHA's controls, thousands of workers involved in the

manufacture and processing of asbestos-containing products are exposed to a lifetime risk of 1 in 1,000 of developing cancer. Many other exposures addressed by this rule are not affected by engineering controls required by OSHA's PEL or by other government regulation. Because asbestos is a highly potent carcinogen, the uncontrolled high peak episodic exposures that are faced by large populations pose a significant risk.

6. Because of the life cycle or "cradle-to-grave" nature of the risk posed by asbestos, attempts by OSHA, the Consumer Product Safety Commission (CPSC), and other EPA offices to regulate the continued commercial use of asbestos still leave many persons unprotected from the hazards of asbestos exposure. Technological limitations inhibit the effectiveness of existing or possible exposure control actions under non-TSCA authorities. Many routes of asbestos exposure posed by the products subject to this rule are outside the jurisdiction of regulatory authorities other than TSCA. EPA has determined that the residual exposure to asbestos that exists despite the actions taken under other authorities poses a serious health risk throughout the life cycle of many asbestos-containing products. This residual exposure can only be adequately controlled by the exposure prevention actions taken in this rule.

7. Despite the proven risks of asbestos exposure and the current or imminent existence of suitable substitutes for most uses of asbestos, asbestos continues to be used in large quantities in the U.S. in the manufacture or processing of a wide variety of commercial products. Total annual U.S. consumption of asbestos dropped from a 1984 total of about 240,000 metric tons to less than 85,000 metric tons in 1987, according to the U.S. Department of Interior, Bureau of Mines data. This change suggests that the use of substitutes has increased markedly since the proposal. However, the 1987 consumption total indicates that significant exposure due to the commercial use of asbestos and the resultant risks would continue for the foreseeable future absent the actions taken in this rule.

Evidence supports the conclusion that substitutes already exist or will soon exist for each of the products that are subject to the rule's bans. In scheduling products for the different stages of the bans, EPA has analyzed the probable availability of nonasbestos substitutes. In the rule, the various asbestos products are scheduled to be banned at times when it is likely that suitable nonasbestos substitutes will be available. However, the rule also includes an exemption provision to account for instances in which technology might not have advanced sufficiently by the time of a ban to produce substitutes for certain specialized or limited uses of asbestos.

8. EPA has calculated that the product bans in this rule will result in the avoidance of 202 quantifiable cancer cases, if benefits are not discounted, and 148 cases, if benefits are discounted at 3 percent. The figures decrease to 164 cases, if benefits are not discounted, and 120 cases, if benefits are discounted at 3 percent, if analogous exposures are not included in the analysis. In all likelihood, the rule will result in the avoidance of a large number of other cancer cases that cannot be quantified, as well as many cases of asbestos-related diseases. Estimates of benefits resulting from the action taken in this rule are limited to mesothelioma and lung and gastrointestinal cancer cases avoided, and do not include cases of asbestosis and other diseases avoided and avoided costs from treating asbestos diseases, lost productivity, or other factors.

EPA has estimated that the cost of this rule, for the 13-year period of the analyses performed, will be approximately $456.89 million, or $806.51 million if

a 1 percent annual decline in the price of substitutes is not assumed. This cost will be spread over time and a large population so that the cost to any person is likely to be negligible. In addition, the rule's exemption provision is a qualitative factor that supports the actions taken in this rule. EPA has concluded that the quantifiable and unquantifiable benefits of the rule's staged ban of the identified asbestos-containing products will outweigh the resultant economic consequences to consumers, producers, and users of the products.

9. EPA has determined that, within the findings required by section 6 of TSCA, only the staged-ban approach employed in this final rule will adequately control the asbestos exposure risk posed by the product categories affected by this rule. Other options either fail to address significant portions of the life cycle risk posed by products subject to the rule or are unreasonably burdensome. EPA has, therefore, concluded that the actions taken in this rule represent the least burdensome means of reducing the risk posed by exposure to asbestos during the life cycles of the products that are subject to the bans.

10. Based on the reasons summarized in this preamble, this rule bans most asbestos-containing products in the U.S. because they pose an unreasonable risk to human health. These banned products account for approximately 94 percent of U.S. asbestos consumption, based on 1985 consumption figures. The actions taken will result in a substantial reduction in the unreasonable risk caused by asbestos exposure in the U.S.

The asbestos industry challenged EPA's asbestos ban in the following case.

Corrosion Proof Fittings v. EPA
947 F.2d 1201 (5th Cir. 1991)

JERRY E. SMITH, Circuit Judge:

The Environmental Protection Agency (EPA) issued a final rule under section 6 of the Toxic Substances Control Act (TSCA) to prohibit the future manufacture, importation, processing, and distribution of asbestos in almost all products. Petitioners claim that the EPA's rule-making procedure was flawed and that the rule was not promulgated on the basis of substantial evidence. . . .

[The court recited the facts and procedural history of the rulemaking and disposed of several procedural issues, including a challenge to the standing of several of the petitioners. It then proceeded to analyze the statutory requirements that the administrator have a "reasonable basis" to conclude that asbestos presents an "unreasonable risk" and that he or she choose the "least burdensome" regulations "to protect adequately against such risk." TSCA §6(a).]

