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FEDERALISM AND INTERSTATE ENVIRONMENTAL EXTERNALITIES

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*2342 Introduction

The two justifications most prominently offered, both in the academic literature and the legislative arena, for vesting responsibility for environmental regulation at the federal level focus on the existence of a "race to the bottom" and of interstate externalities. [FN1] *2343 The "race- to-the-bottom" rationale for federal environmental regulation posits that states, in an effort to induce geographically mobile firms to locate within their jurisdictions, will offer them suboptimally lax environmental standards so as to benefit from additional jobs and tax revenues. The problem of interstate externalities arises because a state that sends pollution to another state obtains the labor and fiscal benefits of the economic activity that generates the pollution but does not suffer the full costs of the activity. Under these conditions, economic theory maintains that an undesirably large amount of pollution will cross state lines.

Though they are sometimes conflated, the race to the bottom and the problem of interstate externalities are analytically distinct. The concern over interstate externalities can be addressed by limiting the amount of pollution that can cross interstate borders, thereby "showing" upwind states the costs that they impose on downwind states. As long as the externality is eliminated, it would not matter, from the perspective of controlling interstate externalities, that the upwind state chooses to have poor environmental quality--a central concern of race-to-the-bottom advocates. Conversely, one could imagine a situation in which the upwind state has chosen a high level of environmental quality but has encouraged the sources in the state to have tall stacks and to locate near the interstate border, so that their effects will be felt only in the downwind state. In that case, race-to-the-bottom advocates would have no concern, but there is an externality problem. [FN2]

A few years ago, I challenged the accepted wisdom on the "race to the bottom," arguing that, contrary to the prevailing consensus, competition among states for industry should not be expected to lead *2344 to a race that decreases social welfare. [FN3] Moreover, I showed that even if there were such a race, federal environmental regulation would shift the competition among states to other regulatory arenas, or to the fiscal arena. Federal environmental regulation would then have undesirable effects on state interests in these arenas, and would not enhance social welfare. Race-to-the-bottom arguments in favor of federal environmental regulation are, in essence, a frontal challenge on federalism because the problems that they seek to correct can be

addressed only by exclusive federal regulatory and fiscal powers. [FN4]
This Article, in turn, criticizes the various approaches that federal environmental laws have taken to address the problem of interstate externalities. Part I shows that the Clean Air Act--the statute designed to deal with the pollution that gives rise to the most serious problems of interstate externalities--has been unsuccessful at forcing the internalization of interstate externalities. Its core provisions cannot be justified by the need to control interstate externalities, and may have exacerbated the problem. Similarly, the relatively minor provisions directed at controlling interstate externalities have been wholly ineffective, largely as a result of the failure of the Environmental Protection Agency ("EPA") and the federal courts to define a coherent and logical body of law. In fact, despite congressional preoccupation with the problem and the existence of statutory provisions expressly designed to correct it, the downwind states have always been unsuccessful at constraining upwind pollution. [FN5] A similar situation arises under the Clean Water Act.

Part II examines how to design a desirable approach to controlling interstate externalities. [FN6] The inquiry reveals the extent to which ***2345** the EPA and the courts have overlooked factors that are relevant to this task. For example, the current regime inquires only whether the emissions of a proposed source in an upwind state are excessive. But to achieve a socially desirable level of interstate spillovers, the regime should also determine whether the proposed stack height and location are motivated by an effort to externalize the effects of pollution. [FN7] Also, the current regime conducts this inquiry only when there is a violation of a federal ambient standard in the downwind state. But in order to properly allocate the downwind state's margin for growth, or to protect the legitimate interests of downwind states in enforcing more stringent state ambient standards, one must also assess the permissibility of upwind pollution when there is no violation of federal standards. Similarly, the current regime considers the problem statically, at one point in time. Instead, the system should undertake a dynamic analysis, which examines desirable allocations of the pollution-control burden between upwind and downwind sources in light of economic growth.
Part III shows how the Dormant Commerce Clause supports stronger controls on interstate pollution externalities. This clause defines an understanding of federalism that ought to inform as a matter of policy, though not of constitutional law, federal regulatory schemes designed to address the problem of interstate externalities. Attention to the principles embodied in the Dormant Commerce Clause would lead to constraints on interstate externalities well beyond those currently enforced under the federal statutes.

Finally, Part IV presents a scheme in which marketable permits would be traded in units of environmental degradation (as opposed to the more traditional market-based schemes that trade units of emissions). In this proposed market, both upwind and downwind sources would purchase permits to degrade ambient air-quality levels in the downwind state. The amount of emissions allowed by each permit would depend on the impact that emissions at each source have on ambient air-quality levels at the affected location, which is a function of factors such as the location of the source, the height of the stack, and the strength of prevailing winds. Using marketable-permit schemes to address the problem of interstate externalities solves an important problem of how to coordinate several states' plans for economic growth. Such coordination would be difficult to ***2346** accomplish through non-market-based federal intervention. This argument for marketable-permit schemes is independent from and in addition to the standard claim that such schemes lead to the minimization of the costs of achieving a given environmental objective.

The central purpose of this Article, particularly in light of my prior work, [FN8] is to refocus the attention of federal environmental regulation. Of the two most prominent reasons for vesting responsibility for environmental regulation at the federal level, the race-to-the-bottom rationale is analytically unsound, despite the fact that much of the legal regime is structured to redress this asserted evil. [FN9] In contrast, the rationale for federal regulation premised on the problem of interstate externalities is analytically unimpeachable but has not been effectively redressed in the current pollution-control scheme. [FN10] At a time when federal environmental regulation is under fierce political attack, [FN11] it is critical to define clearly what tasks can best be accomplished at the federal level and to ensure that the resulting regulatory scheme in fact accomplishes those tasks. This Article shows why a great deal more attention needs to be paid to fashioning an effective federal response to the problem of interstate externalities.

I. Interstate Externalities Under the Clean Air Act

This Part reviews and critiques the treatment of interstate externalities under the Clean Air Act. Section A discusses the major provisions of the statute. Section B shows that these provisions are not well suited to control interstate externalities, and argues that the regulatory scheme adopted in 1970 may in fact have exacerbated the problem. This section also shows that the Act's tall-stack and acid-rain provisions provide, at best, limited relief. Section C evaluates ***2347** sections 110(a)(2)(D) and 126(b)--the two provisions specifically designed to constrain interstate externalities. [FN12]

A. Overview of the Clean Air Act

Some background on the central provisions of the Clean Air Act is necessary to evaluate the Act's treatment of interstate spillovers. The National Ambient Air Quality Standards ("NAAQS"), set at the federal level by the EPA, are the statute's centerpiece. The NAAQS prescribe nationally uniform maximum concentrations for pollutants "which may reasonably be anticipated to endanger public health or welfare." [FN13] These ambient standards establish the minimum levels of environmental quality that the EPA will tolerate. They do not directly constrain the activities of any polluter. Instead, the pollution- control burden necessary to meet the ambient standards is allocated to the various sources by means of emissions standards: new source performance standards ("NSPS") for new stationary sources [FN14] and standards for moving sources--principally automobiles--set by the EPA, [FN15] and standards for existing sources set by the states through State Implementation Plans ("SIPs"). [FN16] The original structure of the statute, which dates back to 1970, left two important questions unanswered. First, what are the requirements of regions that have air quality that is better than the NAAQS? Second, what consequences attach to the failure to meet the NAAQS?

To address the first question, the 1977 amendments adopted a complex Prevention of Significant Deterioration ("PSD") program, which contains both an ambient air-quality component and an emissions component. [FN17] The emissions-standard component of the PSD program consists of a requirement that major sources in PSD areas comply with a limitation set by reference to the best available control technology ("BACT"). BACT standards must be at least as stringent as any applicable NSPS standard. [FN18] *2348 The ambient air-quality component is more complicated. Areas with better ambient air-quality levels than the NAAQS are subjected to more stringent ambient standards. For sulfur dioxide and particulates, ambient air- quality levels in these areas cannot exceed a baseline plus an increment. [FN19] The baseline is the ambient concentration at the time that the first "major emitting facility," defined as a source emitting more than a prescribed amount of pollution, applies for a permit. [FN20] The increment of allowable degradation beyond the baseline depends upon the classification of the area. In Class I areas, which primarily consist of national parks, the allowable increment is only about 2% of the level of the NAAQS. In Class II areas, which initially contained all other areas covered by the PSD program, an increment of 25% of the level of the NAAQS is allowed. Subject to various procedural safeguards, the states have authority to reclassify particular areas to Class III, where the increment can reach 50% of the level of the NAAQS. [FN21] In no event may the ambient air-quality levels in PSD areas (the baseline plus the increment) exceed the NAAQS. [FN22]
Under the PSD program, degradation that takes place before the establishment of a baseline is not counted against the increment. [FN23] For example, under the NAAQS, ambient air-quality levels of sulfur dioxide, averaged over a year, cannot exceed 80<gk_m>g/m. [FN24] The corresponding PSD increment for Class II areas is 20<gk_m>g/m. [FN25] Consider a Class II area that, at the time of the 1977 amendments, had an ambient air-quality level of 40<gk_m>g/m, which deteriorated by 10<gk_m>g/m as a result of pollution from sources that were not "major emitting facilit[ies]," from in-state sources outside the PSD area, or from out-of-state sources, before the baseline was set. This Class II area could still avail itself of the full increment of 20< gk_m>g/m. In contrast, if the area's ambient air-quality levels in 1977 had been 60<gk_m>g/m, the deterioration of 10<gk_m>g/m prior to the establishment of the baseline would have left room for further deterioration of only 10<gk_m> g/m because at that point the NAAQS of 80<gk_m>g/m would become constraining.*2349

For areas with air quality worse than the NAAQS, the 1977 amendments established a nonattainment program. [FN26] These areas were required to make "reasonable further progress" toward the attainment of the NAAQS, [FN27] and had to attain the NAAQS by the mid-1980s. The 1990 amendments extended this deadline, creating distinctions based on the magnitude of the nonattainment problem. [FN28] In addition to this ambient component, new sources seeking to locate in nonattainment areas have to meet an emissions standard defined by reference to the "lowest achievable emission rate"

("LAER"), which, like BACT, has to be at least as stringent as NSPS. [FN29] In addition, such sources must obtain "offsets," under which existing sources in the area reduce their emissions by more than the amount that will result from the new source, so that, in the aggregate, there is "reasonable further progress" toward the attainment of the NAAQS. [FN30] Moreover, existing sources in nonattainment areas must meet "reasonably available control technology" ("RACT") standards. [FN31]

B. Impact of the Statute on Interstate Externalities

This section shows that the ambient and emissions standards described above, which form the core of the Clean Air Act, are an ineffective and poorly targeted means of dealing with the problem of interstate externalities. It also explains why these provisions may have exacerbated the interstate spillover problem. Then, it analyzes three specific sets of provisions directed primarily at controlling interstate externalities. Section 123, added in the 1977 amendments, places constraints on a state's ability to use tall stacks as a method to meet ambient air-quality standards, on the ground that the distance that pollution travels increases with the height of the stack. [FN32] The acid-rain provisions of the 1990 amendments [FN33] create a system of marketable permits in sulfur dioxide. Finally, sections 110(a)(2)(D) and 126(b), also added in the 1977 amendments and amended in ***2350** 1990, seek to place direct limits on the amount of pollution from upwind states that is permitted to affect air quality in downwind states. [FN34] This section shows that the tall-stack and acid-rain provisions provide at best a partial response to the problem. Thus, sections 110(a)(2)(D) and 126(b) provide the only means by which the Clean Air Act can address the problem of interstate externalities in a comprehensive manner. As section C later shows, however, these provisions have been wholly ineffective.

1. Ambient and Emissions Standards

The Clean Air Act's federal emissions standards for stationary sources--NSPS, BACT, LAER and RACT, as well as its federal emissions standards for automobiles--are not a good means by which to combat the problem of interstate externalities. These standards constrain the pollution from each source, but do not regulate the number of sources within any given state or the location of the sources.

Similarly, the various federal ambient air-quality standards of the Clean Air Act--the NAAQS, the baseline-plus-increment approach of the PSD program, and the "reasonable further progress requirements" of the nonattainment provisions--also are not well-targeted means to address the problem of interstate externalities, because they are both overinclusive and underinclusive. From the perspective of constraining interstate externalities at a desirable level, ambient standards are overinclusive because they require a state to restrict pollution that has only in-state consequences. Concern about interstate externalities can be addressed by limiting the amount of pollution that is permitted to cross interstate borders. Such externalities can be controlled even if the upwind state chooses to have poor environmental quality within its borders. Conversely, the federal ambient air-quality standards are underinclusive from the perspective of controlling interstate externalities because a state could meet the applicable ambient standards but nonetheless export a great deal of pollution to downwind states because the sources in the state have tall stacks and are located near the interstate border. In fact, a state might meet its ambient standards precisely because it exports a great deal of its pollution.

2351 The federal ambient and emissions standards could perhaps be justified as a second-best means by which to reduce the problem of uncontrolled interstate externalities. One might believe that by reducing pollution across the board they reduce interstate externalities proportionately. So, for example, if they lead to the halving of the aggregate amount of pollution, one might think that they would also cut in half the pollution that crosses state lines.

Such a view, however, is incorrect as a matter of both theory and empirical observation. The amount of aggregate emissions is not the only variable that affects the level of interstate externalities; two other factors play important roles. The first is the height of the stack from which the pollution is emitted--the higher the stack, the lesser the impact close to the source and the greater the impact far from the source. [FN35] Thus, absent a federal constraint, states have an incentive to encourage their sources to use tall stacks as a way to externalize both the health and environmental effects of the pollution, as well as the regulatory costs of complying with the federal ambient standards.

Second, the level of interstate externalities is affected by the location of the sources. In the eastern part of the United States, where the problem of interstate pollution is most serious, the prevailing winds blow from west to east. Thus, states have an incentive to induce their sources to locate close to their downwind borders, for example, through the use of tax incentives or subsidies, so that the bulk of the effects of the pollution is externalized.

The best evidence that states do indeed encourage sources to use tall stacks can be found in the provisions of the SIPs adopted by at least fifteen states in response to the enactment of the Clean Air Act in 1970. These SIPs allowed sources to meet the NAAQS by using taller stacks rather than by reducing emissions. [FN36] In those SIPs, the permissible level of emissions was an increasing function of the height of the stack. [FN37] If the stack was sufficiently high, the effects ***2352*** would be felt only in the downwind states and would therefore have no impact on in-state ambient air-quality levels. Through these measures, the states created strong incentives for their firms to externalize the effects of their sources of pollution. [FN38]

It is true that states had an incentive to externalize pollution even before the enactment of the Clean Air Act in 1970 because, by encouraging tall stacks, states could make other states bear the adverse health effects of pollution. The 1970 provisions, however, created an additional incentive. By encouraging the use of tall stacks, states could also externalize the regulatory impact of the standards, thereby availing themselves, for example, of the opportunity to attract additional sources without violating the NAAQS. Taller stacks entail higher costs of construction and, possibly, operation. It is therefore conceivable that a state that did not view the externalization of health effects as sufficient by itself to outweigh imposing such costs on in-state firms would reach a different conclusion when tall stacks lead to the externalization of both health and regulatory impacts.

More generally, before 1970, the states had not developed extensive regulatory programs for controlling air pollution. The net benefits of taller stacks, if any, might not have been worth the institutional investment necessary to create a regulatory program to transmit incentives for such stacks. The Clean Air Act, by requiring states to prepare SIPs, gave them no choice but to create an institutional structure designed to regulate the emissions of industrial sources. With that structure in place, it became comparatively easier to encourage tall stacks.

In addition, the health benefits of reducing the impact of emissions on in- state ambient air-***2353** quality levels are external to the firm emitting the pollution. Thus, a firm will take such effects into account only if required to do so by a regulator. In contrast, the regulatory benefits of reducing the impact on in-state ambient air-quality levels can be captured directly by the firms, which, by using taller stacks, need to invest less to reduce their emissions. [FN39] While before 1970, firms would have expended resources in tall stacks only if required to do so by a state regulatory agency, after 1970 they had an independent incentive for pursuing such a policy.

It is therefore not surprising that the use of tall stacks expanded considerably after 1970. For example, whereas in 1970 only two stacks in the United States were higher than 500 feet, by 1985 more than 180 stacks were higher than 500 feet and twenty-three were higher than 1000 feet. [FN40]

In contrast to the experience with tall-stack provisions, my research has uncovered no direct evidence concerning whether states also provided incentives for sources to locate close to their downwind borders. There is, however, literature suggesting that such incentives are present in the case of the siting of waste sites. [FN41] It would not be ***2354** implausible to believe that states acted in the same manner with respect to air pollution facilities.

In summary, the central components of the Clean Air Act are not an effective or well-targeted response to the problem of interstate externalities. As I argued elsewhere, vesting authority at the federal level to promulgate the ambient and emissions standards described above can best be explained by reference to the race-to-the-bottom justification--a justification that I have criticized--rather than to the interstate externality justification.

2. Tall-Stack Provisions

While the ability of states to encourage the use of tall stacks has been curtailed somewhat since the mid-1970s, the concerns expressed in the preceding subsection are still salient. Tall stacks remain a means by which excessive pollution can be externalized.

In 1974, the Fifth Circuit struck down the EPA's approval of Georgia's SIP on the ground that the SIP relied excessively on tall stacks as the means to meet the NAAQS. [FN42] This decision led the EPA to promulgate regulations limiting the "credit" that a source could obtain by the use of tall stacks. In 1977, Congress amended the statute to explicitly require such a limitation. The relevant provision states that the degree of emissions limitation required by a SIP "shall not be affected . . . by so much of the stack height of any source as exceeds good engineering practice (as determined under regulations promulgated by the Administrator [of the EPA])." [FN43] Interestingly, however, the statute also provides that "[i]n no event ***2355** may the Administrator prohibit any increase in any stack height or restrict in any manner the stack height of any source." [FN44]

The EPA subsequently promulgated regulations that define good engineering practice ("GEP") as the greater of:
1. 65 meters;
2. for stacks in existence before January 12, 1979, 2.5 times the height of the facility or other nearby structure, and, for stacks built subsequently, the height of the facility or other nearby structure plus 1.5 times the lesser of the height or width of the facility or other nearby structure; and
3. greater heights where necessary to prevent excessive concentrations as a result of atmospheric downwash, wakes, or eddy effects as a result of nearby structures. [FN45]
Despite these regulations, incentives for suboptimally tall stacks are likely to remain. To explain why, it is necessary to provide some background on the GEP concept. GEP is not solely an engineering concept. The higher the stack, the less a source's emissions will affect ambient air-quality levels nearby, and the more they will affect ambient air-quality levels farther away. [FN46] This phenomenon gives rise to environmental and regulatory tradeoffs, as well as an aggregate tradeoff. The environmental tradeoff concerns the valuations of adverse effects on public health and the environment nearby relative to the value of adverse effects imposed farther away. The regulatory tradeoff arises because a taller stack implies the need for more environmental controls farther from the source and fewer controls closer to the source.

Finally, with respect to the aggregate tradeoff, taller stacks have higher construction and maintenance costs, which must be borne by the source constructing the stack. If the resolution of the environmental and regulatory tradeoffs favors a shorter stack, the inquiry should end, because there would be no socially desirable reason for the source to expend the additional costs of building a taller stack. ***2356** In contrast, if the resolution of the environmental and regulatory tradeoffs favors a taller stack, the socially desirable height will depend on the comparison between the net environmental and regulatory benefits of a taller stack and the additional costs of building and operating such a stack.

If all adverse air-quality effects were felt within a single state, a state regulator interested in maximizing social welfare could make these tradeoffs in an unbiased way. As discussed above, however, if at least some of these effects are interstate, the regulator has incentives to externalize both the environmental and regulatory burdens, thereby approving suboptimally high stacks.

