DATA NEGOTIATION

INTRODUCTION

At the heart of most environmental controversies lies a dispute over the likely future consequences of a proposed action. In the Grayrocks Dam case, the parties argued over the probable effect of the dam on wildlife and farming downstream. In the Brown Paper case, the parties argued over the necessity of installing expensive air pollution control technology. In the Holston River case that follows, the Environmental Protection Agency and the Tennessee Eastman Company had very different opinions about both the cost and the beneficial impact of the agency's proposed water pollution control efforts.

Making predictions about impacts that will occur well into the future necessarily involves a fair degree of scientific and technical analysis. To forecast the effect of construction of the Grayrocks Dam required knowledge of seasonal variations in the North Platte River water flow, the hydrological characteristics of the dam, and the migratory habits of the whooping crane. Similarly, in order to isolate the effect of construction of a new bark boiler on the Berlin, New Hampshire, air quality region required a sophisticated understanding of the distribution of smoke plumes in rough terrain. Although we can predict the operation of a few natural systems quite accurately—the rise and fall of the tides is a good example—our understanding of how man's ecosystems operate is fairly limited. As a result, our predictions are at best approximations of reality.

Regulatory decisions more frequently than not turn on mathematical models that are based upon simplifying assumptions. This produces a situation ripe for conflict. Because modeling is expensive, there is a trade-off between accuracy and cost. Governmental models are constantly subject to challenge by outside experts who claim that their industry-funded models are more accurate. Moreover, because different people are inclined to make different assumptions, environmental disputes often become battles between experts hired by the opposing parties to defend a particular set of premises.

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The Holston River case that follows is a good example of such a dispute. At the root of the conflict between EPA and the Tennessee Eastman Company was a dispute over the validity of the models used by EPA to estimate the capacity of the river to absorb pollutants. In reading the case, think carefully about how access to information and expertise influenced the bargaining strength of the parties. Would the outcomes have been any different if Tennessee Eastman's experts worked for EPA and vice versa?

THE HOLSTON RIVER CASE

This case was originally prepared by Alexander Jaegerman. It has been substantially edited and revised.

Introduction

In October, 1972, Congress passed the Federal Water Pollution Control Act Amendments over the veto of then President Richard Nixon. The law declared that all pollution discharges into U.S. waters were illegal unless specifically authorized in kind and quantity by a permit issued by the EPA. Under the law, the agency is required to set standards and issue permits by reference to the technology available to control pollution. By July 1, 1977, the National Pollution Discharge Elimination System (NPDES) was supposed to reduce discharges to the level achievable through application of the "best practicable technology (BPT)" and operating practice, taking into account costs of implementation and benefits derived. By July 1, 1983, discharges are to be reduced further to the level attainable through use of the "best available technology (BAT)" economically achievable.

The NPDES standards vest a tremendous amount of discretion in the hands of EPA officials. Determining BPT and BAT requires not only an assessment of the state of the art of pollution control technology but also a balancing of the costs and benefits of alternative control strategies. In practice, these are difficult decisions that are scrutinized closely by industry and environmental groups alike. The stakes are high for all parties; controversy is not uncommon.

In late 1972, shortly after adoption of the Clean Water Act amendments, the Tennessee Eastman Company submitted an NPDES application to EPA. Tennessee Eastman is a major chemical processor. Its plant in Kingsport, Tennessee, occupies over 400 acres on the Holston River and employs close to 12 thousand people (see Figure 7). The plant produces an array of chemical products, including Kodel polyester fibers and Kodak films and chemicals. Chemicals are processed in vast quantities; on an average day, over 700 million pounds of materials are handled in the plant. Not surprisingly, Tennessee Eastman is
also a major producer of chemical waste. At the time of its application for an NPDES permit, the company was discharging 400–500 million gallons of treated wastewater into the Holston River daily—about the same amount of wastewater produced by a city of 5 million people, and at times equal to the entire flow of the river.

The Tennessee Eastman NPDES application posed a number of difficult problems for EPA. First, the company was one of five major dischargers along this stretch of the Holston River, albeit by far the largest one (see Figure 8). Effluent limits had to be established in an equitable manner.