1. LEAST BURDENSOME AND REASONABLE

TSCA requires that the EPA use the least burdensome regulation to achieve its goals of minimum reasonable risk. This statutory requirement can create problems in evaluating just what is a "reasonable risk." Congress' rejection of a no-risk policy, however, also means that in certain cases, the least burdensome yet still adequate solution may entail somewhat more risk than would other, known regulations that are far more burdensome on the industry and the economy. The very language of TSCA requires that the EPA, once it has

determined what an acceptable level of non-zero risk is, choose the least burdensome method of reaching that level.

In this case, the EPA banned, for all practical purposes, all present and future uses of asbestos—a position the petitioners characterize as the "death penalty alternative," as this is the *most* burdensome of all possible alternatives listed as open to the EPA under TSCA. TSCA not only provides the EPA with a list of alternative actions, but also provides those alternatives in order of how burdensome they are. [TSCA §6(a)(1)-(7); 15 U.S.C. §2605a(1)-(7).] Total bans head the list as the most burdensome regulatory option.

By choosing the harshest remedy given to it under TSCA, the EPA assigned to itself the toughest burden in satisfying TSCA's requirement that its alternative be the least burdensome of all those offered to it. . . . [T]he EPA's regulation cannot stand if there is any other regulation that would achieve an acceptable level of risk as mandated by TSCA. . . .

The EPA considered, and rejected, such options as labeling asbestos products, thereby warning users and workers involved in the manufacture of asbestos-containing products of the chemical's dangers, and stricter workplace rules. EPA also rejected controlled use of asbestos in the workplace and deferral to other government agencies charged with worker and consumer exposure to industrial and product hazards, such as OSHA, the CPSC, and the Mine Safety and Health Administration (MSHA). The EPA determined that deferral to these other agencies was inappropriate because no one other authority could address all the risks posed "throughout the life cycle" by asbestos, and any action by one or more of the other agencies still would leave an unacceptable residual risk.

Much of the EPA's analysis is correct, and the EPA's basic decision to use TSCA as a comprehensive statute designed to fight a multi-industry problem was a proper one that we uphold today on review. What concerns us, however, is the manner in which the EPA conducted some of its analysis. TSCA requires the EPA to consider, along with the effect of toxic substances on human health and the environment, "the benefits of such substance[s] or mixture[s] for various uses and the availability of substitutes for such uses," as well as "the reasonably ascertainable economic consequences of the rule, after consideration for the effect on the national economy, small business, technological innovation, the environment, and public health." Id. §2605(c)(1)(C-D).

The EPA presented two comparisons in the record: a world with no further regulation under TSCA, and a world in which no manufacture of asbestos takes place. The EPA rejected calculating how many lives a less burdensome regulation would save, and at what cost. Furthermore the EPA, when calculating the benefits of its ban, explicitly refused to compare it to an improved workplace in which currently available control technology is utilized. See 54 Fed. Reg. at 29,474. This decision artificially inflated the purported benefits of the rule by using a baseline comparison substantially lower than what currently available technology could yield. . . .

This comparison of two static worlds is insufficient to satisfy the dictates of TSCA. While the EPA may have shown that a world with a complete ban of asbestos might be preferable to one in which there is only the current amount of regulation, the EPA has failed to show that there is not some intermediate state of regulation that would be superior to both the currently-regulated and the completely-banned world. Without showing that asbestos regulation would be ineffective, the EPA cannot discharge its TSCA burden of showing that its regulation is the least burdensome available to it.

Upon an initial showing of product danger, the proper course for the EPA to follow is to consider each regulatory option, beginning with the least burdensome, and the costs and benefits of regulation under each option. The EPA cannot simply skip several rungs, as it did in this case, for in doing so, it may skip a less-burdensome alternative mandated by TSCA. Here, although the EPA mentions the problems posed by intermediate levels of regulation, it takes no steps to calculate the costs and benefits of these intermediate levels. See 54 Fed. Reg. at 29,462, 29,474. Without doing this it is impossible, both for the EPA and for this court on review, to know that none of these alternatives was less burdensome than the ban in fact chosen by the agency. . . .

2. The EPA's Calculations

Furthermore, we are concerned about some of the methodology employed by the EPA in making various of the calculations that it did perform. In order to aid the EPA's reconsideration of this and other cases, we present our concerns here.

First, we note that there was some dispute in the record regarding the appropriateness of discounting the perceived benefits of the EPA's rule. . . .

Although various commentators dispute whether it ever is appropriate to discount benefits when they are measured in human lives, we note that it would skew the results to discount only costs without according similar treatment to the benefits side of the equation. Adopting the position of the commentators who advocate not discounting benefits would force the EPA similarly not to calculate costs in present discounted real terms, making comparisons difficult. Furthermore, in evaluating situations in which different options incur costs at varying time intervals, the EPA would not be able to take into account that soon-to-be-incurred costs are more harmful than postponable costs. Because the EPA must discount costs to perform its evaluations properly, the EPA also should discount benefits to preserve an apples-to-apples comparison, even if this entails discounting benefits of a non-monetary nature. See What Price Posterity?, The Economist, March 23, 1991, at 73 (explaining use of discount rates for non-monetary goods). . . .