The optimal resolution of all three tradeoffs depends on case-specific factors. The relative sizes of the exposed populations are relevant to the environmental tradeoff because a tall stack is more desirable if the affected population farther from the source is smaller than the affected population closer to the source than if the converse is true. The nature of the pollutant also affects the resolution of this tradeoff because for a stack of a given height, different pollutants will travel different distances. [FN47] In addition, the tradeoff is affected by whether the pollutant emitted by the source gets transformed into a different pollutant as it travels through the atmosphere, as does, for example, sulfur dioxide. [FN48]

The regulatory tradeoff implicates the relative pollution-control costs of the different sources. If a source has a taller stack, the emissions standards of other sources with impacts near to this source could be relaxed, whereas the emissions standards of sources with impacts farther away would need to be made more stringent. Thus, the allocation of pollution-control burdens that minimizes the costs of meeting the federal ambient standards depends on the relative impacts of emissions from each of these sources on ambient air quality, as well as on the relative marginal costs of pollution reduction.

Finally, with respect to the aggregate tradeoff, the construction and operation costs of taller stacks will depend on the nature of the facility. In summary, the question of what stack height is desirable will vary from source to source, from location to location, and from pollutant to pollutant. The EPA's regulations, however, do not ***2357*** permit such case-specific inquiries. As indicated above, GEP is defined as the largest of three dimensions: a fixed height, a multiple of the dimensions of the source or nearby structure, and a greater height if warranted by certain meteorological and physical factors. [FN49] While the latter standard takes certain case- specific factors into account, the inquiry contemplated by the regulations is far narrower than that outlined above.

As a result, there will be instances in which a height that conforms with the requirements of GEP nonetheless produces an amount of interstate pollution that is suboptimal from the perspective of properly controlling the externality. [FN50] If all of the effects of the pollution were felt within a state, the state could, in such circumstances, require lower stacks. Even when there are interstate spillovers, a state has at least a partial incentive to do so as long as at least some of the adverse effects occur in-state.

Under certain conditions, a stack conforming with the GEP requirement might be suboptimally low. In this situation, unlike where GEP is suboptimally high, there is only a crude corrective mechanism. As mentioned above, the Clean Air Act provides that while the regulations can limit the amount of credit that a source receives from a taller stack, they cannot constrain the actual height of the stack. Thus, if a GEP stack is suboptimally low, a source could build a taller stack. But under the regulations, the source would be unable to realize the full social benefits of the taller stack because the nearby effects of the source's emissions would be calculated on the basis of a GEP stack, rather than on the basis of the stack's actual height.

It is now possible to examine the ways in which the statute and regulations are likely to create incentives for stacks that are too tall. First, as a result of the asymmetry in corrective mechanisms, it is in fact desirable for the definition of tall stacks in the regulations to err on the side of allowing, on average, GEP stacks to be suboptimally tall. Regardless of whether the current scheme actually has such a bias, it is relevant for the purposes of this discussion that a socially optimal scheme would exhibit such characteristics.

Second, firms have the ability to affect the permissible height of their stacks by manipulating the dimensions of their facilities or nearby structures. Because the regulations allow pre-1979 stacks ***2358** to be 2.5 times the height of the facility or nearby structure and post-1979 stacks to be the height of the facility times 1.5 times the lesser of the height or width of the facility or nearby structure, larger facilities or nearby structures permit the use of taller stacks. [FN51]

Third, the location of the plant also affects the permissible height of the stack. The regulations allow sources to use stacks that are taller than would otherwise be permissible if the presence of nearby structures would produce excessive concentrations as a result of atmospheric downwash, wakes or eddy effects. For this reason, too, the definition of GEP is manipulable, and the desire to externalize the adverse consequences of pollution might lead states to create incentives for taller stacks.

Fourth, ironically, regulatory provisions concerning stack height have been interpreted in a way that understates the impact of interstate emissions. This phenomenon arises because the statute limits only the credit in terms of emissions reductions that sources can get for tall stacks, but does not limit the height of the stacks themselves. [FN52] Thus, if the height exceeds GEP, the impact of emissions on air quality nearby will be calculated on the basis of a GEP stack, rather than on the basis of the actual height. Therefore, under this calculation, the source's impact on nearby ambient air quality will be greater than the actual impact of these emissions. Farther from the source, however, the opposite is true: the actual impact will be greater than the calculated impact. At least one court has deferred to the EPA's method of determining the effects of using the GEP impact even when the resulting calculation of impact is less than the actual impact. [FN53] This procedure understates the impact of emissions from tall stacks on ambient air quality far from the source. Such an understatement makes tall stacks more desirable to the upwind state than they would otherwise be because it allows greater externalization of the consequences of in-state pollution.

***2359** 3. Acid-Rain Provisions

At best, the acid-rain provisions of the 1990 amendments [FN54] are an incomplete mechanism for dealing with interstate externalities. They apply to only two pollutants: sulfur dioxide and nitrogen oxides. [FN55] Further, they apply to only one type of facility: electric utilities. [FN56]

Moreover, these provisions are not structured to allocate emissions between upwind and downwind states in a desirable manner. With respect to nitrogen oxides, the provisions set emissions standards for new and existing sources. [FN57] As discussed above, emissions standards are not a well-targeted means for controlling interstate externalities. [FN58]

The acid-rain provisions create a national marketable-permit scheme for sulfur dioxide. Phase I of the scheme, which went into effect in 1995, applies only to 110 major polluters. [FN59] It allocates to each utility a yearly allowance of 2.5 pounds of sulfur dioxide for each million BTUs of fuel input consumed, on average from 1985 to 1987. [FN60] Phase II, which will go into effect in the year 2000, covers virtually every electric utility in the country and allocates to each a yearly allowance of 1.2 pounds of sulfur dioxide per million BTUs, based also on their fuel use from 1985 to 1987. [FN61] For both phases, the allowances are tradeable in a single, national market. [FN62]

Although these decreases in the allowable emissions of sulfur dioxide are likely to reduce the amount of acid rain, particularly after the year 2000, they make no attempt to allocate emissions ***2360** between upwind states and downwind states in an optimal way. The acid-rain problem manifests itself primarily in the Northeast, but is caused primarily by emissions from the Midwest. Because the market is national, Midwestern sources could buy, without restriction, permits from the West and the Northeast. [FN63] Such trades would have an undesirable impact in the Northeast. In fact, downwind states are attempting to prevent their sources from selling permits to upwind sources, though such measures may well be struck down on constitutional grounds. [FN64]

4. Interstate Spillover Provisions

Section 110(a)(2)(D), which was codified as section 110(a)(2)(E) until the 1990 amendments, and section 126(b), which dates to the 1977 amendments, are the most comprehensive means for controlling interstate spillovers. The House Report accompanying these provisions expressed the view that the 1970 version of these provisions, which relied solely on intergovernmental cooperation on the part of the state governments, with no federal role, was "an inadequate answer to the problem of interstate air pollution." [FN65]

Section 110(a)(2)(D), in its 1977 version, sets forth as one of the conditions for the approval of SIPs by the EPA that:

[SIPs] contain[ ] adequate provisions (i) prohibiting any stationary source within the State from emitting any air pollutant in amounts which will (I) prevent attainment or maintenance by any other State of any such national primary or secondary ambient air quality standard, or (II) interfere with measures required to be included in the applicable implementation plan for any other State under [the PSD provisions] to prevent significant deterioration of air quality or to protect visibility . . . . [FN66] The 1990 amendments left prong (II) unchanged. [FN67] With respect to prong (I), the "prevent attainment or maintenance by any other State" language was changed to "contribute significantly to nonattainment in, or interfere with maintenance by, any other State." [FN68] As discussed below, this change appears to codify the existing administrative and judicial interpretation. [FN69] In turn, the 1977 version of section 126(b) provided that "[a]ny State or political subdivision may petition the Administrator for a finding that any major source emits or would emit any air pollutant in violation of the prohibition of section [110](a)(2)(E)(i)." [FN70] This section was amended only in minor respects in 1990. [FN71]

Unlike the federal ambient and emissions standards, the interstate spillover provisions are designed to prevent excessive pollution (however that term might be defined) from crossing interstate borders. Unlike the tall-stack and acid- rain provisions, they are designed to deal with the problem comprehensively. The discussion that follows analyzes and criticizes the administrative practice and case law that has developed under these provisions.

2362 C. Administrative and Judicial Interpretation of the Interstate Spillover Provisions This section analyzes the substantive standards that the EPA and the courts have fashioned to guide proceedings under sections 110(a)(2)(D) and 126(b). Before discussing these standards, however, it is necessary to provide some background on several threshold issues. With respect to both the threshold issues and the substantive standards, the EPA and the courts have placed considerable roadblocks in the path of downwind states seeking to constrain upwind pollution. Indeed, despite the congressional concern over the problem of interstate externalities, which led to the enactment in 1977 of sections 110(a)(2)(D) and 126(b), no downwind state has ever prevailed on a claim alleging excessive upwind pollution. [FN72]

1. Threshold Issues

The first threshold issue concerns the models the EPA uses to predict the impact of upwind emissions on ambient air quality in the downwind state. The EPA has maintained that it cannot predict such impacts more than 50 kilometers (about 30 miles) from the source of the pollution, [FN73] and has summarily rejected the predictions made by downwind states on the basis of longer-range models. [FN74] Thus, sections 110(a)(2)(D) and 126(b) have been of no use to downwind ***2363*** states challenging pollution from sources not immediately contiguous to their borders.
The second threshold issue relates to the treatment of pollutants that are transformed as they travel through the atmosphere. In particular, sulfur dioxide emissions become sulfates, which affect the ambient air-quality levels of total suspended particulates. [FN75] Thus, increased sulfur dioxide emissions upwind have an effect downwind not only on ambient air-quality levels of sulfur dioxide, but also on ambient air-quality levels of particulates. The EPA has consistently taken the position, which has been upheld by the courts, that the impact of transformed pollution need not be taken into

account in evaluating whether the upwind pollution is excessive. Thus, the phenomenon of acid rain, an important manifestation of the problem of interstate pollution, has been largely outside the reach of sections 110(a)(2)(D) and 126(b). [FN76]

Third, the EPA has not set an ambient air-quality standard for sulfates, [FN77] even though a relative consensus developed within the scientific community in the 1980s concerning the adverse environmental effects of acid rain. [FN78] Nor has the EPA promulgated regulations to combat regional haze, [FN79] despite a statutory obligation under section 169A to do so by 1979. [FN80] Had the EPA done so, it would have been required by sections 110(a)(2)(D) and 126(b) to take into account the impact of upwind emissions of sulfur dioxide on the downwind ambient air-quality levels of sulfates as well as their impact on regional haze. [FN81]

***2364** Finally, the EPA has taken the position, which the courts have upheld, that the cumulative impacts of upwind sources are not cognizable in a section 110(a)(2)(D) proceeding. In such proceedings, the downwind states challenge the EPA's approval of a SIP revision for an upwind state; under the prevailing administrative and judicial approach, only the impacts of the source (or sources) subject to the revision can be challenged. [FN82] As is discussed below, upwind pollution that exacerbates a violation of the federal ambient standards in the downwind state is deemed excessive only if it makes a "significant contribution" to the violation. [FN83] For example, the EPA has determined that contributions of 1.5% and 3% are not significant. [FN84] By allowing contributions of these magnitudes from single sources without inquiring about the number of other sources affecting the ambient air- quality levels in the downwind state, the EPA may be permitting large cumulative amounts of interstate spillovers. [FN85] This approach also creates incentives for those seeking SIP revisions having interstate impacts to deal only with single sources, thereby masking potentially large cumulative impacts.

While the EPA allows the consideration of cumulative impacts in actions under section 126(b), [FN86] it has placed the burden of producing the facts needed to support the requested action on the downwind state, as the proponent of agency action. [FN87] In contrast, under section 110(a)(2)(D), the "burden of compiling an adequate record to support [a] SIP revision is placed on the . . . state" seeking the revision--the upwind state. [FN88]

2. Substantive Standards

To understand the administrative and judicial interpretations of the substantive standards, it is helpful to construct a taxonomy defined by reference to whether the downwind state would meet the federal ambient standards if it did not have to face pollution ***2365** transported from the upwind state and whether the downwind state actually meets the federal ambient standards despite the upwind pollution. There are three relevant categories.

In the first category, the downwind state would meet the federal ambient standards without the upwind pollution, and meets these standards despite the upwind pollution. In the second category, the downwind state would not meet the federal ambient standards even if there were no upwind pollution and, of course, does not meet the standards with the upwind pollution. In the third category, the downwind state would meet the federal ambient standards in the absence of upwind pollution, but does not meet these standards with the upwind pollution; here, the upwind pollution is the but-for cause of the violation of the federal ambient standards. This taxonomy is summarized in Table I.

Table I: Taxonomy of Interstate Spillovers

	Violation Without Upwind Pollution	Violation with Upwind Pollution
Category I	No	No
Category II	Yes	Yes
Category III	No	Yes

As to each of these categories, two questions are relevant. First, should the federal government play a role in controlling the upwind pollution? Second, assuming that such a role is appropriate, how should the federal government determine the permissible amount of upwind pollution that can enter the downwind state? The discussion that follows considers the principles that ultimately emerged during the Reagan Administration from the administrative and judicial treatment of these issues, as well as the approach taken during the Carter Administration, which was more sympathetic to the interests of downwind states.

In Category I, absent a violation of the federal ambient standards--either the NAAQS or the PSD increments--the EPA will place no limits on the upwind pollution. [FN89] In this situation, the upwind ***2366** pollution will be unconstrained even if it leads to a violation of a state ambient standard in the downwind state, [FN90] even if the downwind state desires to preserve a margin for growth, [FN91] and even if the downwind state has been unable to place at least some constraint on its environmental degradation by setting a baseline under the PSD program. [FN92]
Since the Reagan Administration, the EPA has claimed that this approach is compelled by the statutory focus on upwind pollution ***2367** that "prevent[s] the attainment or maintenance" of the NAAQS or "interfere[s] with measures required" by the PSD program. If the NAAQS are being attained, the Agency reasoned, the upwind pollution is not "prevent[ing]" their "attainment or maintenance." [FN93] Similarly, if the PSD increment is not violated, the upwind pollution is not "interfer[ing]" with any measures "required" by the PSD program. [FN94] The 1990 amendments are unlikely to affect the treatment of cases in which there is no violation of the ambient standards downwind, as the pertinent language concerning "interfer[ence]" with PSD provisions remains unchanged. [FN95]

In contrast to the Reagan Administration's constrained view of the reach of the Clean Air Act's interstate spillover provisions, during the Carter Administration the EPA took the position, in the context of an action under section 126(b), that these provisions protected state ambient standards that were more stringent than the federal standards. [FN96] Moreover, in dicta, the Second Circuit stated, relying in part on the legislative history of section 126(b), [FN97] that while the ***2368** EPA was not required to consider the impact of upwind pollution on the state ambient standards of a downwind state, it had the discretion to do so. [FN98]

In Category II cases, where the upwind pollution exacerbates a violation of a federal ambient standard in the downwind state, the EPA has determined that the upwind pollution should be constrained only if it constitutes a "significant contribution" to the downwind state's violation, and the courts have upheld the EPA's position. [FN99] The 1990 amendments codify this interpretation. [FN100]

The EPA has never found upwind pollution to meet this standard and has given little guidance on what factors distinguish a "significant" contribution from an "insignificant" one. In cases involving a single upwind source, the EPA concluded that contributions of 1.5% [FN101] and 3% [FN102] were not significant. It reached these conclusions with no analysis, apparently basing its determination on the fact that those percentages did not seem particularly large. Nor did the EPA engage in any inquiry as to the cumulative impacts of upwind emissions. In light of the large number of sources that are likely to ***2369** affect ambient air-quality levels in the downwind state, this approach is quite unprotective of the interests of downwind states.

Although the EPA did, in a different proceeding, set forth a list of criteria for determining when a contribution is significant, including the relative stringencies of state regulations and the relative costs of pollution controls in the upwind and downwind states, [FN103] it has never actually applied these factors. Also, while the EPA has indicated that "[t]o be 'significant,' a contribution from a very large area must have a distinctly larger impact on nonattainment or PSD ***2370** programs than a contribution from a single source," [FN104] the Agency has yet to explain the relationship between the size of the area and the magnitude of a "significant contribution."

Moreover, the EPA has not indicated what remedy would be appropriate in the event that upwind pollution were found to constitute a "significant contribution" to a violation. Would the Agency then enjoin only the upwind contribution that exceeds the threshold for significance, or would all the upwind pollution be enjoined?
In Category III, the EPA has indicated that the plain meaning of the statutory phrase "prevent attainment" requires the Agency to deem excessive any upwind pollution that was the but-for cause of a violation of the federal ambient standards in the downwind state. [FN105] The courts have accepted this position, though in dicta. [FN106] In the only case in which the situation was presented, however, the Agency rejected the downwind claim, stating that it doubted the accuracy of the modeling analysis performed by the downwind state. [FN107]

***2371** The 1990 amendments, which substitute "contribute significantly to nonattainment" for "prevent attainment," are unlikely to change the approach of the

EPA and the courts. [FN108] If the upwind pollution is the but-for cause of the nonattainment status, such pollution is contributing exclusively to nonattainment.
In summary, three principal rules emerge from the administrative and judicial interpretations of section 110(a)(2)(D): upwind pollution is never constrained if the downwind state meets the federal ambient standards; upwind pollution that exacerbates a violation of the federal ambient standards in the downwind states is constrained only if the upwind sources "significantly contribute" to the violation; and upwind pollution that is the but-for cause of the violation of federal ambient standards in the downwind state is always constrained.

The combination of these rules leads to illogical and undesirable results. Consider first the Category I case of a downwind state that is not violating the NAAQS or the PSD increments. The amount by which the downwind state's ambient air-quality levels are better than the federal ambient standards represents that state's margin for growth. If the downwind state is not able to attract new sources, because, for example, it is experiencing a temporary economic downturn, the rules allow an upwind state to consume the downwind state's margin for growth without constraint by adding additional sources. [FN109] Indeed, the rules even allow an upwind state to consume the downwind state's margin for growth by amending its SIP to permit its existing sources to increase their emissions up to the point at which the federal ambient standards become constraining in the downwind state. [FN110] Once the air-quality levels in the downwind state reach the level of the federal ambient standards (with the help of the upwind state), the downwind state will be unable to attract any sources without requiring emissions reductions from its existing sources. At the extreme, a downwind state with no existing industrial base would be precluded from ever acquiring one.

In contrast, if the downwind state consumes its margin for growth first, either by attracting new sources or by amending its SIP to allow existing sources to pollute more, any increase in the pollution that ***2372** the upwind state sends downwind would be deemed a violation of section 110(a)(2)(D). An upwind state without an industrial base at the time that the downwind state reaches the federal ambient standards might be effectively precluded by this rule from attracting any polluting sources in the future if, as a result of the state's geography, any in-state emissions would be likely to migrate downwind.

Accordingly, the margin for growth in the downwind state would be allocated on a "first-come-first-served" basis. [FN111] Such rules of capture are undesirable; they create incentives for both upwind and downwind states to use the downwind state's margin for growth at a faster rate than is economically desirable, and do not allocate this margin for growth to the state that values it most highly.