Of more concern to us is the failure of the EPA to compute the costs and benefits of its proposed rule past the year 2000, and its double-counting of the costs of asbestos use. In performing its calculus, the EPA only included the number of lives saved over the next thirteen years, and counted any additional lives saved as simply "unquantified benefits." 54 Fed. Reg. at 29,486. The EPA and intervenors now seek to use these unquantified lives saved to justify calculations as to which the benefits seem far outweighed by the astronomical costs. For example, the EPA plans to save about three lives with its ban of asbestos pipe, at a cost of $128-227 million (i.e., approximately $43-76 million per life saved). Although the EPA admits that the price tag is high, it claims that the lives saved past the year 2000 justify the price. See generally id. at 29,473 (explaining use of unquantified benefits).

Such calculations not only lessen the value of the EPA's cost analysis, but also make any meaningful judicial review impossible. While TSCA contemplates a useful place for unquantified benefits beyond the EPA's calculation, unquantified benefits never were intended as a trump card allowing the EPA to justify any cost calculus, no matter how high.

The concept of unquantified benefits, rather, is intended to allow the EPA to provide a rightful place for any remaining benefits that are impossible to quantify after the EPA's best attempt, but which still are of some concern. But the allowance for unquantified costs is not intended to allow the EPA to perform its calculations over an arbitrarily short period so as to preserve a large unquantified portion.

Unquantified benefits can, at times, permissibly tip the balance in close cases. They cannot, however, be used to effect a wholesale shift on the balance beam. Such a use makes a mockery of the requirements of TSCA that the EPA weigh the costs of its actions before it chooses the least burdensome alternatives.[20]

We do not today determine what an appropriate period for the EPA's calculations would be, as this is a matter better left for agency discretion. See *Motor Vehicle Mfrs. Ass'n*, 463 U.S. at 53. We do note, however, that the choice of a thirteen-year period is so short as to make the unquantified period so unreasonably large that any EPA reliance upon it must be displaced. . . .

3. Reasonable Basis

In addition to showing that its regulation is the least burdensome one necessary to protect the environment adequately, the EPA also must show that it has a reasonable basis for the regulation, 15 U.S.C. §2605(a). . . .

Most problematical to us is the EPA's ban of products for which no substitutes presently are available. In these cases, the EPA bears a tough burden indeed to show that under TSCA a ban is the least burdensome alternative, as TSCA explicitly instructs the EPA to consider "the benefits of such substance or mixture for various uses and the availability of substitutes for such uses." [15 U.S.C. §2605(c)(1)(C).] These words are particularly appropriate where the EPA actually has decided to ban a product, rather than simply restrict its use, for it is in these cases that the lack of an adequate substitute is most troubling under TSCA.

As the EPA itself states, "[w]hen no information is available for a product indicating that cost-effective substitutes exist, the estimated cost of a product ban is very high." 54 Fed. Reg. at 29,468. Because of this, the EPA did not ban certain uses of asbestos, such as its use in rocket engines and battery separators. The EPA, however, in several other instances, ignores its own arguments and attempts to justify its ban by stating that the ban itself will cause the development of low-cost, adequate substitute products.

As a general matter, we agree with the EPA that a product ban can lead to great innovation, and it is true that an agency under TSCA, as under other regulatory statutes, "is empowered to issue safety standards which require improvements in existing technology or which require the development of new technology." Chrysler Corp. v. Department of Transp., 472 F.2d 659, 673 (6th Cir. 1972). As even the EPA acknowledges, however, when no adequate substitutes currently exist, the EPA cannot fail to consider this lack when formulating its own guidelines. Under TSCA, therefore, the EPA must present a

20. . . . By not using such concerns in its quantitative analysis, even where doing so was not difficult, and reserving them as additional factors to buttress the ban, the EPA improperly transformed permissible considerations into determinative factors.

stronger case to justify the ban, as opposed to regulation, of products with no substitutes.

We note that the EPA does provide a waiver provision for industries where the hoped-for substitutes fail to materialize in time. See 54 Fed. Reg. at 29,464. Under this provision, if no adequate substitutes develop, the EPA temporarily may extend the planned phase-out.

The EPA uses this provision to argue that it can ban any product, regardless of whether it has an adequate substitute, because inventive companies soon will develop good substitutes. The EPA contends that if they do not, the waiver provision will allow the continued use of asbestos in these areas, just as if the ban had not occurred at all.

The EPA errs, however, in asserting that the waiver provision will allow a continuation of the status quo in those cases in which no substitutes materialize. By its own terms, the exemption shifts the burden onto the waiver proponent to convince the EPA that the waiver is justified. See id. As even the EPA acknowledges, the waiver only "may be granted by [the] EPA in very limited circumstances." Id. at 29,460.

The EPA thus cannot use the waiver provision to lessen its burden when justifying banning products without existing substitutes. . . .