The discussion so far has focused on a downwind state that intends to use its margin for growth for economic expansion. Instead, states might set state ambient standards that are more stringent than the federal standards because they attach more value to environmental protection. The federal environmental laws emphasize, as explicitly reflected in section 116, that federal standards are floors and not ceilings, and that states remain free to enact standards that are more stringent than the federal standards. [FN112] Under the dominant race-to-the-bottom and interstate externality justifications for vesting responsibility for environmental regulation at the federal level, [FN113] the evil to be remedied is underregulation on the part of the states, not overregulation. Under both ***2373** of these rationales, states should be encouraged to regulate more stringently if their preferences for environmental protection are stronger than those reflected in the federal standards, or if their costs of pollution reduction are lower than average. As discussed in Part II, more stringent standards are undesirable only if they are an effort to externalize to other states the costs of pollution control. [FN114] Under the current administrative and judicial approach, however, more stringent state ambient standards can be used only to limit the emissions of in-state sources and cannot be invoked, under any circumstances, to constrain upwind emissions. Such a regime creates a disincentive for downwind states to have more stringent state ambient standards: downwind states bear all the costs of such standards (the costs of tougher emissions limitations for in- state sources), but the upwind states can appropriate the benefit by taking the additional opportunities created for the externalization of pollution. [FN115]

The administrative and judicial approach to Category II situations, in which the upwind pollution aggravates a violation of the federal ambient standards, also is misguided. In Category II cases, the downwind state would be unable to constrain the upwind pollution unless the pollution was deemed a "significant contribution" to the violation. [FN116] Under the nonattainment provisions of the Clean Air Act, however, the downwind state has an obligation to reduce its emissions until it meets the NAAQS. Thus, absent a "significant contribution" from upwind sources, the full burden of pollution reduction falls initially on the downwind sources, even if upwind reductions would be far less costly.

But once the downwind state made sufficient improvements so that it could meet the NAAQS were it not for the upwind pollution, the situation would change. The upwind pollution would then be the but-for cause of the violation of the NAAQS in the downwind state--a Category III problem. The upwind pollution would be enjoined as "prevent[ing] the attainment" of the NAAQS, even if the costs to the upwind state of doing so were wholly disproportionate to the costs to the downwind state of somewhat more stringent pollution controls. As already indicated, in cases in which all emissions from the upwind state have at least some impact downwind, such a rule ***2374** would prevent any polluting activity in the upwind state. [FN117] The downwind state, by reducing its emissions to the point at which it could meet the NAAQS in the absence of the upwind pollution, but no further, could effectively destroy the upwind state's industrial base. [FN118]

In summary, of the three rules articulated by the EPA and the courts to address the problem of interstate spillovers, two are overly lenient and one is too harsh. It is undesirable to have no constraints on upwind pollution absent a violation of the federal ambient standards. Further, at least in its application, the "significant contribution" rule has allowed excessive upwind pollution. In contrast, the rule banning any upwind pollution that is the but- for cause of a violation of the federal ambient standards is unduly stringent. [FN119]

II. Internalizing the Interstate Externalities

This Part seeks to develop a sound means to force the internalization of interstate environmental externalities in a federal system. The analysis focuses on how to perform such internalization within the context of the Clean Air Act's requirement that states meet the federal ambient standards. The discussion contemplates a procedure like the one provided by the Act's sections 110(a)(2)(D) and 126(b), [FN120] under which downwind states can seek injunctions against upwind pollution.

The presence of interstate externalities constitutes a market failure. In the absence of other market failures or public choice ***2375** problems, correcting the externality leads to the maximization of social welfare. Under the approach contemplated here, however, this maximization is constrained by a requirement that the federal ambient standards be met, so social welfare gains that might result from ambient standards less stringent than the federal standards cannot be considered.

This objective of maximizing social welfare subject to a constraint is different from the objective of minimizing the costs of meeting the federal ambient standards because the states are free to choose more stringent state ambient standards. [FN121] In cases in which the federal ambient standards are constraining (that is, ambient air quality has been degraded to the level of these standards), the welfare-maximization and cost-minimization objectives yield identical results.

The analysis that follows assumes that there are no Coasian bargaining solutions under which states could limit their pollution spillovers through interstate compacts without any federal intervention. If transaction costs were sufficiently low to permit such bargaining, there would be no need for federal regulation. [FN122] Federal regulation of interstate externalities is necessary precisely because such bargaining does not occur. [FN123]

Section A considers the situation in which the federal ambient standards in the downwind state are violated and in which the ***2376** number of sources is fixed. Section B examines the situation in which the downwind state's ambient air-quality levels are better than the federal ambient standards.

A. Dealing with Violations of the Ambient Standard in the Downwind State

The design of a scheme to control interstate externalities must consider the manner in which pollution from an upwind state affects environmental quality in the downwind state. The impact that upwind pollution has on a downwind state's air quality is the product of three principal factors: emissions, location and stack height. [FN124] For a given stack height and location, the source's impact on ambient air quality increases with increasing levels of emissions. For a given stack height and level of emissions, the source's impact on ambient air quality in the downwind state increases as the distance between the source and the border with the downwind state decreases. For a given location and level of emissions, as stack height increases, the source has a smaller impact on ambient air quality within short distances and a greater impact on ambient air quality farther away.

The first subsection deals with the situation in which the sources' location and stack height have been fixed and asks how emissions should be allocated between upwind and downwind sources--the only inquiry performed by the EPA and the courts. In subsequent subsections, these assumptions are relaxed. In all of these instances, the objective is to minimize the aggregate cost of meeting the ambient standard. [FN125]

1. Selecting Desirable Levels of Emissions Where the Location and Stack Heights of Firms Are Fixed

The problem of allocating pollution-control burdens between upwind and downwind states to minimize the aggregate cost of meeting a given level of environmental quality is illustrated through a simple example in which there are only two sources: one, which I shall call U, in the upwind state and the other, which I shall call D, in the downwind state. The level of emissions of these sources is e ***2377*** and e, respectively. The impact of these emissions on ambient air quality is denoted by a and a, respectively. A simple relationship between a source's emissions and the impact of those emissions on ambient air quality at various distances downwind from the source is assumed: the impact increases linearly with distance up to a certain distance, m, downwind from the source and then begins to decrease linearly as the distance from the source continues to increase. The emissions have no impact upwind from the source and the downwind impacts occur along a single line. The distance between the two sources is t.
In both the upwind and downwind states, the ambient standard is set at a level s. Thus, in any given place, the sum of the impact of the two sources on ambient air-quality levels cannot exceed this level.

As indicated, the objective is to minimize the total cost of meeting the ambient standard, which is the sum of the pollution-control costs, c and c, borne by the upwind and downwind sources, respectively. For each source, this cost is a function of the levels of emissions, e and e. The cost rises as the level of emissions falls because the source needs to make more expenditures in pollution control. Moreover, the lower the level of emissions, the higher the increase in costs for an additional unit of emissions reduction. This assumption, which is standard, reflects the fact that a source will first reduce its emissions by the cheapest method, resorting to more expensive methods only when the cheaper reductions have been exhausted. So, for example, an electric utility might be able to achieve a moderate level of emissions reductions by the relatively inexpensive technique of washing its coal, but to achieve larger reductions it will have to utilize the far more expensive technique of installing stack scrubbers.
There are three different situations, which are defined by the distance between the upwind and downwind sources. In the first situation, at the point at which the upwind source has its maximum impact (at a distance m from this source), the downwind source has an impact as well. In the second situation, the downwind source has no

impact at the point at which the upwind source has its maximum impact, but both sources have an impact farther downwind. In the third situation, there is no point at which both sources have an impact.

2378 The analysis that follows focuses on the first situation, because it is the most complex. [FN126] Figure I illustrates this situation: the upwind source has its maximum impact at point m, and at that point the downwind source also has an impact. The extent of the impact from both sources can be broken down into five regions, defined by the distance from the upwind source.

First, for distances of less than t from the upwind source, the only impact on ambient air quality comes from the upwind source, and it increases with increasing distance. Second, for distances between t and m from the upwind source, both sources have an impact on ambient air quality, and the impact of each source increases with increasing distance.

Third, for distances between m and m<tm> from the upwind source, both sources have an impact on ambient air quality. The impact of the upwind source decreases as the distance from the source increases (because distance from the source is greater than m), whereas the impact from the downwind source increases with increasing distance (because throughout the relevant range the distance from the downwind source is less than m). Thus, if the emissions of the two sources are equal, as is shown in Figure I, throughout this range the impact on ambient air quality will be constant. In contrast, if the emissions from the upwind source are higher, the impact on ambient air quality decreases as the distance from the sources increases. Conversely, if the emissions from the downwind source are higher, the impact on ambient air quality increases as the distance from the sources increases.

In the fourth region, in which the distance from the upwind source is between m<tm> and 2m, the impact from each of the sources decreases as the distance increases. Finally, in the fifth region, in which the distance from the upwind source is between 2m and 2m<tm>, the upwind source no longer has any impact on ambient air-quality***2380*** levels; in turn, the impact of the downwind source decreases as the distance increases.

Because the optimization problem analyzed here is constrained by the requirement that the combined impact of the two sources not lead to the violation of the federal ambient standards, it is necessary to determine where the combined emissions have the maximum impact. If the emissions from the two sources satisfy the ambient standard at this point, it will follow, a fortiori, that they will satisfy the ambient standard everywhere else. Figure I reveals that the combined impact of the two sources on ambient air-quality levels will be greater at a distance of m from the upwind source than at any smaller distance, since in this range the impact of each of the sources increases as distance increases. Further, the impact will be greater at a distance of m<tm> than at any greater distance, since in this range the impact of each of the sources decreases as distance increases. Finally, in the range between m and m<tm>, the combined impact of the two sources increases with increasing distance if the emissions from the upwind source are smaller than the emissions from the downwind source, and decreases with increasing distance if the emissions from the upwind source are greater than the emissions from the downwind source.

For example, if the marginal cost of emissions reduction of the upwind source is sufficiently greater than the marginal cost of emissions reduction of the downwind source, then the overall cost of meeting the ambient standard will be minimized if the emissions from the upwind source are greater than those of the downwind source. In that case, the maximum combined impact of the two sources will be at a distance of m from the upwind source. Conversely, if the marginal cost of emissions reduction of the upwind source is sufficiently smaller than the marginal cost of emissions reduction of the downwind source, then the overall cost of meeting the ambient standard will be minimized if the emissions from the upwind source are smaller than those of the downwind source. Then, the maximum combined impact of the two sources will be at a distance m<tm> from the upwind source.

Thus, one needs to ensure only that the ambient standard is not violated at two points: at distances from the upwind source of m and m<tm>, respectively. If the ambient standard is met at both of these points, it will be met at all other points as well. One needs to ensure that the ambient standard is met at both of these points because one does not know until the problem is solved what the optimal relationship between the emissions of the two sources will be. The ambient *2381 standard, however, is going to be constraining only at one of these points (unless the optimal emissions from both sources are identical).

As indicated above, given that the federal ambient standards are binding, the objective is to minimize the aggregate costs of meeting those standards. To this point, for expositional convenience, the analysis has proceeded on the basis of a specific model of the impact of emissions on ambient air quality. It is easy to show, however, that the following results hold generally. The cost-minimizing allocation of the pollution-control burden of meeting a given ambient standard occurs when, at the point at which the ambient standard is constraining, the ratio of the marginal cost of emissions reduction (the cost of abating one additional unit of emissions, where such a unit is infinitesimal) for the upwind source to the marginal cost of emissions reduction for the downwind source is equal to the ratio of the marginal impact (the impact of one additional unit of emissions, where such a unit is infinitesimal) of the upwind source to the marginal impact of the downwind source on the ambient air-quality level in the downwind state.

The intuition behind this result is straightforward. Assume that when the federal ambient standards in the downwind state are met, one additional unit of emissions from the upwind source has twice the impact on the ambient air- quality level in the downwind state as one additional unit of emissions from the downwind source, and that the marginal cost of emissions reduction is the same for both sources. In that case, the aggregate cost of meeting the federal ambient standards would be lowered if the upwind source were required to reduce its emissions further and the downwind source were permitted to increase its emissions. Alternatively, if one additional unit of emissions from the upwind source has the same impact on the ambient air-quality level in the downwind state as one additional unit of emissions from the downwind source, and the marginal cost of emissions reduction is twice as high for the upwind source, then the aggregate cost of meeting the federal ambient standards would be lowered if the downwind source were required to reduce its emissions further, and the upwind source were permitted to increase its emissions. It is only when the two ratios are equal that the aggregate costs of meeting the federal ambient standards cannot be reduced by reallocating the emissions reduction requirements.

This result differs in an important respect from the well-known result of how to minimize the costs of achieving an aggregate level of emissions. In the latter case, the costs are minimized when the ***2382** marginal costs of emissions reduction are equal for all the sources. Otherwise the aggregate costs would be reduced by imposing more stringent controls on the source with the lower marginal costs and less stringent controls on the source with the higher marginal costs. Where, instead, the goal is not to minimize the cost of meeting an aggregate level of emissions, but rather to minimize the cost of meeting an ambient standard, the solution takes the more complex form described above. [FN127]

The preceding discussion illuminates how to deal with situations in which there is a violation of the ambient standard in the downwind state and where both the upwind and the downwind sources are contributing to the violation. To summarize, the following steps need to be undertaken by a decisionmaker interested in minimizing the aggregate costs of meeting the ambient standard in the downwind state.
First, at a point at which there is a violation, the decisionmaker would determine the impact of one unit of emissions from each of the sources and calculate their ratio. Second, it would determine the marginal costs of emissions reduction for each of the firms and calculate their ratio. Third, it would determine at what levels of emissions these ratios are equal; at these levels, the pollution-control burden is allocated optimally. Fourth, it would ascertain whether the upwind source is polluting more than this amount and, if so, would order it to reduce its emissions accordingly.
If, in contrast, the upwind source was polluting less than this optimal amount, the decisionmaker would simply deny the downwind state's petition, and all the reductions would have to come from the downwind state. From the perspective of social welfare, too little pollution from the upwind source can be as undesirable as too much pollution, because it permits the downwind source to emit a suboptimally large amount of pollution without violating the ambient standard. Nonetheless, the reason for federal intervention--the concern about interstate externalities--is implicated only if the upwind pollution is excessive.

***2383** The work of the decisionmaker, however, does not end here. The fact that it was able to calculate the optimal allocation of the pollution-control burden at a particular point does not mean that the corresponding levels of emissions will lead to the achievement of the ambient standard everywhere else. Even if the basis for this calculation was the point where the ambient standard was violated by the largest amount, it may well be that the optimal level of emissions, from the perspective of minimizing the costs of meeting the ambient standard at that point, might nonetheless lead to violations elsewhere. The decisionmaker would then have to determine what additional reductions would need to be made, and in what proportion, so that the ambient standard was met everywhere.

A rule of thumb for how to carry out this process might be to start at the point of maximum violation and determine the optimal adjustment to emissions of the upwind and downwind sources consistent with meeting the ambient standard there. Next, one would check whether these adjusted levels of emissions lead to violations elsewhere. If so, one would focus on the point at which the adjusted levels of emissions produced the largest violation and determine, once again, the optimal adjustments. This process would be repeated until there were no further violations.

The inquiry becomes more complicated when there are multiple sources in the upwind and downwind states. The ratios of marginal costs of emissions reductions would have to be set equal to the ratio of the impacts of one unit of emissions for each pair of sources. Any upwind source that had emissions that were excessive under this standard would be ordered to reduce them. Here, too, the decisionmaker would have to perform the iterations described above to ensure that the ambient standard was met at every point.

The preceding inquiry exposes fundamental misconceptions in the administrative and judicial approaches to the problem of interstate pollution. First, it is not desirable to bar all upwind pollution from reaching the downwind state, as the legal regime purports to do in cases in which the upwind pollution is the but-for cause of the violation in the downwind state. [FN128] Because of prevailing winds, for a given location and stack height, it may be inevitable that emissions from the upwind state will have some impact on ambient air quality in the downwind state. [FN129] To prohibit any such ***2384** impact is tantamount to prohibiting industrial activity in those locations. Second, the appropriate test is not dependent on which source is polluting more, whether in the aggregate or per unit of input into or output from the production process. Indeed, it is desirable for the upwind source to pollute more if its marginal cost of emissions reduction is sufficiently higher, or if one unit of its emissions has a sufficiently smaller impact than that of the downwind source at the point in the downwind state where the ambient standard is constraining.

Third, as already indicated, the well-known condition that cost minimization requires that the marginal costs of emissions reductions be equal for all sources does not hold where the objective is to minimize the aggregate cost of meeting a given ambient standard rather than to minimize the aggregate cost of reducing the total level of emissions to a given level.

Fourth, it is inappropriate to rest the analysis solely on a comparison of which source has the larger impact on ambient air-quality levels in the downwind state. Given the location, stack height and marginal cost of emissions reduction of the upwind source, the cost-minimizing solution might be for that source to have a larger impact.
Fifth, the prevailing judicial standard, under which upwind emissions are enjoined only

if they significantly contribute to the violation of the ambient standard in the downwind state, is both overinclusive and underinclusive. It is overinclusive because there will be instances in which, as a result of the location, stack height and marginal costs of emissions reduction of the upwind source, it will be socially desirable for that source to have a large impact on ambient air quality downwind. [FN130] The standard is underinclusive because, even if the contribution of the upwind source to a violation is small, the aggregate cost of meeting the ambient standard in the downwind state might be reduced by imposing more stringent controls on the upwind source.
To this point, the analysis has been static. It has assumed that the number of sources is fixed and has asked how the pollution-control burden among these sources should be allocated to minimize costs. Significant complications arise when the problem is viewed ***2385** dynamically, so that, over time, additional sources choose to locate in the upwind and downwind states. Neither the EPA nor the courts have addressed these complications.

The addition of a new source can be the but-for cause of a violation of the ambient standards. This violation would trigger the need to recalculate the optimal contributions of upwind and downwind sources by equating the ratios of marginal costs in the manner explained above.

Two features concerning the costs of emissions reduction suggest that it is likely to be considerably cheaper for a new source to meet a given level of emissions reduction than for an existing source to do so. First, new sources tend to install the technology that is optimal for the level of emissions reduction that they are required to meet and anticipate having to meet during the life of the technology. For example, if the standard prevailing when a source installs its technology requires emissions reductions of fifty percent (as compared with the level of uncontrolled emissions), the source is likely to choose the technology that works optimally at that level. While it may be technologically feasible to push that technologyto meet a reduction requirement of sixty percent, the costs of doing so are likely to be higher than the costs a new source would incur in installing a technology chosen specifically to meet the sixty-percent requirement.

Second, an existing source might need to change its pollution-control technology altogether in order to meet a more stringent standard. For example, the technology used to reduce emissions by fifty percent might simply not be suitable to reduce emissions by ninety percent. If so, the source's investment in the original pollution-control technology would be worthless, and new technology would have to be purchased to meet the more stringent standard. [FN131]

Because of the nature of these cost functions, if, for example, the ambient air quality in the downwind state is degraded by upwind sources all the way to the level of the federal ambient standards, and ***2386** the downwind state then attracts new sources, the cost-minimizing solution has the following properties: it would call for tightening the emissions reduction requirements for the existing sources in order to accommodate the new growth, while demanding even more stringent emissions reductions requirements for the new sources than for the existing sources.

Although this approach will minimize the costs of meeting the federal ambient standards, given the nature of the existing sources, it will not minimize the aggregate costs over time of meeting the federal ambient standards. Instead, it would be less costly overall for the existing sources to be subjected initially to more stringent standards, thus "reserving" a margin for growth to be consumed by the sources that the state now wants to attract.

If the sources affecting ambient air quality in the downwind state were all located in that state, the decision to "reserve" such a margin for growth would be quite straightforward because such a jurisdiction would capture the cost savings that result from its actions. The situation is more complex when sources in an upwind state affect ambient air-quality levels in the downwind state. In that case, both states would have to agree on the likely levels of future economic growth in each state, and on how to divide the costs of future pollution.

If both states were a single jurisdiction, one would not worry about a decision to "reserve" a particular area for future economic growth. Unlike the downwind state, such a jurisdiction would not face the structural bias that arises when the costs of preserving a margin for growth are externalized outside its borders.