We also are concerned with the EPA's evaluation of substitutes even in those instances in which the record shows that they are available. The EPA explicitly rejects considering the harm that may flow from the increased use of products designed to substitute for asbestos, even where the probable substitutes themselves are known carcinogens. Id. at 29,481-83. The EPA justifies this by stating that it has "more concern about the continued use and exposure to asbestos than it has for the future replacement of asbestos in the products subject to this rule with other fibrous substitutes." Id. at 29,481. The agency thus concludes that any "[r]egulatory decisions about asbestos[,] which poses well-recognized, serious risks[,] should not be delayed until the risks of all replacement materials are fully quantified." Id. at 29,483.

This presents two problems. First, TSCA instructs the EPA to consider the relative merits of its ban, as compared to the economic effects of its actions. The EPA cannot make this calculation if it fails to consider the effects that alternate substitutes will pose after a ban.

Second, the EPA cannot say with any assurance that its regulation will increase workplace safety when it refuses to evaluate the harm that will result from the increased use of substitute products. While the EPA may be correct in its conclusion that the alternate materials pose less risk than asbestos, we cannot say with any more assurance than that flowing from an educated guess that this conclusion is true.

Considering that many of the substitutes that the EPA itself concedes will be used in the place of asbestos have known carcinogenic effects, the EPA not only cannot assure this court that it has taken the least burdensome alternative, but cannot even prove that its regulations will increase workplace safety. Eager to douse the dangers of asbestos, the agency inadvertently actually may increase the risk of injury Americans face. The EPA's explicit failure to consider the toxicity of likely substitutes thus deprives its order of a reasonable basis.

Our opinion should not be construed to state that the EPA has an affirmative duty to seek out and test every workplace substitute for any product it seeks to regulate. TSCA does not place such a burden upon the agency. We do not think it unreasonable, however, once interested parties introduce credible

studies and evidence showing the toxicity of workplace substitutes, or the decreased effectiveness of safety alternatives such as non-asbestos brakes, that the EPA then consider whether its regulations are even increasing workplace safety, and whether the increased risk occasioned by dangerous substitutes makes the proposed regulation no longer reasonable. In the words of the EPA's own release that initiated the asbestos rulemaking, we direct that the agency consider the adverse health effects of asbestos substitutes "for comparison with the known hazards of asbestos," so that it can conduct, as it promised in 1979, a "balanced consideration of the environmental, economic, and social impact of any action taken by the agency." 44 Fed. Reg. at 60,065 (1979).

In short, a death is a death, whether occasioned by asbestos or by a toxic substitute product, and the EPA's decision not to evaluate the toxicity of known carcinogenic substitutes is not a reasonable action under TSCA. Once an interested party brings forth credible evidence suggesting the toxicity of the probable or only alternatives to a substance, the EPA must consider the comparative toxic costs of each. Its failure to do so in this case thus deprived its regulation of a reasonable basis, at least in regard to those products as to which petitioners introduced credible evidence of the dangers of the likely substitutes.[22]

4. Unreasonable Risk of Injury

The final requirement the EPA must satisfy before engaging in any TSCA rulemaking is that it only take steps designed to prevent "unreasonable" risks. . . .

That the EPA must balance the costs of its regulations against their benefits further is reinforced by the requirement that it seek the least burdensome regulation. While Congress did not dictate that the EPA engage in an exhaustive, full-scale cost-benefit analysis, it did require the EPA to consider both sides of the regulatory equation, and it rejected the notion that the EPA should pursue the reduction of workplace risk at any cost. See *American Textile Mfrs. Inst.*, 452 U.S. at 510 n.30 ("unreasonable risk" statutes require "a generalized balancing of costs and benefits"). Thus, "Congress also plainly intended the EPA to consider the economic impact of any actions taken by it under . . . TSCA." *Chemical Mfrs. Ass'n,* 899 F.2d at 348.

Even taking all of the EPA's figures as true, and evaluating them in the light most favorable to the agency's decision . . . the agency's analysis results in figures as high as $74 million per life saved. For example, the EPA states that its ban of asbestos pipe will save three lives over the next thirteen years, at a cost of $128-277 million ($43-76 million per life saved), depending upon the price of substitutes; that its ban of asbestos shingles will cost $23-34 million to save 0.32 statistical lives ($72-106 million per life saved); that its ban of asbestos coatings will cost $46-181 million to save 3.33 lives ($14-54 million per life saved); and that

22. We note that at least part of the EPA's arguments rest on the assumption that regulation will not work because the federal government will not adequately enforce any workplace standards that the EPA might promulgate. This is an improper assumption. The EPA should assume reasonable efforts by the government to implement its own regulations. A governmental agency cannot point to how poorly the government will implement regulations as a reason to reject regulation. Rather, the solution to poor enforcement of regulations is better enforcement, not more burdensome alternative solutions under TSCA.

its ban of asbestos paper products will save 0.60 lives at a cost of $4-5 million ($7-8 million per life saved). See 54 Fed. Reg. at 29,484-85. . . .