The problem of allocating economic growth could be addressed through a regional planning authority, or through planning by the federal government. Neither outcome, however, is likely to work well. Because regional planning authorities are formed by representatives of the various affected states, relying on such a mechanism implies confidence in the ability of the states to take care of the problem of interstate externalities absent outside intervention. In seeking to justify the presence of federal regulation to address the problem of interstate externalities, one is assuming that, left to their own devices, states will not be able to solve the problem well. [FN132] As an alternative, a federal planning process could take place ***2387** when the downwind state complained about the upwind pollution by challenging the proposed permit of an upwind source. In theory, the inquiry could focus on the likelihood that each state would face a demand for industrial location in the future. The factors at stake, however, are too speculative and manipulable for the federal inquiry to have much credibility. A possible solution is explored in Part IV.

2. Role of Stack Height

To this point, the analysis has proceeded on the assumption that the stack heights of sources are fixed. This assumption might hold if there were a "correct" height for each stack, determined solely by reference to engineering criteria. But as indicated in Part I, the engineering criteria do not establish a "correct" height. [FN133] While the regulations provide some constraints, they leave substantial room for discretion on the part of a source. [FN134] This section relaxes the assumption of fixed stack heights and determines both the optimal levels of emissions and the optimal stack heights for upwind and downwind sources.

For this purpose, the problem needs to be modified in some minor ways. First, the pollution-control costs, c and c, are now a function of both the level of emissions, e and e, and the stack heights, h and h. For a given level of emissions, higher stacks imply higher control costs. Moreover, the higher the stack, the greater the cost of an additional unit of stack height. [FN135]

Second, the impact of a source's emissions on ambient air-quality levels depends on the height of the stack. Higher stacks imply smaller impacts on ambient air quality closer to the source and greater impacts farther from the source. [FN136]
2388 The cost-minimizing solution to this problem requires that four conditions be satisfied at the point at which the federal ambient standards are constraining. First, as in the case where the level of emissions reduction was the only decision variable, [FN137] cost minimization requires that the ratio of the cost of an additional unit of emissions reduction for the upwind source to the cost of an additional unit of emissions reduction for the downwind source be equal to the ratio of the impact on downwind ambient air quality of an additional unit of emissions reduction from the upwind source to the impact of an additional unit of emissions reduction from the downwind source. [FN138]

Second, cost minimization requires that the ratio of the cost of an additional unit of stack height for the upwind source to the cost of an additional unit of stack height for the downwind source be equal to the ratio of the impact on downwind ambient air quality of an additional unit of stack height for the upwind source to the impact of an additional unit of stack height for the downwind source. Otherwise, as a result of an argument similar to the one made in the case of emissions, aggregate costs would be reduced by decreasing the height of one stack and increasing the height of the other stack.

For example, if, in contrast, one additional unit of stack height for the upwind source has the same impact on the ambient air-quality level in the downwind state as one additional unit of stack height for the downwind source, but the cost of an additional unit of stack height is twice as high for the upwind source, the aggregate cost of meeting the federal ambient standards would be lowered if the upwind source had a smaller stack and the downwind source had a taller stack. The additional impact on ambient air quality of the upwind source would then be mitigated by the decreased impact of the downwind source. [FN139]

In contrast to the first and second conditions, which set forth the relationships across sources concerning, respectively, emissions levels and stack heights, the third and fourth conditions define, for each source, the optimal tradeoffs between emissions and stack height. ***2389*** For each source, cost minimization requires that the ratio of the cost of an additional unit of emissions reduction to the cost of an additional unit of stack height increase be equal to the ratio of the impact on ambient air quality of an additional unit of emissions to the impact of an additional unit of stack height. Otherwise, aggregate costs could be reduced by intrasource tradeoffs between emissions and stack height: the aggregate costs of compliance could be lowered by lower emissions compensating for lower stack height, or vice versa.

3. Role of Location

This section relaxes the assumption that the location of the sources is fixed. That assumption would hold if the location of a source is determined independently of the impact of its emissions on ambient air-quality levels. But that is not so. Sources can choose their location, and states have an incentive to favor certain choices over others. If a source's environmental effects were confined to a single jurisdiction, the source could pick the location that was most convenient for it in light of all the associated costs and benefits, such as the price of land, access to raw materials, proximity to customers, and availability of a suitable workforce, as well as costs of meeting the environmental requirements. For example, one location might be preferable on nonenvironmental grounds but might have associated with it higher costs of environmental compliance as a result of its greater proximity to other sources. Because the firm "sees" all the associated costs and benefits, it will be able to resolve the tradeoff in a socially desirable way. The only action required on the part of the state to produce this socially desirable outcome is for it to have a credible environmental enforcement scheme (or, alternatively, for there to be a credible federal enforcement scheme).

The situation is different when there are interjurisdictional externalities. Then, the state in which the firm wishes to locate has no incentive to worry about the interjurisdictional effects of the firm's pollution, and in fact will favor environmental and regulatory externalization. [FN140] Similarly, absent an interstate mechanism designed to control interjurisdictional spillovers, the firm's tradeoff will be skewed. It will take into account all the nonenvironmental ***2390** costs and benefits of competing locations, but will consider only the environmental compliance cost over which the state in which it locates has a regulatory interest.

Thus, unless there is a well-functioning scheme for controlling interjurisdictional pollution, the presence of interstate borders will affect the location of sources in a way that reduces social welfare. Specifically, other things being equal, a state will benefit if its sources locate as far downwind as possible, so that the state can capture the source's benefits in terms of jobs and taxes without suffering the full environmental and regulatory costs. Similarly, the source will benefit from less stringent environmental requirements.

When a source from an upwind state applies for a permit, the inquiry concerning the permissibility of the interstate impact must consider whether the proposed location of the source was affected by the presence of the border. If so, the source should be required to locate in the place where it would have located if its emissions had affected only one jurisdiction. Absent such an inquiry, the source, as a result of its suboptimal location, will have too large an impact on ambient air quality in the downwind state. Thus, to solve the optimization problem, one needs to determine not only the optimal emissions limitations and stack heights for the upwind and downwind sources, but also the optimal locations of these sources. To perform this inquiry one needs to know the effect of location both on the impact of a source's emissions on ambient air-quality levels and on the interactions between the emissions of upwind and downwind sources. Once again, at the point at which the ambient standard in the downwind state is constraining, several conditions must be satisfied. As before, the ratio of the cost of an additional unit of emissions reduction from the upwind source to the cost of an additional unit of emissions reduction from the downwind source must be equal to the ratio of the impact on downwind ambient air quality of an additional unit of emissions from the upwind source to the impact of an additional unit of emissions reduction from the downwind source.

Also, the ratio of the cost of an additional unit of stack height for the upwind source to the cost of an additional unit of stack height for the downwind source must be equal to the ratio of the impact on downwind ambient air quality of an additional unit of stack height from the upwind source to the impact of an additional unit of stack height from the downwind source.

A similar condition applies to location: the ratio of the cost of one additional unit of departure from the location that would have ***2391** been preferred absent environmental regulation for the upwind source to the cost of a similar locational movement for the downwind source must be equal to the ratio of the impacts of such departures on downwind ambient air quality. [FN141]

It might appear at first glance that only the upwind source would be motivated by the desire to externalize the effects of pollution to other states. But the downwind source can externalize costs as well, by locating in a place in which the effects of its emissions on ambient air-quality levels result in the need for the upwind source to undertake greater emissions reductions. In a single jurisdiction, a regulator would have an incentive to take this possibility into account in approving permits. In contrast, when two separate jurisdictions are involved, absent a regime for controlling spillovers, the downwind source would not pay attention to the impact of its locational choice on the pollution reduction costs of the upwind source.

This discussion underscores the difference between the static and dynamic considerations of the permissibility of interstate impacts. Once a source has been located, the cost of requiring it to relocate is likely to be prohibitive. As a result, the order in which sources locate matters a great deal. For example, one source might be fairly indifferent between two possible locations. If it chooses the location that is preferable, though only by a small margin, it might foreclose a later source from locating there even though, for that source, the location would have been preferable by a far larger margin. In a single jurisdiction, this problem might be taken care of through the planning process, where different sites could be reserved for predicted economic growth of different types. When there are interjurisdictional consequences, the coordination problems between the two jurisdictions are far more complex.

[FN142] Absent such ex ante planning, the ex post remedies available in actions brought by the downwind states against the upwind pollution will not lead to siting decisions that reduce the aggregate cost of pollution control over time.

*2392 B. Dealing with Instances in Which the Ambient Standard in the Downwind State Is Not Violated A wholly different set of issues is present in cases in which the downwind state meets the federal ambient standards but nonetheless would like to limit upwind pollution. There are two distinct scenarios. First, the downwind state might have a state ambient standard that is more stringent than the federal standard, and this standard might be violated as a result of the combined impact of the in-state and upwind pollution. Under section 116 of the Clean Air Act, states can set more stringent standards. [FN143] The statute, however, says nothing about whether a state can then invoke this more stringent standard in order to enjoin upwind pollution.
Second, the downwind state might wish to reserve a margin for economic growth in order to attract new industry in the future. Under this scenario, industry might not be currently interested in locating in the state. The state will believe, however, that economic conditions might change in the future and might want to ensure that when this happens, its margin for growth will not have been consumed by pollution coming from the upwind state. [FN144]

In each of these scenarios, the EPA and the courts have ruled against the downwind state, finding that in the absence of an actual violation of the federal ambient standards, the upwind pollution should not be enjoined. [FN145] These decisions reflect a misunderstanding of the issues implicated by the control of interstate externalities. The first scenario lends itself to the most straightforward analysis. The downwind state's attempt to invoke its more stringent state ambient standards against the upwind source might reflect an effort to externalize the costs of better environmental quality. Alternatively, it could be a policy that would have been undertaken even if the state had taken into account all the costs imposed outside its borders.

*2393 To address this scenario, one should first ask: if the upwind state and downwind state had been a single jurisdiction, would a decisionmaker interested in maximizing aggregate social welfare have adopted the more stringent ambient standard in the downwind state? Such a decision would be made if the preferences in the downwind state for more stringent environmental standards are such that the resulting net benefits to the downwind state outweigh the costs imposed on polluters in the upwind state. If that is the case, it should not matter that part of the costs are borne by the upwind state. This inquiry reveals whether the more stringent state ambient standard is permissible. A state ambient standard that does not meet this test should not be the predicate for any action to enjoin upwind pollution, and any attempt by the downwind state to limit such pollution should rest exclusively on the federal ambient standards. If, in contrast, the state ambient standard survives scrutiny, the second step involves determining when upwind pollution that violates such a standard is impermissible. The inquiry described in the previous subsections would then be performed, treating the more stringent state ambient standard as if it were the relevant ambient standard.

In the second scenario, the downwind state wishes to preserve its margin for growth in order to attract industry in the future. At first glance, it might appear that the state could adequately protect this margin for growth by relaxing the emissions limitations on its existing sources until the ambient standard is constraining. In the event of a later violation caused by upwind pollution, under the misguided approach followed by the EPA and the courts, [FN146] the downwind state could move to enjoin such pollution on the ground that it is the but-for cause of the violation. Subsequently, when new sources were ready to move in, the state could strengthen the emissions limitations on its existing sources.

Such a strategy is quite problematic. From the perspective of cost minimization, what matters is whether the marginal costs of emissions reduction among the sources have the correct relationships, not which source's pollution placed the emissions in the downwind state over the level of the ambient standards. The latter approach, moreover, creates undesirable incentives for states to offer their ***2394** sources suboptimally lax standards in order to capture the margin for growth before the other state consumes it. Alternatively, one could let the upwind state consume the margin for growth during the period in which there is no demand for industrial location in the downwind state. Subsequently, when economic conditions in the downwind state changed, the downwind state could move to limit the upwind pollution. This strategy is problematic as well. As already indicated, it generally is cheaper to build a polluting facility designed to meet a stringent emissions standard than to build it with a less stringent standard in mind and, subsequently, require it to meet a more stringent standard. [FN147] It is true that the upwind sources might predict what the calculus would look like once the downwind state was able to attract new sources, but such an inquiry would be highly speculative.

Thus, neither of the polar solutions is desirable. Instead, it would be preferable to predict at the outset the future rate and location of economic growth. As discussed above, however, neither an interstate nor a federal planning process is likely to work well. [FN148] A possible solution is explored in Part IV.

III. Interstate Externalities and the Dormant Commerce Clause

Part II defined a set of standards for dealing with interstate externalities that was premised on the maximization of social welfare in light of the requirements of the federal ambient standards. This objective leads to far stronger constraints on interstate externalities than those enforced, to date, by the EPA and the courts.

This Part argues that the standards of the Dormant Commerce Clause are relevant to the interpretation of federal regulatory provisions designed to address the problem of interstate externalities (such as sections 110(a)(2)(D) and 126(b) of the Clean Air Act) and that these standards justify controls on interstate externalities at least as rigorous as those that emerged from the discussion in Part II. [FN149]

***2395** A. Analogy to the Dormant Commerce Clause

In order to shield itself from the health-and-safety consequences of out-of-state products or wastes, or to preserve for its citizens a scarce natural resource, a state can constrain the importation of the product or waste, or the exportation of the natural resource. In such cases, the standards of the Dormant Commerce Clause define the extent to which the state can impose costs on out-of-state firms or citizens in order to fulfill the preferences of its own citizens. [FN150]

In contrast, a state cannot directly stop air or water pollution from coming across its border. It can, however, seek a federal injunction against excessive upwind pollution under provisions such as sections 110(a)(2)(D) and 126(b) of the Clean Air Act. The federal remedy allows it to do indirectly what it cannot do directly. The role of the federal decisionmaker under these provisions is to determine the extent to which the state's preferences for higher environmental quality or a larger margin for economic growth should be respected in light of the costs imposed on out-of-state interests. Both situations--one in which self-help is available and one in which it is not--raise the same tradeoffs between in-state and out-of-state interests. Where states can take direct action, giving an affected state too much leeway to constrain the importation of a product or waste or the exportation of a natural resource is undesirable because it permits the state to externalize the costs of its environmental preferences or to act in a protectionist manner. The state would therefore impose more stringent constraints than it would if it had to bear the costs of its actions. Where states can protect themselves only indirectly by invoking a federal remedy, an analogous situation arises if the standards under which affected states can obtain injunctions are too lax.

Similarly, in cases in which direct action is available to affected states, giving the state too little leeway to constrain the importation of a product or the exportation of a natural resource will undervalue the preferences of the affected state for more stringent health-and-safety or environmental protection and, concomitantly, weigh too heavily the out-of-state interests at stake. Here, too, an analogous situation arises where affected states can protect themselves only indirectly by invoking a federal remedy. If the standards under which they can obtain injunctions are too stringent, out-of-state ***2396** interests will be unduly privileged. Thus, the interests at stake in the control of interstate environmental externalities are parallel to those that arise in the context of problems addressed by the Dormant Commerce Clause.

Admittedly, the situations are different in two important ways. As already indicated, a state cannot stop air or water pollution at its border in the way that it can stop the entry of wastes or of products that violate a state health-and-safety standard. Moreover, the presence of federal regulation in the environmental area makes the Dormant Commerce Clause formally inapplicable: there are simply no constitutional constraints on how the federal government allocates among the states the burdens of meeting the federal ambient standards. These differences, however, do not detract from the force of the analogy.

First, the nature of the harm--air or water pollution as opposed to wastes or dangerous products--should not affect how the burdens of regulating health and safety or the environment are allocated between source states and affected states. If a particular distribution of this burden is appropriate for wastes or dangerous products, there is no compelling reason why a different allocation should be preferable for air or water pollution.

Second, the standards of the Dormant Commerce Clause flow from a vision about the appropriate relationships among states in our federal system. [FN151] They reflect our nation's attempt to define constraints, in the absence of congressional action, on the ability of ***2397** both source states and affected states to externalize the impacts of their policies. As a result, these standards ought to govern the interpretation of federal provisions designed to combat interstate externalities, such as sections 110(a)(2)(D) and 126(b) of the Clean Air Act, unless Congress has explicitly mandated a different tradeoff between the interests of upwind and downwind states. Thus, even though the Dormant Commerce Clause is not formally applicable in the presence of federal regulation, [FN152] its standards should define a canon of construction for the interpretation of federal statutes designed to constrain interstate externalities. [FN153] The Dormant Commerce Clause has a peculiar status as a constitutional provision that can be displaced by federal statutory or regulatory enactments. Indeed, when this provision applies as a matter of constitutional principle, it can be displaced by any applicable federal statutory or regulatory pronouncement. The view ***2398** advocated here, in contrast, is that even in the face of federal action, the Dormant Commerce Clause retains vitality as a canon of construction if the federal pronouncement does not contain standards contrary to those of the clause. In such cases, the federalism principles embodied in the Dormant Commerce Clause have not been displaced by Congress.

This broader view of the applicability of the Dormant Commerce Clause is most compelling in cases in which the federal regime is designed to enable affected states to seek injunctions against source states. In such cases, the role of the federal regime in constraining an affected state's ability to obtain injunctions is most closely analogous to the role of the Dormant Commerce Clause in constraining such a state's ability to rely on self-help.

For other types of federal regulatory approaches, the argument is likely to be less straightforward. For example, if the federal statute authorizes the EPA to address the problem of interstate externalities through command-and- control regulation, the longstanding practice of geographic uniformity in the promulgation of federal regulations might be the basis for a competing canon of construction.

B. Standards Under the Dormant Commerce Clause

There is widespread agreement that doctrinal confusion surrounds the Dormant Commerce Clause. Thus, rather than attempt to provide a single answer as to how the Dormant Commerce Clause standards would allocate the burdens of interstate externalities among upwind and downwind states, this section suggests three plausible ways in which Dormant Commerce Clause jurisprudence might address the problem faced by downwind states. [FN154]

First, efforts by a downwind state with ambient air-quality levels that are better than the federal ambient standards to enjoin upwind pollution in order to preserve a larger margin for economic growth can be analogized to attempts to reserve landfill capacity for in-state waste producers. Second, such efforts are also analogous to attempts to preserve natural resources for the enjoyment of a state's citizens. Finally, efforts to constrain upwind pollution on the ground that it violates state ambient standards more stringent than the federal standards are analogous, though in a somewhat more tenuous ***2399** fashion, to attempts to ban the importation of products presenting health-and-safety concerns.

For each of the three alternatives, this section analyzes the leading Dormant Commerce Clause case and discusses how its standards would treat the problem of interstate environmental externalities. Under all three formulations, the resulting constraints would be at least as stringent as those derived in Part II, where the objective was the maximization of social welfare subject to certain federal regulatory constraints.

1. Protecting a Margin for Economic Growth

In City of Philadelphia v. New Jersey, [FN155] the Supreme Court struck down a New Jersey statute that barred the transportation of certain solid wastes into the state in order to reserve landfill space for in-state wastes. The effect of this policy was to delay the expensive and politically difficult task of searching for additional landfill space. [FN156] Similarly, a downwind state with ambient air-quality levels better than the federal standards has an interest in reserving for in-state sources the resulting margin for growth.

While there are some differences between the landfill and air pollution situations, these differences do not detract significantly from the force of the analogy. First, once a state exhausts its landfill capacity, it can build another landfill. [FN157] In contrast, in the case of air pollution, the margin for growth is finite. Once it is consumed, there is no further permissible deterioration. Nonetheless, the state can create room for additional growth by imposing more stringent controls on its existing sources. Therefore, in both cases, the consumption by out-of-state sources of resources in the affected state creates pressure for the latter to develop more costly resources--additional landfill capacity in one case and a margin for additional air pollution in the other.

Second, in the landfill situation, the margin for economic growth is created by the investment decisions of the affected state (or of private firms in the affected state), which expended resources to construct a landfill even though it was not compelled to do so. In contrast, in the air pollution case, the margin for growth is defined by the federal regulatory standards: in the absence of such standards, ***2400** there would be no external constraints on a state's ambient air-quality levels. Nonetheless, the size of the margin for growth is still dependent on the decisions of the affected state: the more stringent the emissions standards that the affected state imposes on its existing sources, the greater its ability to attract other sources in the future, provided that upwind sources do not consume the resource first.

City of Philadelphia v. New Jersey and the line of cases that followed it [FN158] establish the proposition that a state may not discriminate between in-state and out-of-state sources of solid wastes. The host state cannot constrain the flow of out-of-state wastes more than the flow of in-state wastes. [FN159] Nor can it charge fees for the disposal of out-of-state wastes that are greater than those charged for in-state wastes. [FN160] The case clearly establishes, however, that the host state can impose flow controls in the form of direct restrictions, taxes or charges that do not discriminate against out-of-staters. [FN161]

In contrast, as discussed above, the federal environmental statutes have been far less protective of the interests of the downwind states. As applied by the EPA and the courts, these statutes have allowed upwind states to consume with impunity the margin for growth in the downwind states.

***2401** Attention to the analogy developed here would have led the EPA and the courts to allocate differently the burdens between upwind and downwind states. One way to understand how such an allocation could be performed is by reference to the effects of a hypothetical tax on units of environmental degradation in the downwind state levied on the sources in both the upwind and downwind states responsible for such degradation. Under the reasoning of City of Philadelphia v. New Jersey, the tax could not be proportional to the number of units of emissions because the impact of emissions on environmental degradation is a function of several factors, including the location of the source. [FN162] Indeed, one unit of emissions in the upwind state might have a lesser effect on downwind ambient air-quality levels than one unit of emissions in the downwind state, and a uniform tax on emissions would therefore be likely to fail the nondiscrimination requirements of City of Philadelphia v. New Jersey. [FN163] Making the tax proportional to the source's contribution to environmental degradation in the downwind state corrects this problem.

Under such a scheme, the downwind state could control the rate of degradation of its margin for growth through the choice of the hypothetical tax. The higher the tax, of course, the more such degradation would be restricted. The downwind state could choose any hypothetical tax that it wanted, in the same way that City of Philadelphia v. New Jersey does not constrain a state's choice of nondiscriminatory disposal fees. For each source in an upwind state that affected the ambient air-quality levels of the downwind state, the EPA would determine the level of emissions that would result if the source actually faced the hypothetical tax. [FN164] If the source's actual emissions were higher than this level, the excess emissions would potentially be subject to an injunction.

To obtain such an injunction, however, the downwind state would have to satisfy the nondiscrimination requirement of the Dormant Commerce Clause. To satisfy this burden, the downwind state would need to show that none of its in- state sources were emitting more than they would have emitted if they had faced the hypothetical tax. If any of the downwind sources emitted at a higher level, the upwind ***2402** sources would not be enjoined unless the downwind state promptly corrected the problem. [FN165]

The downwind state would never invoke a hypothetical tax so low that it would lead to violations of the federal ambient standards. Such a low tax would compromise the downwind state's ability to obtain injunctions against upwind pollution, and, in light of its obligation to comply with the federal ambient standards, would increase the burden on its own sources. Neither, however, would the downwind state invoke an excessively high hypothetical tax, because it would fail to obtain an injunction against upwind pollution if its own sources were polluting at levels higher than those that would be induced by such a tax.

In a static world, with no entry of new firms into pollution-generating activities or expansion in the demand for the products manufactured by the existing firms, the pattern of emissions reductions produced through the device of the hypothetical tax would lead to the least costly way of attaining whatever ambient air-quality levels are induced by the tax. Recall from Part II that a given ambient air-quality level is met at least cost when the ratio of the costs of one additional unit of emissions reductions to upwind and downwind sources, respectively, is the same as the ratio of the impacts of one additional unit of emissions from these sources on ambient air-quality levels in the downwind state. [FN166] A tax on units of environmental degradation would accomplish this goal. For example, if the impact on downwind ambient air quality caused by the downwind source is twice that of the upwind source, the tax levied on an additional unit of emissions would be twice as high for the downwind source. Furthermore, because under a tax system a source will reduce its pollution up to the point at which the cost of an additional unit of emissions reduction is equal to the tax levied on each unit of emissions, for the downwind source the cost of an additional unit of emissions reduction would also be twice as high as for the upwind source.
Unless the hypothetical tax levels are periodically raised, economic growth would lead to a worsening of the downwind ***2403** ambient air-quality levels.

As already indicated, the downwind state could encourage or slow down such growth by raising or lowering the tax levied on units of environmental degradation, in the same way that a state hosting a landfill can, consistent with City of Philadelphia v. New Jersey and its progeny, affect the rate at which the landfill is filled by varying the disposal fee. [FN167] Regardless of the ambient air-quality level in the downwind state, the pollution-control burden would be allocated between upwind and downwind sources in a manner that minimized the aggregate costs of pollution abatement.
It is fairly straightforward to compare this approach to constraining interstate externalities with the approach of Part II, which concerned itself with maximizing social welfare subject to the requirement that the federal ambient standards be met. In the case in which the downwind state's hypothetical tax is sufficiently low that its air quality is degraded right up to the level of the federal ambient standards, both approaches produce identical results: the resulting burdens among upwind and downwind sources are allocated in the manner that minimizes the aggregate costs of compliance.

The standards derived in Part II, however, did not comprehensively regulate the manner in which the margin for growth in the downwind state would be consumed: they ensured only that such degradation take place in a manner that did not increase the ultimate cost of meeting the federal ambient standards. [FN168] In contrast, attention to the nondiscrimination standards of the Dormant Commerce Clause gives the downwind state full leeway to decide at what rate to degrade its margin for growth and allows it to constrain upwind pollution even when the federal ambient standards are not yet binding and even when such constraints on upwind pollution are not necessary to minimize the ultimate costs of meeting the ambient standards.

In summary, reliance on the nondiscrimination principles of the Dormant Commerce Clause permits more extensive controls on upwind pollution than the controls justified by the goal of maximizing social welfare. [FN169] The reason is that the nondiscrimination principles give the downwind state full decisionmaking authority over the rate at which the degradation of its ambient air quality occurs, ***2404** even in cases in which the downwind state would not retard growth to the same extent if it were required to bear the costs imposed on out-of-state interests.

2. Protecting a Natural Resource

Alternatively, ambient air-quality levels that are better than the federal ambient standards can be seen as a natural resource that a downwind state might wish to protect from out-of-state encroachment so that it can be consumed by its own citizens. From this perspective, constraining the out-of-state deterioration of higher quality air is analogous to constraining the out-of- state use of natural resources such as ground water, fish, wildlife or natural gas.

In Sporhase v. Nebraska ex rel. Douglas, [FN170] the Supreme Court upheld a Nebraska statute placing restrictions on the withdrawal of ground water from any well in Nebraska for use in an adjoining state. The statute provided that such withdrawals would be permissible only if they were "reasonable," "not contrary to the conservation and use of ground water," "not otherwise detrimental to the public welfare," and only "if the state in which the water is to be used grants reciprocal rights to withdraw and transport ground water from that state for use in the State of Nebraska." [FN171] The Supreme Court upheld the first three restrictions but struck down the reciprocity requirement. The Court conceded that the restrictions that it upheld applied only to interstate transfers but noted that in the geographic area containing the wells subject to the litigation, the interstate restrictions "may well be no more strict in application" than limitations imposed on intrastate transfer by the local water district. [FN172] There were no findings, however, that even in this geographic area the restrictions on interstate and intrastate transfers were in fact equally stringent or that intrastate transfers were governed by similar restrictions in other areas. [FN173] The Court openly acknowledged that preferential treatment for intrastate transfers was appropriate. It stated: "[W]e are reluctant to condemn ***2405** as unreasonable, measures taken by a State to conserve and preserve for its own citizens this vital resource in times of severe shortage." [FN174]

Sporhase is even more protective of in-state interests than City of Philadelphia v. New Jersey. Both cases give the affected state full control over the rate at which its resource is consumed. But whereas the latter case insists on nondiscriminatory treatment for in-state and out-of-state interests, the former allows preferential treatment for the in-state interests.

It is important to emphasize that the ground water at issue in Sporhase was primarily an economic resource, to be used for agricultural activity within the state. [FN175] There is therefore a strong analogy between this situation and that of a state attempting to use ambient air-quality levels better than the federal ambient standards as a vehicle for promoting in-state economic growth. [FN176] The analytically different situation of a state attempting to preserve higher quality air is dealt with in the following subsection.

3. Enforcing More Stringent State Ambient Standards

The final analogy is to a state seeking to impose restrictions on the importation of products that have a detrimental impact on the environment or on health and safety. This analogy might seem, at first glance, to be less straightforward than the analogies that formed the bases for the preceding two sections. After all, in the case of interstate pollution spillovers, what the downwind state is trying to constrain is the by-product of the industrial process under which a product was manufactured, not the product itself. [FN177]

***2406** The interests implicated in both cases, however, are directly analogous. The downwind state, like the importing state, seeks to protect its citizens from undesirable environmental or health-and-safety consequences. Similarly, the federalism concerns are that the downwind state would seek to externalize too much of the resulting cost to the upwind state and that the importing state would do likewise with respect to the exporting state. Thus, the standards derived under the Dormant Commerce Clause to evaluate restrictions on the importation of products are directly relevant to judge the permissibility of restrictions on interstate pollution externalities.

In Minnesota v. Clover Leaf Creamery Co., [FN178] the Supreme Court upheld against a Dormant Commerce Clause challenge [FN179] a Minnesota statute that banned the sale of milk in plastic nonreturnable, nonrefillable containers but permitted sale in other nonreturnable, nonrefillable containers like paperboard cartons. The restriction was designed to "promote resource conservation, ease solid waste disposal problems, and conserve energy." [FN180]

In assessing the permissibility of the restriction under the Dormant Commerce Clause, the Court invoked the standard articulated in Pike v. Bruce Church, Inc. [FN181] Under this standard, [w]here the statute regulates evenhandedly to effectuate a legitimate local public interest, and its effects on interstate commerce are only incidental, it will be upheld unless the burden imposed on such commerce is clearly excessive in relation to the putative local benefits. If a legitimate local purpose is found, then the question becomes one of degree. And the extent of the burden that will be tolerated will of course depend on the nature of the local interest involved, and on whether it could be promoted as well with a lesser impact on interstate activities. [FN182]

Applying the test to the Minnesota statute, the Court found that the restriction "regulate[d] evenhandedly" because it applied in a nondiscriminatory fashion to both in-state and out-of-state dairies seeking to sell milk in Minnesota. [FN183] With respect to the balancing ***2407** of the local benefits against the out-of-state burdens, however, Minnesota faced two hurdles. In brushing aside the weaknesses in Minnesota's case, the Court set forth a reading of the Pike v. Bruce Church balancing test that was highly deferential to the interests of the state imposing restrictions on the importation of products. [FN184]

First, the Court noted that opponents of the restriction on plastic containers "produced impressive supporting evidence at trial" to prove that the restriction would actually exacerbate the problems that it sought to remedy because it would induce a shift toward the use of paperboard milk cartons, which are allegedly more harmful. [FN185] On the basis of this evidence, the state trial court had concluded, in a ruling affirmed by the Minnesota Supreme Court, that the statute " 'will not succeed in effecting the Legislature's published policy goals."' [FN186]

The Supreme Court, in rejecting a separate challenge to the statute under the Equal Protection Clause, determined that the strength of the empirical evidence adduced by the opponents was irrelevant as long as the state legislature believed the legislative facts on which its restriction was based. [FN187] Turning to the Dormant Commerce Clause challenge, the Court found Minnesota's interest to be "substantial." [FN188] Because the Court did not attempt an independent evaluation, this conclusion must have flowed directly from deference to the legislative judgment.

Second, the restriction's challengers argued that the materials used for making plastic nonreturnable milk jugs were produced entirely by non-Minnesota firms, while the pulpwood used to make paperboard was a "major Minnesota product." [FN189] This attack was consistent with the district court's finding that the " 'actual basis"' for the statute " 'was to promote the economic interests of certain segments of the local dairy and pulpwood industries at the expense of the economic interests of other segments of the dairy industry and the plastics industry."' [FN190] The Supreme Court concluded that even if the burden on out-of-state industries was heavier, this burden was not " 'clearly excessive"' in light of Minnesota's "substantial state ***2408** interest." [FN191] Again, the Court appears to have been swayed by the legislative decision to impose the restriction, without acknowledging that in this context a rational legislature has a structural incentive to privilege local interests by externalizing the costs of its statutory enactments. [FN192]

A balancing test that led to the upholding of restrictions only if the benefits to the state imposing the restriction outweighed the costs imposed on other states would be consistent with the goal of maximizing social welfare [FN193] and therefore consistent with the approach of Part II. The Pike v. Bruce Church test, however, privileges the interests of the state imposing the restriction, since it calls for upholding restrictions unless the out-of-state costs are "clearly excessive" when compared to the local benefits. [FN194] Moreover, the local interests are further privileged by the manner in which the Supreme Court applied the Pike v. Bruce Church test, deferring to the findings of the legislature imposing the restriction.

As discussed in Part II, if the interests of upwind and downwind states were balanced in an unbiased manner, with no thumb on the downwind state's side of the scales, a downwind state could enjoin upwind pollution that violated a state ambient standard more stringent than the federal standard only if the net benefits of the standard to the state imposing the restriction (environmental benefits minus costs to in-state economic interests) outweighed the costs imposed on the economic interests of other states. In contrast, the downwind state could obtain the injunction on the basis of a lesser showing under the Pike v. Bruce Church test, and in particular, on the basis of the application of this test in Minnesota v. Clover Leaf Creamery.

***2409** 4. Summary

This survey of the standards of the Dormant Commerce Clause reveals at least four distinct approaches relevant to the analysis of the conditions under which downwind states can obtain injunctions against upwind pollution. [FN195] The four standards are presented in increasing order of deference to the interests of the downwind state. Expositionally, it is useful to consider whether injunctions against upwind pollution would be issued under these various standards, based on the pollution-control burdens that would result from application of the hypothetical tax on units of environmental degradation that was discussed above. [FN196] The following discussion assumes that the emissions from the downwind state's own sources are no higher than those that would result if they in fact had to pay the hypothetical tax.

First, as already indicated, an unbiased application of a test that balanced upwind against downwind interests is equivalent to the welfare-maximization approach. Under this approach, the injunction would be denied if the costs imposed on the upwind state were higher than the benefits to the downwind state. Second, an application of the Pike v. Bruce Church test that, consistent with Minnesota v. Clover Leaf Creamery, favored the downwind state's interest would deny such an injunction only if the costs to the upwind state were disproportionately higher than the benefits to the downwind state. Third, an application of the nondiscrimination provision of City of Philadelphia v. New Jersey would grant the injunction regardless of the burdens on the upwind state. Fourth, the approach in Sporhase v. Nebraska would go even further by granting the injunction even if the tax levied on units of environmental degradation was higher for upwind sources than for downwind sources.

In summary, the first of these approaches is equivalent to that of Part II, which sought to maximize social welfare. The remaining three approaches are increasingly more protective of the interests of downwind states.

*2410 IV. The Promise of Marketable-Permit Schemes

Part II identified an important structural problem raised by procedures such as those described in sections 110(a)(2)(D) and 126(b) of the Clean Air Act, which rely on administrative and judicial determinations of the permissible amounts of interstate externalities. This problem arises because requiring existing sources to reduce their emissions is generally more costly than imposing the same standards on new sources. Thus, from the perspective of maximizing aggregate social welfare over time, the periodic strengthening of the emissions reductions requirements to accommodate economic growth is likely to be more costly than "reserving" a margin for such growth by imposing more stringent requirements at the outset. [FN197] This problem is present both when the federal ambient standards in the downwind state are constraining and when the downwind state has ambient air-quality levels that are better than the federal ambient standards. [FN198]

As noted in Part II, the problem would be far less serious if the effects of emissions were confined to a single state, which could then, as part of its planning process, determine where in the jurisdiction to "reserve" the margin for growth. With interjurisdictional effects, however, the situation is more complex because neither an interstate nor a federal planning process is likely to work well to determine how to allocate the additional burden needed to "reserve" a margin for growth. [FN199] Recall, also from the discussion in Part II, that this inquiry involves predicting where new firms will choose to locate, what the costs of emissions reductions will be, and what impact the new firms' emissions will have on ambient air-quality levels. When a firm proposes to locate in a given place, these factors will determine how the burden of ensuring compliance with the applicable federal or state ambient standards will be allocated among that firm, other firms in the same state, and firms in other states. The purpose of this allocation, once again, is to maximize social welfare in light not only of the current pattern of emissions (the static inquiry) but also in light of future development (the dynamic inquiry).

In at least some ways, marketable-permit schemes are better suited to address this issue than administrative or judicial inquiries. *2411 Most importantly, under such schemes it is not necessary for a federal decisionmaker to determine whether the likely growth will come to the upwind or the downwind state. Instead, either the downwind state or the upwind state could acquire permits in the marketplace, thereby "reserving" for itself a margin for growth. Then, when the economic expansion materialized, the state holding the permits could either sell them to the firms proposing to build plants, or, as an inducement to locate in the state, simply give the permits to those firms. [FN200] Firms planning to build plants in the future could also buy permits directly in the marketplace. [FN201] Eventually, as with other commodities, futures markets would develop.

The marketable permits described here would be measured in units of environmental degradation in the downwind state, rather than in units of emissions. Under marketable-permit schemes in units of environmental degradation, a source must purchase permits at each location at which its emissions will have an impact on ambient air-quality levels. Thus, any upwind and downwind sources that affect ambient air-quality levels at some location in the downwind state will have to purchase permits to degrade ambient air quality at that location.

Because it is obviously impractical for a source to buy permits at each of the infinite number of points at which such impacts occur, some geographic aggregation is necessary for the scheme to be administrable. Nonetheless, marketable-permit schemes measured in units of environmental degradation, unlike marketable-permit schemes measured in units of emissions, require that a source purchase permits in more than one market.

Under marketable-permit schemes in units of environmental degradation, the permissible number of emissions for each source is a function of how the source's emissions affect ambient air-quality levels at all of the points at which it is required to purchase permits. For example, if eight units of emissions cause one unit of environmental degradation at a particular point away from the source, a permit for one unit of environmental degradation at this point would allow eight units of emissions at the source. These equivalencies ***2412** would be predicted through mathematical modeling, and, for each pollutant, would depend on factors such as wind patterns and topography.

In contrast to marketable-permit schemes in units of environmental degradation, marketable-permit schemes in units of emissions are not well suited for the task at issue here. They cannot allocate--between upwind and downwind sources--the pollution-control burdens that will lead to the attainment of the relevant ambient standards in the manner that maximizes social welfare. First, if the downwind and upwind states are in a single market for emissions trading, any one-to-one trades would be allowed, even if such trades compromised aggregate social welfare by transferring emissions from a location at which their impact is less serious to a location at which their impact is more serious. Second, marketable-permit schemes in units of emissions cannot ensure compliance with particular ambient standards because, if, as a result of the pattern of trades, a sufficiently large number of permits is transferred to a particular geographic area, the applicable ambient standards will be violated at the hot spots at which the emissions have their maximum impact.

Permits in units of environmental degradation solve this problem. [FN202] The number of permits in such units is determined by reference to the ambient standards that need to be met. Thus, hot spots cannot occur.