While we do not sit as a regulatory agency that must make the difficult decision as to what an appropriate expenditure is to prevent someone from incurring the risk of an asbestos-related death, we do note that the EPA, in its zeal to ban any and all asbestos products, basically ignored the cost side of the TSCA equation. The EPA would have this court believe that Congress, when it enacted its requirement that the EPA consider the economic impacts of its regulations, thought that spending $200-300 million to save approximately seven lives (approximately $30-40 million per life) over thirteen years is reasonable.

As we stated in the OSHA context, until an agency "can provide substantial evidence that the benefits to be achieved by [a regulation] bear a reasonable relationship to the costs imposed by the reduction, it cannot show that the standard is reasonably necessary to provide safe or healthful workplaces." Although the OSHA statute differs in major respects from TSCA, the statute does require substantial evidence to support the EPA's contentions that its regulations both have a reasonable basis and are the least burdensome means to a reasonably safe workplace.

The EPA's willingness to argue that spending $23.7 million to save less than one-third of a life reveals that its economic review of its regulations, as required by TSCA, was meaningless. As the petitioners' brief and our review of EPA case-law reveals, such high costs are rarely, if ever, used to support a safety regulation. [The court then reviewed each of four subcategories of product bans included in the rulemaking—friction products (where EPA had determined that three-fourths of the anticipated asbestos-related cancer benefits would be achieved); asbestos-cement pipe products; gaskets, roofing, shingles, and paper products; and products produced outside the United States—and found each of them legally unjustified, in each case substantially on the basis of the general deficiencies reviewed in the first part of the opinion. However, the court upheld EPA's decision to ban products that once were, but no longer are, being produced in the United States, noting that "sections 5 and 6 of TSCA allow the EPA to ban a product that presents or will present a *significant* risk" (emphasis the court's).]

We regret that this matter must continue to take up the valuable time of the agency, parties and, undoubtedly, future courts. The requirements of TSCA, however, are plain, and the EPA cannot deviate from them to reach its desired result. We therefore GRANT the petition for review, VACATE the EPA's proposed regulation, and REMAND to the EPA for further proceedings in light of this opinion.

NOTES AND QUESTIONS

1. **TSCA and Multimedia Regulation.** Why did the court strike down the asbestos ban? What impact will the court's decision have on EPA's ability to use TSCA as a comprehensive approach for reducing multimedia exposures to highly toxic substances? Note that the court states that "EPA's basic decision to use TSCA as a comprehensive statute designed to fight a multi-industry problem was a proper one that we uphold today on review." What then was wrong with EPA's decision to ban asbestos?

2. **Sufficiency of Evidence.** The court held that EPA had presented insufficient evidence to justify its asbestos ban. In what respects was EPA's evidence lacking? Note that EPA's decision to ban asbestos had not been undertaken lightly. It was the product of ten years of Agency activity that included an advance notice of proposed rulemaking in 1979 and a data collection rule promulgated under section 8(a) of TSCA in 1982. EPA had held 22 days of public hearings, taken thousands of pages of testimony, and received 13,000 pages of comments from more than 250 interested parties. The Agency and its contractors had prepared ten major regulatory analysis documents in support of the rule. What additional information would EPA need and what additional analysis would it have to undertake to justify an asbestos ban?

3. **The "Least Burdensome" Requirement.** Why did EPA believe that a ban was the "least burdensome" means "to protect adequately against" the risks posed throughout the life cycle of asbestos use? How does the court interpret section 6(a)(1)'s "least burdensome" requirement? What findings must EPA make before banning a product under the court's interpretation?

4. **Reasonableness of Risk.** Did the court believe that the risks posed by asbestos were not unreasonable in light of the cost of the asbestos ban? EPA had estimated that the quantifiable benefits from the rule included the prevention of at least 202 cases of cancer at a total cost of $459 million over 13 years. 54 Fed. Reg. 29,484-29,485 (1989). Did the court think that this was too much for society to spend to prevent asbestos risks, did it simply disagree with EPA's calculations of costs and benefits, or both? Do you think that a risk that costs more than $2 million per life saved to eliminate is reasonable?

5. **How Much Is a Life Worth?** While the Fifth Circuit did not specify what dollar value it would place on preventing deaths from asbestos exposure, the court noted in a footnote that

> the EPA regularly rejects, as unjustified, regulations that would save more lives at less cost. For example, over the next 13 years, we can expect more than a dozen deaths from ingested *toothpicks*—a death toll more than twice what the EPA predicts will flow from the quarter-billion-dollar bans of asbestos pipe, shingles, and roof coatings. See L. Budnick, Toothpick-Related Injuries in the United States, 1979 Through 1982, 252 J. Am. Med. Ass'n, Aug. 10, 1984, at 796 (study showing that toothpick-related deaths average approximately one per year). [947 F.2d at 1223 n.23 (emphasis in original).]

What is the relevance of the toothpick data?

6. **Comparing Costs and Benefits.** EPA estimated that the most likely costs of its decision were $459 million and its quantified benefits were estimated at 202 deaths avoided (148 if benefits are discounted). That is between $2.4 and $3.1 million per death avoided. Yet the court criticizes parts of EPA's rule for costing as much as $74 million per death avoided. Why did the court disaggregate EPA's data by product?