Marketable-permit schemes in units of environmental degradation would minimize the cost of meeting any set of ambient standards. Under such schemes, at the point at which no further trades would be beneficial to the parties, for any two sources, say Source 1 and Source 2, the following condition would hold at every point at which the sources purchased permits: the ratio of the marginal cost of emissions reduction for Source 1 to the marginal cost of emissions reduction for Source 2 would equal the ratio of the impact on ambient air quality of an additional unit of emissions from Source 1 to the impact of an additional unit of emissions from Source 2. Otherwise these sources would benefit from a trade. [FN203]

The analysis presented here underscores an argument for the use of marketable-permit schemes in units of environmental degradation ***2413*** that is independent of the goal of cost minimization. Such schemes solve a coordination problem between upwind and downwind states that poses difficulties for other allocative mechanisms, like reliance on administrative or judicial determinations of permissible spillovers in light of the possibility of future economic growth. Traditionally, the comparison between centralized regulation and marketable-permit schemes focuses on how the central planner is unlikely to have sufficient information about matters such as the costs of emissions reduction to devise allocations that maximize social welfare. This problem is exacerbated here because if each state were an independent central planner, nonmarket mechanisms for coordinating the actions of these states would be exceedingly cumbersome. [FN204]

This discussion seeks neither to design a fully specified marketable- permit scheme nor to argue that, in light of all relevant considerations, such schemes are the preferred policy tool. Rather, the exposition seeks to explain why marketable-permit schemes can remedy the serious problems of coordination that otherwise would arise.
One obvious objection to marketable-permit schemes in units of environmental degradation is worth addressing briefly. Critics are likely to argue that such schemes are exceedingly difficult to administer. In particular, in order for the markets to work, one needs accurate information about the manner in which emissions at each source translate into ambient air-quality impacts at each location at which these emissions affect ambient air-quality levels.

In fact, the same procedures are currently used to determine compliance with the federal ambient standards. Indeed, the EPA determines whether areas violate these standards primarily through the use of computer modeling, rather than by direct measurement. [FN205] These models are mathematical matrices that translate emissions at the various sources into contributions to the degradation of ambient air-quality levels at different distances from the sources. [FN206] Thus, the technical inquiry undertaken to determine compliance with the federal ambient standards under the command-and- ***2414*** control regulatory system currently in effect is identical to the one that would need to be undertaken in order to administer a marketable-permit scheme in units of environmental degradation.

Conclusion

This Article has shown the extent to which the federal government has failed in the control of interstate environmental externalities. The core provisions of the environmental statutes are not well designed for addressing this problem and may in fact have exacerbated it. The specific federal provisions dealing with interstate externalities have been wholly ineffective in part as a result of the inability of the EPA and the courts to analyze the problem in a coherent manner.

Combining the conclusions of this Article with those of my earlier work challenging race-to-the-bottom justifications for federal environmental regulation [FN207] should lead to a serious questioning of the current structure of environmental law, with its emphasis on regulation at the federal level. The race-to-the-bottom justification is theoretically suspect but explains the genesis for much federal environmental regulation. In contrast, the interstate externalities justification is theoretically compelling but little of the regulatory regime actually advances this goal.
This Article seeks to produce a closer congruence between the plausible justifications for federal environmental regulation and the structures of the particular statutes. For the short term, the arguments presented here should lead to energizing the federal approach to controlling interstate externalities. Even without any statutory amendment, the EPA has the necessary statutory authority under the Clean Air Act to adopt either the welfare- maximizing approach developed in Part II or the Dormant Commerce Clause approach developed in Part III. [FN208] (Of course, accepting the argument in Part III would require the EPA to adopt the Dormant Commerce Clause standards, since these standards would represent the default rule in the event of congressional silence.)

Indeed, the constrained interpretation of these provisions by the EPA in the Reagan and Bush Administrations is not compelled by the statute. Perhaps the clearest support for this view comes from the fact that during the Carter Administration--the Administration in ***2415** office at the time that the interstate externality provisions were first enacted--the EPA took positions far more conducive to protecting downwind states and less divergent from the standards advocated here. [FN209] Most importantly, upwind pollution could be enjoined even if it did not lead to a violation of the federal ambient standards in the downwind state. An early judicial decision also read the relevant provisions in a manner somewhat sympathetic to the interests of the downwind states. [FN210]

It was only in the early 1980s, a period during the Reagan Administration in which environmental protection was accorded a particularly low priority, that the current barriers to the interests of the downwind states were first erected. Subsequently, these barriers were solidified by a series of broad judicial opinions deferring to the EPA. [FN211] Moreover, in the case of upwind pollution that exacerbates a violation of the federal ambient standards in the downwind state, even the current approach contemplates that the permissibility of upwind pollution should be determined by reference to a large set of factors, including a comparison of the costs of emissions reductions and of the impacts of emissions on ambient air-quality levels of upwind and downwind sources.

The longer-term objective of my work is to lay the foundation for a more rational allocation of decisionmaking authority in the environmental arena between the federal government and the states. This Article did not question the existence of the federal ambient standards. It asked, instead, how to constrain interstate externalities desirably in light of these standards. A broader inquiry would ask, simultaneously, whether ambient standards should be set at the federal level and how interstate externalities should be constrained. My critique of race-to-the-bottom arguments makes one step in that direction, but the full analysis of the optimal allocation of decisionmaking authority cannot be performed without a comprehensive evaluation of other rationales for federal environmental regulation, including public choice arguments. [FN212] I plan to turn to that task as part of my ongoing study of environmental regulation in a federal system.

***2416** Finally, it is worth emphasizing that the issues studied here arise in any federal system. Thus, this project should be of direct interest to environmental policymaking in the European Union, where there is also a mismatch between the rhetoric of interstate externalities and the Council Directives on ambient and emissions standards that form the core of the Union's environmental policy--a matter to which I am turning my attention. [FN213] Moreover, the standards derived here should aid in the development of international environmental law, with respect to both regional pollution that crosses international boundaries, [FN214] and pollution that affects the global commons.

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[FN1]. For discussion of other rationales for federal regulation, see Richard B. Stewart, Pyramids of Sacrifice? Problems of Federalism in Mandating State Implementation of National Environmental Policy, 86 Yale L.J. 1196, 1211-15 (1977). For a more recent treatment of these issues, generally consistent with Stewart's categorization, see John P. Dwyer, The Practice of Federalism Under the Clean Air Act, 54 Md. L. Rev. 1183, 1219-24 (1995).

[FN2]. See infra text accompanying notes 35-41. These two rationales also are distinct from the public choice argument for vesting responsibility for environmental regulation at the federal level, with which they are also sometimes confused. Such public choice arguments rest on the claims that state political processes undervalue the benefits of environmental regulation or overvalue the corresponding costs relative to the federal process, and that the outcome from the federal process is socially more desirable. Even if there were no interstate externalities, or if industry were wholly immobile so that there could be no race to the bottom, environmental standards would still be more protective at the federal level if, as the public choice argument posits, environmental groups are more effective at this level. Conversely, the interstate externality and race-to- the-bottom arguments for federal environmental regulation may apply even if states properly value the benefits of environmental protection. For further discussion of the distinctions among these different rationales for federal regulation, see Richard L. Revesz, Rehabilitating Interstate Competition: Rethinking the "Race-to-the-Bottom" Rationale for Federal Environmental Regulation, 67 N.Y.U. L. Rev. 1210, 1221-24 (1992).

[FN3]. See Revesz, supra note 2, at 1211-12. For commentary generally supportive of my approach, see, e.g., David L. Shapiro, Federalism: A Dialogue 42-43, 81-83 (1995); James E. Krier, On the Topology of Uniform Environmental Standards in a Federal System--and Why It Matters, 54 Md. L. Rev. 1226, 1236-37 (1995); Richard B. Stewart, Environmental Regulation and International Competitiveness, 102 Yale L.J. 2039, 2058-59 (1993); Richard B. Stewart, International Trade and Environment: Lessons from the Federal Experience, 49 Wash. & Lee L. Rev. 1329, 1371 (1992) [hereinafter Stewart, International]; Stephen Williams, Culpability, Restitution, and the Environment: The Vitality of Common Law Rules, 21 Ecology L.Q. 559, 560-61 (1994).

[FN4]. See Revesz, supra note 2, at 1244-47.

[FN5]. For expositional convenience, this discussion focuses on air pollution. Except where otherwise indicated, see infra notes 7, 124, the arguments also apply in the context of water pollution.

[FN6]. This Article focuses on pollution externalities. It does not explicitly deal with situations in which the interstate externality arises as a result of existence (non-use) values placed on natural resources by out-of- state citizens. Such existence values provide a powerful justification for federal control over exceptional natural resources such as national parks. See Stewart, supra note 1, at 1215-16 & n.77.

[FN7]. In the case of water pollution, there is no direct analog to stack height.

[FN8]. See Revesz, supra note 2.

[FN9]. See supra text accompanying notes 2-4.

[FN10]. See infra Part I.C.

[FN11]. For example, a recent report commissioned by the Senate and House Appropriations Committees calls for Congress and the EPA to give states, communities and businesses greater flexibility and autonomy in addressing environmental problems, forging a "new partnership ... based on 'accountable devolution' of national programs and on a reduction in EPA oversight when it is not needed." National Academy of Public Administration Summary Report to Congress on Role, Structure of the Environmental Protection Agency Released April 12, 1995 (Text), Daily Env't Rep. (BNA) (Apr. 13, 1995), available in LEXIS, BNA Library, BNAED File.

[FN12]. The approach to interstate externalities in the domain of water pollution, where interstate externalities also are potentially an important issue, is presented in the margin. See infra notes 38, 74, 105, 124.

[FN13]. Clean Air Act s 108, 42 U.S.C. s 7408 (1994).

[FN14]. See Clean Air Act s 111, 42 U.S.C. s 7411 (1994).

[FN15]. See Clean Air Act s 202, 42 U.S.C. s 7521 (1994).

[FN16]. See Clean Air Act s 110, 42 U.S.C. s 7410 (1994).

[FN17]. See Clean Air Act ss 160-69, 42 U.S.C. ss 7470-79 (1994).

[FN18]. See Clean Air Act s 169(3), 42 U.S.C. s 7479(3) (1994).

[FN19]. See Clean Air Act s 163, 42 U.S.C. s 7473 (1994).

[FN20]. Clean Air Act s 169(1), (4), 42 U.S.C. s 7479(1), (4) (1994).

[FN21]. See Clean Air Act ss 162-63, 42 U.S.C. ss 7472-73 (1994).

[FN22]. See Clean Air Act s 163(4), 42 U.S.C. s 7473(4) (1994).

[FN23]. See Clean Air Act s 169(4), 42 U.S.C. s 7479(4) (1994).

[FN24]. See 40 C.F.R. s 50.4 (1995).

[FN25]. See Clean Air Act s 163(b)(2), 42 U.S.C. s 7473(b)(2) (1994).

[FN26]. See Clean Air Act ss 171-93,42 U.S.C. ss 7501-15 (1994).

[FN27]. Clean Air Act ss 171(1), 172(c)(2), 42 U.S.C. ss 7501(1), 7502(c)(2) (1994).

[FN28]. See Clean Air Act ss 182, 187, 189, 42 U.S.C. ss 7511a, 7512a, 7513a (1994).

[FN29]. Clean Air Act ss 171(3), 173(a)(2), 42 U.S.C. ss 7501(3), 7503(a)(2) (1994).

[FN30]. Clean Air Act s 173(a)(1)(A), (c), 42 U.S.C. s 7503(a)(1)(A), (c) (1994).

[FN31]. Clean Air Act s 172(c)(1), 42 U.S.C. s 7502(c)(1) (1994).

[FN32]. See Clean Air Act s 123, 42 U.S.C. s 7423 (1994).

[FN33]. See Clean Air Act ss 401-16, 42 U.S.C. ss 7651-51 o (1994).

[FN34]. See Clean Air Act ss 110(a)(2)(D), 126(b), 42 U.S.C. ss 7410(a)(2)(D), 7426(b) (1994).

[FN35]. See Samuel J. Williamson, Fundamentals of Air Pollution 219-25 (1973).

[FN36]. See Clean Air Act Oversight: Hearings Before the Subcomm. on Environmental Pollution of the Senate Comm. on Public Works, 93d Cong., 2d Sess. 330-31, 337, 357-59 (1974) [hereinafter Senate Comm. on Public Works]; Richard E. Ayres, Enforcement of Air Pollution Controls on Stationary Sources Under the Clean Air Amendments of 1970, 4 Ecology L.Q. 441, 452 & nn.28, 30 (1975).

[FN37]. For example, the Georgia regulations that were struck down in Natural Resources Defense Council v. EPA, 489 F.2d 390, 403-11 (5th Cir. 1974), rev'd on other grounds sub nom. Train v. Natural Resources Defense Council, 421 U.S. 60 (1975), provided that, for sulfur dioxide, allowable emissions could be proportional to the cube of the stack height for stacks under 300 feet, and proportional to the square of the stack height for stacks over 300 feet. See Georgia Rules and Regulations for Air Quality Control s 270-5-24-.02(2)(g) (1972). A similar formula applied to particulate emissions. See id. s 270-5-24-.02(2)(m). Thus, a sufficiently high stack would eliminate the need for any emissions reduction.

[FN38]. In a quite different manner, the Clean Water Act increased the ability of states to externalize pollution by displacing common law remedies in interstate disputes. City of Milwaukee v. Illinois, 451 U.S. 304, 317 (1981), held that the Clean Water Act preempted the federal common law of nuisance. International Paper Co. v. Ouellette, 479 U.S. 481, 494 (1987), held that the Clean Water Act preempted state nuisance actions brought under the common law of the affected state. Under Ouellette, actions can be maintained only under the common law of the source state. See id. at 493- 94.

[FN39]. The savings can be substantial. For example, a study in the early 1970s, when tall-stack credits were most prevalent, see infra text accompanying notes 41-42, showed that the cost of complying with regulatory requirements was between $60/kw and $130/kw for a new lime scrubber, as compared with between $4/kw and $10/kw for a tall stack. See Senate Comm. on Public Works, supra note 36, at 210, 215; see also Michael Weisskopf, 'Tall Stacks' and Acid Rain, Wash. Post, June 5, 1989, at A1, A6 (reporting that the stack of an electric utility cost $10 million in the mid-1970s and that the alternative of outfitting it with scrubbers would cost $756 million).

[FN40]. See Arnold W. Reitze, Jr., A Century of Air Pollution Control Law: What's Worked; What's Failed; What Might Work, 21 Envtl. L. 1549, 1598 (1991); James R. Vestigo, Acid Rain and Tall Stack Regulation Under the Clean Air Act, 15 Envtl. L. 711, 730 (1985).

[FN41]. See, e.g., Bradford C. Mank, Environmental Justice and Discriminatory Siting: Risk-Based Representation and Equitable Compensation, 56 Ohio St. L.J. 329, 421 (1995) ("[S]tates and municipalities tend to site polluting facilities on their boundaries, passing external costs on to other communities."); Robert B. Wiygul &

Sharon C. Harrington, Environmental Justice in Rural Communities Part One: RCRA, Communities, and Environmental Justice, 96 W. Va. L. Rev. 405, 437-38 (1993-1994) (referring to " 'state line syndrome,' in which waste disposal facilities are frequently proposed for political subdivisions bordering another state").

Several state statutes have acknowledged and attempted to control the incentives for municipalities and counties to encourage the development near their borders of facilities that have undesirable consequences on the adjoining area. Minnesota, for example, has established a regional council for metropolitan Minneapolis-St. Paul, which serves "as informal mediator and helps municipalities negotiate side agreements when impacts from development in one community are felt by its neighbors." Michael Wheeler, Negotiating NIMBYs: Learning from the Failure of the Massachusetts Siting Law, 11 Yale J. on Reg. 241, 286 n.171 (1994); see also Minn. Stat. Ann. ss 473F.01-.13 (West 1977). The same issues arise with respect to environmentally fragile, "critical areas," such as coastal zones, shorelands and wetlands, which often receive special state protection. See Richard Briffault, Our Localism: Part I--The Structure of Local Government Law, 90 Colum. L. Rev. 1, 65-66 (1990). In these areas, "the benefits of development, in terms of new jobs or an expanded tax base, will be enjoyed by local residents, while the environmental losses will be felt statewide." Id. at 65. The empirical evidence, though limited, seems to point in the same direction. One commentator has noted that "[e]mpirically, many landfills are located on political borders." Daniel E. Ingberman, Siting Noxious Facilities: Are Markets Efficient?, 29 J. Envtl. Econ. & Mgmt. S-20, S-23 (1995). In particular, "approximately 2/3 of landfills in Pennsylvania are located at or near state or county boundaries." Id. Another analyst examined the location in two northeastern states of sites listed on the National Priorities List--the list of the most hazardous waste sites in the nation. She found that "a number of sites were within a few miles of counties other than the one ascribed to the site location." Rae Zimmerman, Issues of Classification in Environmental Equity: How We Manage Is How We Measure, 21 Fordham Urb. L.J. 633, 650 (1994). The implication of both works appears to be that the number was disproportionate, though neither performed any statistical analysis.

[FN42]. See Natural Resources Defense Council v. EPA, 489 F.2d 390, 406- 11 (5th Cir. 1974), rev'd on other grounds sub nom. Train v. Natural Resources Defense Council, 421 U.S. 60 (1975).

[FN43]. Clean Air Act s 123(a)(1), 42 U.S.C. s 7423(a)(1) (1994).

[FN44]. Clean Air Act s 123(c), 42 U.S.C. s 7423(c) (1994).

[FN45]. See 40 C.F.R. s 51.100(ii) (1995). For the EPA's technical background document, see U.S. Environmental Protection Agency, Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (1985) (on file with author). For an analysis of the evolution of the EPA's policy, see R. Shep Melnick, Regulation and the Courts: The Case of the Clean Air Act 123-54 (1983). For a discussion of the extensive litigation surrounding the tall-stack regulations, see, e.g., Reitze, supra note 40, at 1597-1601; Vestigo, supra note 40, at 729- 36.

[FN46]. See infra text accompanying note 136.

[FN47]. For example, particulates of larger size will not travel as far as particulates of smaller size. See Gordon H. Strom, Atmospheric Dispersion of Stack Effluents, in Air Pollution 227, 229 (Arthur C. Stern ed., 1968).

[FN48]. See infra text accompanying note 76.

[FN49]. See supra note 45 and accompanying text.

[FN50]. The determination of the stack heights necessary to minimize the costs of meeting the federal ambient standards is discussed infra in Part II.A.2.

[FN51]. See supra text accompanying note 45.

[FN52]. See supra text accompanying notes 43-44.

[FN53]. See Connecticut v. EPA, 696 F.2d 147, 161 (2d Cir. 1982) (Connecticut II) (noting that employing "good engineering practice stack height" was not an abuse of EPA discretion when the EPA "also considered additional evaluations using ... actual height").

[FN54]. See Clean Air Act ss 401-16, 42 U.S.C. ss 7651-51 o (1994). For discussion of the scientific basis of the acid-rain problem, see J. Laurence Kulp, Acid Rain: Causes, Effects, and Control, Regulation, Winter 1990, at 41, 41-43.

[FN55]. See Clean Air Act s 401(b), 42 U.S.C. s 7651(b) (1994).

[FN56]. See id.

[FN57]. See Clean Air Act s 407, 42 U.S.C. s 7651f (1994).

[FN58]. See supra text accompanying notes 34-35. A similar objection can be raised against a provision, added in the 1990 amendments, controlling interstate ozone pollution on the eastern seaboard. See Clean Air Act s 184, 42 U.S.C. s 7511c (1994). For a discussion of this provision, see Michael C. Naughton, Note, Establishing Interstate Markets for Emissions Trading of Ozone Precursors, 3 N.Y.U. Envtl. L.J. 195, 228-32 (1994).

[FN59]. See Peter S. Menell & Richard B. Stewart, Environmental Law and Policy 408 (1994).

[FN60]. See id.

[FN61]. See id. at 409.

[FN62]. For further discussion, see Jeanne M. Dennis, Comment, Smoke for Sale: Paradoxes and Problems of the Emissions Trading Program of the Clean Air Act Amendments of 1990, 40 UCLA L. Rev. 1101, 1118-27 (1993).

[FN63]. Such trades, however, cannot lead to violations of the NAAQS. See Clean Air Act s 403(g), 42 U.S.C. s 7651b(g) (1994).

[FN64]. For discussion, see Russell Korobkin, Note, Sulfur Dioxide and the Constitution: Legal Doctrine and Responses to the Clean Air Act Amendments of 1990, 13 Stan. Envtl. L.J. 349 (1994).

[FN65]. H.R. Rep. No. 294, 95th Cong., 1st Sess. 330 (1977), reprinted in 1977 U.S.C.C.A.N. 1077, 1409. For other legislative history, see H.R. Conf. Rep. No. 564, 95th Cong., 1st Sess. 145-46 (1977), reprinted in 1977 U.S.C.C.A.N. 1502, 1525-27; S. Rep. No. 127, 95th Cong., 1st Sess. 41-42 (1977). For academic criticism of the pre-1977 approach, see William V. Luneburg, The National Quest for Clean Air 1970-1978: Intergovernmental Problems and Some Proposed Solutions, 73 Nw. U. L. Rev. 397, 400-21 (1978).

[FN66]. Clean Air Act s 110(a)(2)(E), 42 U.S.C. s 7410(a)(2)(E) (1988), amended by Clean Air Act s 110(a)(2)(D), 42 U.S.C. s 7410(a)(2)(D) (1994).

[FN67]. See Clean Air Act s 110(a)(2)(D)(i)(II), 42 U.S.C. s 7410(a)(2)(D)(i)(II) (1994).

[FN68]. Clean Air Act s 110(a)(2)(D)(i)(I), 42 U.S.C. s 7410(a)(2)(D)(i)(I) (1994). The full provision now requires SIPs to:
(D) contain adequate provisions--
(i) prohibiting, consistent with the provisions of this subchapter, any source or other type of emissions activity within the State from emitting any air pollutant in amounts which will--
(I) contribute significantly to nonattainment in, or interfere with maintenance by, any other State with respect to any such national primary or secondary ambient air quality standard, or
(II) interfere with measures required to be included in the applicable implementation plan for any other State under [the PSD provisions] to prevent significant deterioration of air quality or to protect visibility ....
Clean Air Act s 110(a)(2)(D), 42 U.S.C. s 7410(a)(2)(D) (1994).

[FN69]. See infra text accompanying notes 99-100.

[FN70]. Clean Air Act s 126(b), 42 U.S.C. s 7426(b) (1988).

[FN71]. It now provides that "[a]ny State or political subdivision may petition the

Administrator for a finding that any major source or group of stationary sources emits or would emit any air pollutant in violation of the prohibition of section [110](a)(2)(D)(ii)." Clean Air Act s 126(b), 42 U.S.C. s 7426(b) (1994).

[FN72]. See New York v. EPA, 852 F.2d 574, 581 (D.C. Cir. 1988) (Ruth Bader Ginsburg, J., concurring) (New York III), cert. denied, 489 U.S. 1065 (1989). For academic discussion decrying the lack of effectiveness of these provisions, see J.B. Ruhl, Interstate Pollution Control and Resource Development Planning: Outmoded Approaches or Outmoded Politics?, 28 Nat. Resources J. 293, 296-300 (1988); Kay M. Crider, Note, Interstate Air Pollution: Over a Decade of Ineffective Regulation, 64 Chi.-Kent L. Rev. 619, 624-39 (1988); Timothy Talkington, Comment, Interstate Air Pollution Abatement and the Clean Air Act Amendments of 1990: Balancing Interests, 62 U. Colo. L. Rev. 957, 959-71 (1991).

[FN73]. See New York v. EPA, 716 F.2d 440, 443-44 (7th Cir. 1983) (New York II) (deferring to the EPA's use of a short-range model); New York v. EPA, 710 F.2d 1200, 1204 (6th Cir. 1983) (New York I) (same).

At least in the case of nitrogen oxides, the EPA is currently attempting to quantify the impact of emissions at distances of several hundred kilometers. See Approval and Promulgation of Section 182(f) Exemption to the Nitrogen Oxides (NO) Control Requirements for the Baton Rouge Ozone Nonattainment Area; Louisiana, 61 Fed. Reg. 2438, 2440 (1996) (to be codified at 40 C.F.R. pt.52).

[FN74]. See Talkington, supra note 72, at 969-71. Under the Clean Water Act, the EPA appears to employ a similar technique, arguing that the upstream pollution does not lead to a "detectable violation" of the downstream state's water quality standards. See, e.g., Arkansas v. Oklahoma, 503 U.S. 91, 97 (1992).

[FN75]. See Jerome Ostrov, Interboundary Stationary Source Pollution-- Clean Air Act Section 126 and Beyond, 8 Colum. J. Envtl. L. 37, 41 n.14, 48-50 (1982).

[FN76]. See New York II, 716 F.2d at 443; New York I, 710 F.2d at 1204. The Second Circuit, however, expressed reservations about the EPA's treatment of transformed pollution in Connecticut v. EPA, 696 F.2d 147, 163 (2d Cir. 1982) (Connecticut II).

[FN77]. See Connecticut II, 696 F.2d at 164-65 (stating that the "EPA, as yet, has no adequate model to predict the likelihood of [sulfates]"); Bruce A. Ackerman & William T. Hassler, Clean Coal/Dirty Air 65-72 (1981).

[FN78]. See Kulp, supra note 54, at 41; Valerie Lee, Interstate Sulfate Pollution: Proposed Amendments to the Clean Air Act, 5 Harv. Envtl. L. Rev. 71, 72-76 (1981).

[FN79]. See New York v. EPA, 852 F.2d 574, 578-79 (D.C. Cir. 1988) (New York III) (stating that " 'visibility measures at this time do not address regional haze'" (quoting 49 Fed. Reg. 48,153 (1984))), cert. denied, 489 U.S. 1065 (1989); Vermont v. Thomas, 850 F.2d 99, 103 (2d Cir. 1988) (stating that "no 'plain meaning' to regulate regional haze can be discerned from the face of the [1980] regulations").

[FN80]. See Clean Air Act s 169A(4), 42 U.S.C. s 7491(a)(4) (1994). In Thomas, 850 F.2d at 104, the Second Circuit expressed concern that "more than ten years after the enactment of section 169A, there is still no national program addressing regional haze." The EPA currently estimates that it will promulgate such regulations by January 31, 1997. See 60 Fed. Reg. 60,604, 60,685 (1995).

[FN81]. See New York III, 852 F.2d at 578-79; Thomas, 850 F.2d at 104; New York v. EPA, 716 F.2d 440, 443 (7th Cir. 1983) (New York II); New York v. EPA, 710 F.2d 1200, 1204 (6th Cir. 1983) (New York I).

[FN82]. See New York I, 710 F.2d at 1203-04; Connecticut v. EPA, 656 F.2d 902, 908-09 (2d Cir. 1981) (Connecticut I).

[FN83]. See infra text accompanying notes 99-105.

[FN84]. See infra text accompanying notes 101-02 (discussing contributions found not significant).

[FN85]. See Talkington, supra note 72, at 968-72.

[FN86]. See sources cited supra note 82.

[FN87]. See 49 Fed. Reg. 48,152, 48,154 (1984); 47 Fed. Reg. 6624, 6626 (1982).

[FN88]. New York v. EPA, 710 F.2d 1200, 1203 (6th Cir. 1983) (New York I).

[FN89]. See, e.g., Air Pollution Control Dist. v. EPA, 739 F.2d 1071, 1085-88 (6th Cir. 1984) (Jefferson County) (rejecting Jefferson County's margin-for-growth argument on the grounds that it attempts to "establish a local air quality standard that is more stringent than the national standard"); Connecticut v. EPA, 656 F.2d 902, 909 (2d Cir. 1981) (Connecticut I) ("Nothing in the Act ... indicates that a state must respect its neighbor's air quality standards ... if those standards are more stringent than the requirements of federal law."); 49 Fed. Reg. 34,851, 34,858 (1984).

[FN90]. See Connecticut I, 656 F.2d at 910 (holding that the "EPA is not obligated to consider state law before approving [a] SIP revision").

[FN91]. See Jefferson County, 739 F.2d at 1085-88. In this case, an electric utility in Indiana had a large effect on the margin for growth for sulfur dioxide in Jefferson County, Kentucky. For example, an EPA study found that, with respect to two out of the three NAAQS for sulfur dioxide, 34.5% and 46.8%, respectively, of the permissible pollution levels in a portion of Jefferson County were consumed by this plant. See Hearing Notice, 45 Fed. Reg. 17,048, 17,048-49 (1980); see also Jefferson County, 739 F.2d at 1078. While the air quality in this part of Jefferson County was better than the federal ambient standards, the county as a whole was classified as nonattainment. The EPA determined that, as a nonattainment area, Jefferson County was not subject to any PSD requirement, and therefore that the Indiana utility's emissions could not "interfere" with PSD measures. 47 Fed. Reg. 6624, 6625 (1982).

[FN92]. See Jefferson County, 739 F.2d at 1085-88. In a case in which the downwind state had established a baseline, the EPA concluded that upwind pollution may "consume a portion of the allowable PSD increment, but in general unless it causes that increment to be exceeded, it will not trigger section 126 relief." 49 Fed. Reg. 34,851, 34,858 (1984). Under this reasoning, even where the downwind state has an established PSD program, the upwind state can destroy the PSD increment--and therefore the downwind state's margin for growth--with no constraint, provided that the increment is not actually violated. This decision was upheld in New York v. EPA, 852 F.2d 574 (D.C. Cir. 1988) (New York III), cert. denied, 489 U.S. 1065 (1989).
An earlier case had taken a position more sympathetic to the interests of the downwind states:

[A] situation could arise where, because of the absence of a baseline in one state, a nearby state could continue to export pollution until the affected state's concentration of a specific pollutant reached the NAAQSs. Thereafter, if a baseline were set, the affected state would be unable to permit additional pollution within its own PSD increment because any further [[[pollution] would violate the NAAQSs. The PSD increment in effect would have been consumed by the nearby state.
Connecticut v. EPA, 696 F.2d 147, 167 (2d Cir. 1982) (Connecticut II). The court also noted that states that are not subject to PSD requirements even though they have air-quality levels that are better than the NAAQS may nonetheless have taken voluntary measures to prevent the deterioration of their air quality. The court referred to the "danger" of allowing upwind pollution to interfere with such state-imposed measures. Id.

[FN93]. See 49 Fed. Reg. 48,152, 48,154-55 (1984).

[FN94]. See id.

[FN95]. See supra text accompanying notes 66-69.

[FN96]. The EPA had stated that these provisions "are designed to protect against interstate interference with State or local ambient air standards or other measures more stringent than necessary to attain federal standards." Hearing Notice, 45 Fed. Reg. 72,702, 72,707 (1980). Opening a hearing in the Jefferson County case, David Hawkins, the Carter Administration's Assistant Administrator of the EPA for Air, Noise, and Radiation, stated:
EPA's interpretation of the interstate pollution provisions is that they provide protection against national ambient air quality standards violations and protection against unreasonable interference with a maintenance program or margin for growth in the State Implementation Plan....
....

... In addition, the Agency believes that the provisions are designed to protect against interstate interference with State or local ambient air quality standards or other measures more stringent than necessary to attain the Federal standards.
Public Hearing on Interstate Pollution Abatement Petition from Jefferson County, Kentucky 6-7 (April 17, 1980) (on file with author) (emphasis added). This proceeding, however, was not completed during the Carter Administration. I am grateful to Charles Carter, Esq., for having made available to me, when he was Assistant General Counsel of the EPA, the full administrative record in the Jefferson County case.

[FN97]. The House Report accompanying the 1977 amendments provides:
The committee intends that the prohibition against interstate pollution which interferes with prevention of significant deterioration plans in new section 110(a)(2)(E) and new section 126 of the act be construed as including a prohibition on interstate pollution which prevents timely attainment or maintenance of State or local ambient air quality standards or other measures adopted under section 116 of the act. The prohibition should also be construed to protect state or local plans to prevent significant deterioration which are more stringent than is required by ... the act.
H.R. Rep. No. 294, 95th Cong., 1st Sess. 331 n.14 (1977), reprinted in 1977 U.S.C.C.A.N. 1077, 1410 n.14.

[FN98]. See Connecticut v. EPA, 656 F.2d 902, 910 (2d Cir. 1981) (Connecticut I).

[FN99]. See Air Pollution Control Dist. v. EPA, 739 F.2d 1071, 1093 (6th Cir. 1984) (Jefferson County) (concluding that "the proper test to be applied in evaluating the section 126 petition is whether [the offender's] emissions ' significantly contribute' to ... violations"); 49 Fed. Reg. 34,851, 34,859 (1984) (emphasizing that a state may contend that an "out-of-State source prevents it from meeting" federal air-quality standards "only if that source makes a significant contribution to the levels of pollution that cause a ... violation").
In the first case in which the issue arose, the Second Circuit refused to adopt the EPA's "significant contribution" test, but nonetheless upheld the Agency's decision on the basis of a de minimis exception. See Connecticut v. EPA, 696 F.2d 147, 164-65 (2d Cir. 1982) (Connecticut II).

[FN100]. See supra text accompanying notes 66-69 (detailing the changes made by the 1990 amendments).

[FN101]. See Connecticut II, 696 F.2d at 165 (upholding the EPA's determination that a New York firm's emissions of 1.5% of Connecticut's federal air-quality standards would not "prevent the attainment" of the federal standards in that state).

[FN102]. See Jefferson County, 739 F.2d at 1092-93. The downwind claims in this case seemed particularly strong because the Gallagher source, an electric utility in the upwind state, was permitted to have sulfur dioxide emissions of 6.0 lbs./MBTU--a standard that it could meet with no controls at all--whereas the electric utility in

Jefferson County, in the downwind state, had spent $138 million installing scrubbers in order to meet a standard of 1.2 lbs./ MBTU. See id. at 1076-77.

[FN103]. See 49 Fed. Reg. 34,851, 34,859 (1984). The EPA stated:
In determining that a contribution is significant, the Administrator will take the following factors, among others, into account:
the location of the named source;
the nature and degree of the violation; its extensiveness; the number of violations to which the named source has or may have contributed;
the amounts or volumes contributed by the named source as compared with the amounts and volumes contributed by in-State and unnamed out-of-State sources;
the relative stringencies of the pollution controls placed on in-State sources compared to those placed upon out-of-State sources; the use of the best available control technologies on those sources;
the historical record of the petitioning State and the named source State with respect to meeting national ambient air quality objectives;
projections concerning future violations or attainments absent a Section 126 determination;
the degree to which a named source meets SIP requirements in its own State;
the degree to which that source uses its allowable emission quota;
the types of sources involved and the dates they begin to emit;
the relative costs of pollution abatement between sources that contribute to a violation.
Id.
During the Carter Administration, the EPA suggested that a similar inquiry might be appropriate to determine when upwind pollution is excessive. In listing the set of issues to be addressed at a hearing, the Agency stated that one possibility would be to "requir[e] generally comparable emission limits for comparable sources in both States. In determining a comparable emissions limit for the contested source, the Administrator would consider the air-quality impacts permitted comparable sources in each State and emissions limits required for similar sources in similar areas." Hearing Notice, 45 Fed. Reg. 17,048, 17,049 (1980). The EPA also inquired about how differences in emissions levels should be compared against the estimated air-quality impacts of in-state and comparable out-of-state sources, and whether it would be appropriate to require regionally uniform emissions limits or uniform control technologies. See id. at 17,049-50. Unlike the approach adopted during the Reagan Administration, see supra text accompanying notes 89-95, this inquiry would not have been confined to cases in which the federal ambient standards in the downwind state are violated. This proceeding, however, was not completed during the Carter Administration. See supra note 96.

[FN104]. 49 Fed. Reg. 34,851, 34,864 (1984).

[FN105]. The EPA's regulations under the Clean Water Act provide for the denial of permits to sources in upstream states if their effluents would produce a violation of the water quality standard of a downstream state. See Arkansas v. Oklahoma, 503 U.S. 91, 103 (1992) (noting that the Clean Water Act "appears to prohibit the issuance of any federal license or permit over the objection of an affected State unless compliance with the affected State's water quality requirements can be ensured"); Champion Int'l Corp. v. EPA, 850 F.2d 182, 183-84 (4th Cir. 1988). Thus, in Category III, upstream pollution is constrained. The EPA has not indicated how it would treat Category I and Category II. For commentary on the issues raised by the Arkansas v. Oklahoma litigation, see Maria V. Maurrasse, Comment, Oklahoma v. EPA: Does the Clean Water Act Provide an Effective Remedy to Downstream States or Is There Still Room Left for Federal Common Law?, 45 U. Miami L. Rev. 1137 (1991); Thomas E. Osment, Jr., Note, Congress Has Entrusted the EPA, Not the Courts, with the Final Word on Federal Water Pollution Regulatory Law, 15 U. Ark. Little Rock L.J. 117 (1992).

From the perspective of the analysis of interstate externalities, the legal regime under the Clean Water Act is somewhat different from that of the Clean Air Act. Most importantly, states have considerable discretion in their choice of water quality standards--the analog to ambient standards--although the standards must be approved by the EPA. See 33 U.S.C. s 1313(a) (1994); 40 C.F.R. s 131.1-.22 (1995). The discretion of the states in choosing water-quality standards affects both the wealth-maximization analysis, see infra Part II.B, and the Dormant Commerce Clause analysis, see infra Part III.B.3.

[FN106]. See Connecticut v. EPA, 696 F.2d 147, 156 (2d Cir. 1982) (Connecticut II).

[FN107]. See 49 Fed. Reg. 34,851, 34,860-61 (1984) (recognizing the limitations and preliminary nature of the modeling analysis). The EPA's decision was upheld by the D.C. Circuit. See New York v. EPA, 852 F.2d 574, 580 (D.C. Cir. 1988) (New York III), cert. denied, 489 U.S. 1065 (1989).

[FN108]. See supra text accompanying notes 66-69 (detailing the changes made by the 1990 amendments).

[FN109]. See Crider, supra note 72, at 629-31.

[FN110]. Of course, this strategy can be followed only if it does not lead to a violation of the federal ambient standards in the upwind state.

[FN111]. In January 1980, the EPA proposed to approve a variance to the New York SIP that allowed the Consolidated Edison Company, an electric utility, to use, for one year, fuel oil with a sulfur content of 1.5% in three facilities. See 45 Fed. Reg. 3331, 3331-32 (1980). The EPA found that the variance would not lead to any violation of the NAAQS or PSD increments in other states. See id. at 3332. Several comments filed in response to the notice of proposed rulemaking objected to a "first-come-first-served" approach to regional growth, under which a downwind state could lose its margin for growth if the upwind state used it first. See 45 Fed. Reg. 26,101, 26,101 (1980). In rejecting these comments, the EPA reasoned that Con Edison would not be in a position to take the margin for growth in the downwind states on a "first-come- first-served" basis, because any new source in the downwind state could trump a further extension of the Con Edison variance. See 45 Fed. Reg. 53,138, 53,140 (1980). Interestingly, given the EPA's stated opposition to "first- come-first-served" allocations, this reasoning would have created a "first- come-first-served" right for the downwind sources.

[FN112]. See Clean Air Act s 116, 42 U.S.C. s 7416 (1994). This principle is subject only to narrow qualification in cases such as emissions standards for automobiles, where national uniformity is considered desirable to capture economies of scale in the production process. See id.

[FN113]. See supra text accompanying notes 1-4.

[FN114]. See infra Part II.B.

[FN115]. See Ruhl, supra note 72, at 307.

[FN116]. See supra text accompanying notes 99-104.

[FN117]. See supra text accompanying notes 110-11.