7. **Discounting Lives.** The debate over whether benefits of health and safety regulation should be discounted when those benefits include saving lives is considerably more intense, with many more twists and turns, than the court's treatment suggests. Among other arguments, those opposed to discounting argue that the obligation to save life is a moral obligation owed equally to everyone, including future generations, so that a life saved 20, 40, or 100 years from now should be as highly valued as a life saved tomorrow. Some also argue that the avoidance of an irreversible course of events that culminates in death should be considered a present benefit.

Those favoring discounting remind us that dollars expended today to save a life in the future are actually more expensive than dollars expended to save a life tomorrow, because by spending now for future benefits we are deprived of the stream of benefits that would otherwise flow from those dollars between now and the future time when they will save a life. In that period of time, we might find ways to prevent the future loss of life more cheaply. Richard Revesz has urged a distinction between the problems of discounting raised by programs that mitigate latent harms to existing persons and those raised by programs designed to benefit future generations. "The reason for discounting in the case of latent harms," he writes, "is not that a regulator . . . determines that life in the future is less valuable than life in the present. Instead, discounting simply reflects the fact that the individual who is valuing her own life derives less utility from living a year in the future than in the present. Discounting is therefore necessary to provide an accurate value of the utility that the individual loses in the present as a result of a premature death that might occur in the future." Revesz, Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives, 99 Colum. L. Rev. 941, 984 (1999). Revesz endorses discounting as appropriate in such cases, but only if significant adjustments to current regulatory practices are made, which would tend to raise the value of future benefits compared to methodologies such as those endorsed in *Corrosion Proof Fittings*. Id.

As for problems of intergenerational equity raised by issues such as global warming, Revesz argues that whereas "intragenerational discounting affects the timing with which a particular individual decides to expend a fixed amount of resources [and thus reflects that individual's preferences] . . . intergenerational discounting affects the quantity of resources available to each individual . . . [so that] in an intergenerational context, one must initially decide how to allocate resources to individuals in different generations—a societal decision with ethical underpinnings." Id. at 999.

In addition to employing a 3 percent discount rate in its asbestos decision, EPA discounted benefits from the date of exposure rather than the date of illness. What impact did this decision have on the apparent reasonableness of the asbestos ban? Was EPA justified in making that decision? The court did not think so; "[EPA] chose an unreasonable time upon which to base its discount calculation. . . . The EPA's approach implicitly assumes that the day on which the risk of injury occurs is the same day the injury actually occurs." Do you agree? On remand, what impact will this aspect of the court's decision have on the reasonableness of the asbestos ban? In its comments on EPA's Regulatory Impact Analysis, OMB had observed that "a life saved 40 years from now [the latency period for asbestos-related cancers is 30-40 years] is worth roughly only one forty-fifth as much as a life saved this year." An outraged congressional oversight committee calculated that such discounting would mean that it would be worth only $22,094.93 to OMB to save a life in these circumstances. EPA's Asbestos Regulations, Report of the Subcomm. on Oversight and Investigations of the House Comm. on Energy and Commerce, 99th Cong., 1st Sess. 79 (Oct. 1985). Lisa Heinzerling argues that mitigation of latent harms has substantial present benefits that are ignored by a pure discounting approach. In her view, "life-saving environmental regulation produces benefits from the very moment it takes effect." Heinzerling, Environmental Law and the Present Future, 87 Geo. L.J. 2025, 2026 (1999). These benefits include reducing the dread people have of involuntary, long-term risk exposure, bolstering trust in institutions undermined by potentially misleading statements their

representatives may make about the significance of an unmitigated risk, the reduction in risk itself, which can be treated as an immediate benefit, as well as avoiding the adverse physiological effects that occur contemporaneously with exposure to some latent harms such as chemical agents. She argues that these considerations "cast[] a shadow over [the] analytic technique[] . . . [of] discounting." Id. at 2078.

8. **The Discount Rate.** Whatever the merits of the debate over discounting various types of life-saving environmental measures, the Office of Management and Budget requires discounting. When the value of future lives saved is being discounted, the rate at which the value is discounted is vitally important. For an illustration of the effect of discounting, the Center for Progressive Reform has posted on the Web a "future lives calculator." Go to its Perspective on cost-benefit analysis and click on the link to "Honey I shrunk the future" at the bottom of the second paragraph. The calculator shows the impact of various discount rates. See *http://www.progressivereform.org/perspectives/costbenefit.cfm.* In a footnote the court found that EPA's use of a 3 percent discount rate was reasonable. 947 F.2d at 1218 n.19. For years, the OMB and EPA had disagreed over various aspects of the asbestos ban rule. For one thing, OMB had urged that a 10 percent discount rate be applied to asbestos-related cancers. The dispute is documented in EPA's Asbestos Regulations, Report of the Subcomm. on Oversight and Investigations of the House Comm. on Energy and Commerce, 99th Cong., 1st Sess. 78-82 (Oct. 1985).