[FN118]. In formulating this rule, the Second Circuit also considered a different scenario, under which, as a result of the upwind pollution, the downwind state could not meet the NAAQS under its then-prevailing standards for in-state sources, but could meet the NAAQS if it tightened up those standards. The court noted that under a literal reading of the word "prevent," there would be no violation of this section unless it was impossible for the downwind state to meet the NAAQS even by imposing more stringent control measures on its own sources. Rejecting this interpretation, the court stated that the interstate pollution provisions of the Act "were designed to ensure that one state would not be able to foist its pollution on another state and accordingly require that state to tighten its regulations to keep its air clean." Connecticut v. EPA, 696 F.2d 147, 156 (2d Cir. 1982) (Connecticut II). The court never made the connection that under its but-for cause rule, the downwind state could foist on the upwind state the full cost of the downwind state's failure to impose more stringent controls on its sources.

[FN119]. See supra text accompanying notes 105-08.

[FN120]. Clean Air Act ss 110(a)(2)(D), 126(b), 42 U.S.C. ss 7410(a)(2)(D), 7426(b) (1994).

[FN121]. See Clean Air Act s 116, 42 U.S.C. s 7416 (1994).

[FN122]. See Jacques LeBoeuf, The Economics of Federalism and the Proper Scope of the Federal Commerce Power, 31 San Diego L. Rev. 555, 573-74 (1994). LeBoeuf notes: "The objection that the bargaining suggested by the Coase theorem would obviate federal intervention is in a sense nothing more than a dispute over semantics.

Congress is, in a sense, the forum wherein states hammer out their differences." Id. at 574.

[FN123]. Thus, for example, the provisions that preceded sections 110(a)(2)(D) and 126(b), which relied on intergovernmental cooperation, were wholly ineffective. See supra text accompanying note 65.

Several reasons might explain why transaction costs are sufficiently high to prevent the formation of compacts. First, the baselines are not well defined in the current legal regime. Does an upwind state have the right to send pollution downwind unconstrained? Alternatively, does the downwind state have the right to enjoin all upwind pollution? Second, for different pollution problems, the range of affected states will vary. This shifting membership makes less likely the emergence of relationships favoring cooperation. Third, the causation questions are not likely to be straightforward. Considerable scientific work needs to be undertaken in order to determine what sources of pollution are having an impact on the downwind state. The federal government has the technical expertise to make such determinations because they are quite similar to the determinations that it must make under different provisions of environmental law--for example, in determining whether emissions limitations in a SIP lead to the attainment of the NAAQS in that state. This type of expertise would be costly for states to replicate in connection with their negotiations over compacts.

[FN124]. For water pollution, only effluent levels--the analog of emissions--and location are relevant.

[FN125]. See supra text accompanying notes 120-22 (discussing the relationship between welfare maximization and cost minimization).

[FN126]. The second and third scenarios are discussed briefly in the margin. See infra note 127.

[FN127]. In cases in which t <gt> m, see supra text accompanying notes 125- 26, at the point at which each source has its maximum impact on ambient air quality, the other source has no impact at all. If the ambient standard is met at the point at which each source has its maximum impact, it follows that it will be met everywhere else as well. Thus, the permissible level of emissions from each source is independent of the cost of achieving the emissions reductions: it is simply the level necessary to meet the ambient standard. The solution is simply e = e = s/m, and is independent, for both sources, of the costs of pollution abatement.

[FN128]. See supra text accompanying notes 116-18.

[FN129]. See Ostrov, supra note 75, at 83.

[FN130]. Of course, if these factors are taken into account in determining which contributions are significant, this problem does not arise.

[FN131]. For discussion of these features of control costs, see, e.g., Robert W. Crandall, The Political Economy of Clean Air: Practical Constraints on White House Review, in Environmental Policy Under Reagan's Executive Order: The Role of Benefit-Cost Analysis 205, 212-13 (V. Kerry Smith ed., 1984); Matthew D. McCubbins et al., Structure and Process, Politics and Policy: Administrative Arrangements and the Political Control of Agencies, 75 Va. L. Rev. 431, 467 (1989); Richard B. Stewart, Regulation, Innovation, and Administrative Law: A Conceptual Framework, 69 Cal. L. Rev. 1256, 1270 (1981).

[FN132]. See supra text accompanying notes 122-23.

[FN133]. See supra text accompanying notes 35-41.

[FN134]. See supra text accompanying notes 43-54.

[FN135]. One manufacturer estimates that a 1000-foot stack costs more than three times as much as a 500-foot stack, in part because of the need to have a stronger base to support the larger structure. See The Building of Tall (and Not So Tall) Stacks, Envtl. Sci. & Tech., June 1975, at 522, 525 [hereinafter Tall (and Not So Tall) Stacks]. For estimates of the costs of building tall stacks, see Senate Comm. on Public Works, supra note 36, at 516-17, 527; Tall (and Not So Tall) Stacks, supra, at 525.

[FN136]. See Williamson, supra note 35, at 219-25. Another complication arises because the impact of emissions on downwind ambient air quality depends not only on stack height but also on plume rise. If the emissions are warm when they leave the stack, they will continue to rise as a result of their buoyancy. In addition, the emissions can be induced to rise by means of fans-- a common technique in the case of large steam-generating electrical power plants. The effective height of a stack is therefore equal to its physical height plus the amount of plume rise. See id. at 226-27. The regulations prohibit "manipulating" the production process to increase plume rise but do not specify what counts as manipulation. See 40 C.F.R. s 51.100(hh)(1)(iii) (1995).

[FN137]. See supra text accompanying notes 126-27.

[FN138]. As in the prior subsection, all units are assumed to be infinitesimal.

[FN139]. This example assumes that the distance from both sources to the point at which their combined emissions produce the largest impact on ambient air-quality levels is such that for each source, a taller stack decreases the impact on ambient air-quality levels of one unit of emissions.

[FN140]. See supra text accompanying notes 38-40 (discussing these two types of externalization).

[FN141]. In addition, for each source there will be three intrasource conditions, concerning the relationships among emissions, stack height and location. See supra text accompanying notes 138-40.

[FN142]. See supra text accompanying notes 131-32.

[FN143]. See Clean Air Act s 116, 42 U.S.C. s 7416 (1994).

[FN144]. A similar situation arises in instances in which the downwind state might wish to attract new industry immediately, but might be unable to do so because it is in violation of the ambient standards for another pollutant. For example, sources that emit sulfur dioxide typically also emit particulates. Thus, for example, if a state is a nonattainment area for particulates, it would not be able to use its margin for growth with respect to sulfur dioxide. The question, then, is whether the upwind state should be allowed to consume this margin for growth without constraint.

[FN145]. See supra notes 89-98 and accompanying text.

[FN146]. See supra text accompanying notes 98-105.

[FN147]. See supra text accompanying notes 130-32.

[FN148]. See supra text accompanying notes 132-33.

[FN149]. For recent discussions of these standards in the context of environmental and health-and-safety protections, see, e.g., Daniel A. Farber & Robert E. Hudec, Free Trade and the Regulatory State: A GATT's-Eye View of the Dormant Commerce Clause, 47 Vand. L. Rev. 1401, 1412-14 (1994); Stewart, International, supra note 3, at 1332.

[FN150]. See Michael E. Smith, State Discriminations Against Interstate Commerce, 74 Cal. L. Rev. 1203, 1220-22 (1986).

[FN151]. The Framers granted Congress plenary authority over interstate commerce in "the conviction that in order to succeed, the new Union would have to avoid the tendencies toward economic Balkanization that had plagued relations among the Colonies and later among the States under the Articles of Confederation." "This principle that our economic unit is the Nation, which alone has the gamut of powers necessary to control the economy, ... has as its corollary that the states are not separable economic units."
Oregon Waste Sys. v. Department of Envtl. Quality, 114 S. Ct. 1345, 1349 (1994) (alteration in original) (citations omitted). The multiplicity of approaches taken in the jurisprudence of the Dormant Commerce Clause, see infra text accompanying notes 195-97, does not detract from the force of the claim that this provision embodies an important structural principle concerning the permissible relationship among the states in our federal system. For academic commentary concerning the Dormant Commerce Clause, see generally Richard B. Collins, Economic Union as a Constitutional Value, 63 N.Y.U. L. Rev. 43 (1988); Julian N. Eule, Laying the Dormant Commerce Clause

to Rest, 91 Yale L.J. 425 (1982); Donald H. Regan, The Supreme Court and State Protectionism: Making Sense of the Dormant Commerce Clause, 84 Mich. L. Rev. 1091 (1986); Smith, supra note 150; Mark Tushnet, Rethinking the Dormant Commerce Clause, 1979 Wis. L. Rev. 125 (1979).

[FN152]. Congress may authorize the states to engage in regulation that the Dormant Commerce Clause would otherwise forbid. See, e.g., Maine v. Taylor, 477 U.S. 131, 138 (1986); Southern Pac. Co. v. Arizona ex rel. Sullivan, 325 U.S. 761, 769 (1945).

[FN153]. This conclusion follows even if at least some of the standards developed by the Supreme Court under the Dormant Commerce Clause are viewed as underenforced constitutional norms--norms which the Court has not enforced to their full conceptual boundaries as a result of institutional concerns. See Lawrence G. Sager, Fair Measure: The Legal Status of Underenforced Constitutional Norms, 91 Harv. L. Rev. 1212, 1213 (1978). For example, one might believe that courts are not institutionally well suited to balance the interests of the state imposing the restriction subject to the Dormant Commerce Clause challenge against the interests of other states, as is contemplated in Pike v. Bruce Church, Inc., 397 U.S. 137, 142-46 (1970), and that the nondiscrimination test, see infra text accompanying notes 195-96, is merely an underenforced norm, adopted because of its ease of application. Because the courts would make determinations about permissible upwind pollution, the same institutional issues arise for the analogy presented here.

The use of such a canon of statutory construction is not necessarily inconsistent with the requirement of Chevron, U.S.A. v. Natural Resources Defense Council, 467 U.S. 837, 842-43 (1984), that courts uphold an agency's construction of a statute that it is entitled to administer unless it is unreasonable or inconsistent with the clear intent of Congress. See Wagner Seed Co. v. Bush, 946 F.2d 918, 924-25 (D.C. Cir. 1991), cert. denied, 503 U.S. 970 (1992); Michigan Citizens for an Indep. Press v. Thornburgh, 868 F.2d 1285, 1293 (D.C. Cir. 1989), aff'd by an equally divided court, 493 U.S. 38, 39 (1989); American Fed'n of Gov't Employees, AFL- CIO v. Federal Labor Relations Auth., 798 F.2d 1525, 1528 (D.C. Cir. 1986). Some canons, however, have been found to be "too thin a reed to support the conclusion that Congress has clearly resolved [an] issue." Texas Rural Legal Aid, Inc. v. Legal Serv. Corp., 940 F.2d 685, 694 (D.C. Cir. 1991) (expressio unius canon); see also Chugach Alaska Corp. v. Lujan, 915 F.2d 454, 457 n.4 (9th Cir. 1990) (canon that statutes benefiting Native Americans should be construed liberally in their favor); Michigan Citizens for an Indep. Press, 868 F.2d at 1292 (canon that exemptions from the antitrust laws should be construed narrowly).

[FN154]. The discussion that follows does not assume that the courts would be equally likely to pick each of these three formulations. See infra note 195.

[FN155]. 437 U.S. 617 (1978).

[FN156]. See id. at 625.

[FN157]. Of course, at some point a state could exhaust the land suitable for landfills.

[FN158]. See Oregon Waste Sys. v. Department of Envtl. Quality, 114 S. Ct. 1345 (1994); Chemical Waste Management, Inc. v. Hunt, 504 U.S. 334 (1992); Fort Gratiot Sanitary Landfill, Inc. v. Michigan Dep't of Natural Resources, 504 U.S. 353 (1992). For a recent analysis of these cases, see Kirsten Engel, Reconsidering the National Market in Solid Waste: Trade-Offs in Equity, Efficiency, Environmental Protection, and State Autonomy, 73 N.C. L. Rev. 1481, 1495-1500 (1995); Lisa Heinzerling, The Commercial Constitution, 1995 Sup. Ct. Rev. 217, 223-34.

[FN159]. See Fort Gratiot, 504 U.S. at 367 ("Michigan could ... limit the amount of waste that landfill operators may accept each year."); City of Philadelphia, 437 U.S. at 626 ("[I]t may be assumed ... that New Jersey may ... slow[ ] the flow of all waste into the State's remaining landfills, even though interstate commerce may incidentally be affected.").

[FN160]. See Oregon Waste Sys., 114 S. Ct. at 1351-53; Chemical Waste Management, 504 U.S. at 343-46.

[FN161]. See sources cited supra notes 159-60 (citing cases establishing the nondiscrimination test). Restrictions on the out-flow of wastes from a state are subject to the same analysis as restrictions on the in-flow of wastes. See C & A Carbone, Inc. v. Town of Clarkstown, 114 S. Ct. 1677, 1681-84 (1994).
In Maine v. Taylor, 477 U.S. 131 (1986), the Supreme Court upheld a Maine statute banning the importation of live baitfish on the basis of factual findings that such foreign baitfish would introduce parasites into Maine waters, and that they would be commingled with nonnative fish species, potentially causing ecological damage. See id. at 140-43, 151-52. In contrast, in City of Philadelphia, the foreign waste was no more harmful than the domestic waste. See City of Philadelphia, 437 U.S. at 629.

[FN162]. See supra text accompanying notes 124-25.

[FN163]. The reverse might also be true.

[FN164]. For discussion of the limitations of models to estimate the impact of emissions on ambient air-quality levels, see supra text accompanying notes 72-74.

[FN165]. The purpose of this discussion is to explain the broad outlines of an alternative means of controlling interstate externalities, rather than to deal with the details of implementation. Thus, it is not necessary to discuss here whether small sources should be exempted from the inquiry or how the burdens of producing the necessary information should be allocated.

[FN166]. See supra text accompanying notes 126-27.

[FN167]. See supra text accompanying notes 159-61.

[FN168]. See supra Part II.B.

[FN169]. This Article does not consider the independent question whether the rule of City of Philadelphia v. New Jersey provides the optimal incentives for investment in landfill facilities.

[FN170]. 458 U.S. 941 (1982).

[FN171]. Id. at 944 (quoting Neb. Rev. Stat. s 46-613.01 (1978)).

[FN172]. Id. at 956.

[FN173]. In Hughes v. Oklahoma, 441 U.S. 322 (1979), the Supreme Court struck down an Oklahoma statute prohibiting the transportation or shipping outside the state of natural minnows taken from in-state waters. There were no restrictions on the in-state use of the resource, and there was a total prohibition on out-of-state use. See id. at 337-38. Thus, the disparity between in-state and out-of-state requirements was far greater than in Sporhase.

[FN174]. Sporhase, 458 U.S. at 956 (emphasis added).

[FN175]. See id. at 953. The "severe shortage" of ground water, which the Court emphasized, id. at 956, implied that little new agricultural activity could be undertaken, just as ambient air-quality levels close to the federal ambient standards impede new industrial activity.

[FN176]. In Fort Gratiot Sanitary Landfill, Inc. v. Michigan Dep't of Natural Resources, 504 U.S. 353, 363-66 (1992), the Court emphasized that its holding in Sporhase was narrow, and that it was as a result of a "confluence of factors" that a state could "conserve and preserve ground water for its own citizens in times of severe shortage." For a similar view, see Oregon Waste Sys. v. Department of Envtl. Quality, 114 S. Ct. 1345, 1354 (1994). But even under a narrow view of Sporhase, air might be considered a resource comparable to ground water.

[FN177]. A different issue arises if a state attempts to restrict the importation of a product on the ground that it was manufactured through an environmentally undesirable process. Such practices, which have not arisen in the domestic context, are an increasingly important issue in the regulation of international trade. See Stewart, International, supra note 3, at 1340-44.

[FN178]. 449 U.S. 456 (1981).

[FN179]. The Court also upheld the statute against an equal protection challenge. See id. at 461-70.

[FN180]. Id. at 459.

[FN181]. 397 U.S. 137 (1970).

[FN182]. Id. at 142 (citations omitted). This standard was also invoked in Sporhase v. Nebraska ex rel. Douglas, 458 U.S. 941, 954 (1982), and City of Philadelphia v. New Jersey, 437 U.S. 617, 624 (1978).

[FN183]. Minnesota v. Clover Leaf Creamery Co., 449 U.S. 456, 471-72 (1981).

[FN184]. Such deference is not unusual. See Farber & Hudec, supra note 149, at 1415; Stewart, International, supra note 3, at 1336.

[FN185]. See Clover Leaf Creamery, 449 U.S. at 463-64.

[FN186]. Id. at 460 (citation omitted).

[FN187]. See id. at 464-65.

[FN188]. Id. at 473.

[FN189]. Id.

[FN190]. Id. at 460 (citation omitted).

[FN191]. Id. at 473.

[FN192]. See South Carolina State Highway Dep't v. Barnwell Bros., 303 U.S. 177, 185 n.2 (1938) ("[W]hen the regulation is of such a character that its burden falls principally upon those without the state, legislative action is not likely to be subjected to those political restraints which are normally exerted on legislation...."); Eule, supra note 151, at 445-46 (arguing that when "the cost of compliance falls upon groups to whom the legislators are not answerable, there is no incentive to minimize the burdens or maximize the efficiency of the regulation").

[FN193]. See supra Part II.B.

[FN194]. For further discussion concerning what interests ought to be taken into account in applying this test, see Stewart, International, supra note 3, at 1336.

[FN195]. This analysis does not assume that each of these approaches is equally likely to be adopted by the courts. Indeed, recent cases suggest that the nondiscrimination approach is becoming dominant. See supra notes 158-61.

[FN196]. See supra text accompanying notes 161-68.

[FN197]. See supra text accompanying notes 131-32.

[FN198]. See supra text accompanying notes 141-42, 146-48.

[FN199]. See supra text accompanying notes 141-42.

[FN200]. Under the nonattainment provisions, see supra text accompanying notes 26-31, it is not uncommon for states to provide the offsets as an inducement to attract new plants. See National Comm'n on Air Quality, To Breathe Clean Air 136-37 (1981).

[FN201]. This discussion does not address how the initial allocation of the permits would be conducted.

[FN202]. For discussion of such markets, see generally W. David Montgomery, Markets in Licenses and Efficient Pollution Control Programs, 5 J. Econ. Theory 395 (1972); Thomas H. Tietenberg, Transferable Discharge Permits and the Control of Stationary Source Air Pollution: A Survey and Synthesis, 56 Land Econ. 391 (1980).

[FN203]. See supra text accompanying notes 126-27.

[FN204]. See supra text accompanying notes 131-32.

[FN205]. See, e.g., Connecticut v. EPA, 696 F.2d 147, 157-58 (2d Cir. 1982) (Connecticut II); Cleveland Elec. Illuminating Co. v. EPA, 572 F.2d 1150 (6th Cir. 1978), cert. denied, 439 U.S. 910 (1978); 40 C.F.R. s 51.115 (1995).

[FN206]. See sources cited supra note 205. For discussion of the limitations of these models, see supra text accompanying notes 72-74.

[FN207]. Revesz, supra note 2.

[FN208]. The same is true for the Clean Water Act. See supra note 105.

[FN209]. See supra text accompanying notes 96-98, 103 (describing the EPA's position on interstate externalities during the Carter Administration).

[FN210]. See supra note 92 (discussing Connecticut II).

[FN211]. See supra text accompanying notes 92-95.

[FN212]. See supra text accompanying notes 1-4.

[FN213]. For discussion of issues of federalism and environmental regulation in Canada, see Colleen Shannon, Air Pollution in Canada and the United States: Choosing to Regulate at the Federal Level (Nov. 1995) (manuscript, on file with author).

[FN214]. Interestingly, the Dormant Commerce Clause standards of our constitutional jurisprudence are influencing the free trade principles administered by the World Trade Organization. See Farber & Hudec, supra note 149, at 1419; Stewart, International, supra note 3, at 1346.