In 1992, OMB revised its discount rate for cost-benefit analyses downward to 7 percent. 57 Fed. Reg. 53,519, 53,522 (1992). This rate is still higher than the current views of the majority of economists, who have concluded that the most appropriate discount rate for government projects is the "real return on long-term government debt—the interest rate on long-term government bonds minus the rate of inflation," Revesz, Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives, 99 Colum. L. Rev. 941, 978 (1999). In recent years this rate has been between 2 and 3 percent, id. at 979, roughly the same rate that EPA used in the asbestos rule struck down in *Corrosion Proof Fittings.*

9. **Nonquantified Benefits.** EPA's benefit estimates did not attempt to quantify certain benefits including the prevention of asbestosis and certain other diseases and the avoided costs of treating asbestos diseases and lost productivity. EPA also stated that if it had followed the normal practice of using "upper bound" estimates, its risk assessment could have projected 10 times more lung cancer deaths and 20 times more mesothelioma deaths due to asbestos exposure. Recall the concern that cost-benefit analysis exhibits a tendency to "downgrade" unquantified benefits. How does the court of appeals treat the unquantified benefits of EPA's ban? Is its treatment appropriate? Do you believe that unquantified benefits should only be used as a "tie-breaker" in cost-benefit analyses?

10. **The Risks of Substitutes.** The data available to EPA concerning the health risks posed by asbestos were far better than the data available for virtually any other toxic substance. Unlike many other substances, scientific understanding of the dangers of asbestos is based on the results of numerous epidemiological studies that have documented scores of thousands of deaths from asbestos exposure. The court faulted EPA for not giving more serious consideration to the potential risks posed by other substances that might be substituted for asbestos. For example, vinyl chloride is used to make PVC

pipe, a likely substitute for asbestos-cement pipe. Under what circumstances did the court think EPA must assess the risk of substitutes? How extensively must EPA analyze such products?

Inquiry into the riskiness of substitutes as a desirable prerequisite to regulation involves a special case of risk-benefit analysis that has come to be called "risk-tradeoff" analysis. It arises in numerous regulatory contexts, and is exacerbated in the eyes of some by the perceived tendency of environmental statutes to impose higher standards of safety on new products than on old, already marketed products. What do you think the explanation for that practice might be? The result of the practice can be the inability of a new product or use to be authorized because it fails an agency's risk requirements for new products, whereas allowing its use would actually reduce overall risks because the new product would replace an already established product that was riskier.

There are circumstances in which risk-tradeoff analysis seems a sensible regulatory approach and yet in others it raises significant questions. In a concurring opinion in International Union, UAW v. OSHA, 938 F.2d 1310 (D.C. Cir. 1991), Judge Williams carried the logic of risk-tradeoff analysis to one of its logical extremes. Citing studies finding that higher incomes correlate with improved health (why might that be so?), Judge Williams referred in particular to one economist's study suggesting that each $7.5 million of costs generated by a new regulation depresses workers' incomes sufficiently to induce one fatality. Judge Williams suggested that OSHA ought to conduct risk-tradeoff analysis whenever its regulatory initiatives generated significant compliance costs. 938 F.2d at 1326-1327. OMB subsequently followed up on Judge Williams's suggestion by blocking an OSHA regulation on the ground that its $163 million in compliance costs would cause 22 additional deaths, more than the 8 to 13 lives OSHA estimated would be saved. Swoboda, OMB's Logic: Less Protection Saves Lives, Wash. Post, Mar. 17, 1992, at A15. After the controversy received publicity, OMB withdrew its objection, although it continued to insist that "richer is safer" ought to be considered in rulemaking. For an opinion rejecting an effort to require OSHA to conduct risk-tradeoff analysis, see American Dental Association v. Martin, 984 F.2d 823 (7th Cir. 1993). For an argument that risk-tradeoff analysis has been systematically biased by focusing only on regulation's ancillary risks and not its ancillary benefits see Rascoff & Revesz, The Biases of Risk Tradeoff Analysis: Toward Parity in Environmental and Health-and-Safety Regulation, 69 U. Chi. L. Rev. 1763 (2002).

11. **Technology-Forcing Regulation.** The court criticized EPA's assumption that the availability of a waiver would reduce the costs of replacing products for which no adequate substitutes for asbestos currently were available. Is the court suggesting that EPA should not be able to use TSCA to force the development of safer technology? Would a better approach for forcing technology be to impose a tax on asbestos products that increases over time?

12. **Marginal Analysis.** The court appears to require that EPA calculate the costs and benefits of the product ban compared to the costs and benefits of the next less burdensome regulatory alternative. In this way, the Agency can assess the incremental, or marginal, costs and benefits of the final regulatory step. Suppose the next less burdensome alternative were found to save 128 (discounted) lives at a cost of $125 million. Then the incremental benefits and costs of the product ban would be 20 lives and $334 million. If the Agency had made such a determination as this, would TSCA permit it to go ahead with the product ban?

13. **Risk Disaggregation.** EPA had found that 102 (or 144, if benefits are not discounted) of the deaths avoided came from its ban of asbestos in friction products—primarily brake drums. The cost of this ban was estimated to be between $31 million and $85 million. The court indicated that it might have been inclined to uphold this part of the asbestos to ban if that had been the only part of the rule challenged. As long as the court was remanding, however, it found that it was "impossible to ignore" EPA's failure to study the effect of nonasbestos brakes on automotive safety, "despite credible evidence that non-asbestos brakes could increase significantly the number of highway fatalities." Was EPA's failure to conduct further study of the highway fatality issue justified? To what extent does the court's decision hinge on disaggregating the overall risks posed by asbestos in order to analyze risk and cost estimates for each type of product containing it?

Compare the approach in *Corrosion Proof Fittings* to that in American Dental Association v. Martin, 984 F.2d 823 (7th Cir. 1993). There, the Seventh Circuit refused to require OSHA to disaggregate risks in more detail when making the "significant risk" findings required by the *Benzene* decision. The court explained that

> OSHA cannot impose onerous requirements on an industry that does not pose substantial hazards to the safety or health of its workers merely because the industry is a part of some larger sector or grouping and the agency has decided to regulate it wholesale. That would be an irrational way to proceed. But neither is the agency required to proceed workplace by workplace, which in the case of bloodborne pathogens would require it to promulgate hundreds of thousands of separate rules. It is not our business to pick the happy medium between these extremes. It is OSHA's business. If it provides a rational explanation for its choice, we are bound. [984 F.2d at 827.]

The court found that OSHA's explanation that the risks of infection from bloodborne pathogens do not vary in a readily determinable fashion from industry to industry was sufficiently rational so as not to require an industry-by-industry disaggregation of risk estimates. OSHA had found that infection risks vary with practices, rather than industries, and it had issued regulations designed to control these practices.

14. **"Cleanup" Ban on Future Products.** The one aspect of the asbestos ban that the court upheld was a ban on asbestos products not currently being produced. How could EPA determine that the benefits of such a ban would outweigh its costs? Such products pose no current risks. The court stated that although "EPA cannot possibly evaluate the costs and benefits of banning unknown, uninvented products, we hold that the nebulousness of these future products, combined with TSCA's language authorizing the EPA to ban products that 'will' create a public risk, allows the EPA to ban future uses of asbestos even in products not yet on the market."

15. **International Developments.** While the *Corrosion Proof Fittings* decision derailed EPA's efforts to ban asbestos in the United States, a growing number of countries throughout the world are enacting asbestos bans. In September 2000, the World Trade Organization (WTO) rejected a challenge by Canada to France's decision to ban imports of chrysotile asbestos. As of March 2009, 46 countries had adopted, or were in the process of implementing, national asbestos bans, including the members of the European Union, Australia, Argentina, Chile, Japan and Saudi Arabia. Brazilian cities and states accounting for

70 percent of Brazil's market also have banned asbestos use. In the United States, Senator Patty Murray (D-WA) has since 2003 sponsored the Ban Asbestos in America Act, which would accomplish through legislation what EPA attempted to do under its TSCA authority.

4. *Technology-Based (Feasibility-Limited) Regulation*

In most of the environmental statutes regulating toxic substances, Congress has not explicitly endorsed cost-benefit or risk-benefit balancing in setting standards to control pollution or to protect public health. Rather, it has instructed agencies to control potentially dangerous substances by using technology-based standards (as in parts of the Clean Water Act and the Clean Air Act), usually up to the point at which further reductions in exposures are no longer "feasible" (as in the OSH Act, see below), or sometimes simply to regulate so as to "protect the public health," often with a "margin of safety" (as in the Clean Air Act, which requires provision of an "adequate margin of safety" from conventional air pollutants, CAA §109, and an "ample margin of safety" from hazardous air pollutants, CAA §112(f)).

This section discusses several feasibility-limited approaches to risk management. These statutes direct regulators to protect against certain health risks to the extent feasible. They are a species of technology-based approaches because the state of existing technology ultimately determines what is technologically feasible. Not all technology-based approaches to regulation impose pollution controls that are as stringent as those required by a strict feasibility-limited standard. For example, the "best practicable technology" controls established by the Clean Water Act are less stringent than standards that require control of health risks to the limits of feasibility.

Because of the nature of the adverse health effects associated with toxics, when Congress employs a technology-based approach to manage toxics, it generally mandates that technology be used up to the point at which it becomes infeasible to reduce emissions any further. At least, that is the theory. This feasibility-limited type of technology-based approach bases the level of control on the capabilities of technology rather than on the degree of risk or the results of risk-benefit balancing. The degree of risk is not entirely irrelevant to feasibility-limited statutes, for they require that some threshold level of risk, sufficient to satisfy the statute's regulatory trigger, be found, as illustrated by the interpretation of OSHA in *Benzene*, requiring OSHA to make a "significant risk" determination prior to issuing a regulation. Once that trigger has been satisfied, feasibility-limited approaches to regulation then instruct the agency to eliminate as much of the health risk as can feasibly be done.

Feasibility has two components: the technological and the economic. Something may be strictly possible given the current state of technology, e.g., a trip to the moon or to Mars, but so expensive that it could force an entire industry to shut down if mandated by regulators. Most feasibility-limited regulation is so limited precisely to avoid causing such massive dislocations. Thus, regulatory authorities implementing feasibility-limited standards have had to give consideration to both technological and economic factors, as we will see below.