Second, setting effluent limits involved making complex determinations about the capacity of the Holston River to assimilate pollutants. EPA’s models were certain to be challenged by Tennessee Eastman’s experts. Third, Tennessee Eastman had substantially greater technical resources at its disposal than did EPA. It employed over 1,800 scientists, engineers, and support personnel in five laboratories located on site. Moreover, it had the capacity to hire the best consultants in the field. Fourth, the criteria specified in the statute for granting NPDES permits were inherently ambiguous. Although this ambiguity gave EPA a fair amount of latitude to fashion a permit, it also gave Tennessee Eastman room subsequently to challenge any permit it regarded as excessively strict on the grounds that EPA had misinterpreted its statutory mandate. Finally, as a major employer essential to the economic health of the region, Tennessee Eastman was capable of mustering substantial political support in favor of its position on the NPDES permit discussion blossomed into a full-scale public dispute.

Setting Effluent Limits Under the NPDES

The purpose of effluent limits permits under the NPDES is to ensure maintenance of minimum water quality in the nation’s waterways. Water quality is generally measured along a number of dimensions, including color, odor, turbidity, and the presence of toxins, pathogens (e.g., viruses), surface scum, oil, or foam. The presence of dissolved oxygen is also an important indicator of water quality. When organic matter is discharged into a stream, a decomposition process occurs in which microorganisms digest the waste, breaking it down into its essential elements—generally nitrogen, phosphorus, and carbon. During this process, which is called waste assimilation, the oxygen that is dissolved in the streamwater is consumed; as more waste is assimilated, more oxygen is drawn from the stream. If waste enters a stream in large quantities, the oxygen supply will be depleted in the decomposition process. As the level of dissolved oxygen falls below three to five parts per million (ppm), fish are adversely affected. If the oxygen level drops to zero, anaerobic digestion occurs, killing all edible and causing odorous gases to be emitted.

The oxygen available for waste assimilation at any point in a stream varies
with a number of factors, including temperature (colder water supports more oxygen), turbulence, depth, upstream conditions, bottom deposits, aquatic weeds, and the tide. The precise way in which these factors interact to influence the level of dissolved oxygen is not perfectly understood. As a result, competing models exist to describe the impact of waste discharges on the availability of dissolved oxygen downstream.

The responsibility for modeling the water quality of the Holston River in the Tennessee Eastman case fell to Douglas Lankford, a sanitation engineer employed by EPA with a recent masters degree in engineering from Vanderbilt University. Lankford used a waste load allocation model to specify discharge limits for the various firms along the Holston River. The basic assumption of such a model is that the stream can assimilate a certain waste load and still have an adequate supply of dissolved oxygen to maintain water quality. Given the biological oxygen demand (BOD) represented by a particular discharge, the model will describe the downstream effects on the oxygen deficit in the river, including the minimum oxygen concentration known as the oxygen sag. Later, during the months of negotiation, Lankford found himself defending his model from a vigorous attack by several of his former professors.

EPA began to assemble the information needed to run the model with three trips to the Tennessee Eastman plant in late 1972. Of particular interest were the magnitude and composition of Tennessee Eastman's waste discharges. In giving consent to EPA to do sampling at the plant, James Mitchell, executive vice president for manufacturing, indicated that Tennessee Eastman would collect and analyze duplicate samples to those taken by EPA. In so doing, Tennessee Eastman was sending a clear signal to EPA that it was prepared to challenge the technical underpinnings of any effluent limitations that it believed to be unacceptable.

EPA returned to the Holston River in January and February to gather more data on heavy metals, monitor stations, BOD generation, and previous pollution control measures. This information was used by the Region IV EPA staff to formulate the permit limitations. The results of these information-gathering and modeling efforts were published in a report entitled Waste Source Investigations—Kingsport, Tennessee. The report was distributed to Tennessee Eastman as well as state water quality officials. At the same time, EPA sent to the state (but not to Tennessee Eastman) a preliminary draft of the NPDES permits for the Kingsport area with a request for review and comment.

Negotiations Begin

When a copy of the previously mentioned report was received by Jim Edwards, manager of the Clean Environment Program at Tennessee Eastman,
The response quickly with a letter to EPA. The text of the letter set the tone for many of Tennessee Eastman's subsequent communications and emphasized the complex nature of determining effluent limitations; it urged that Eastman be given opportunities to discuss the permitting process, particularly before EPA went to public notice with the permit conditions. Tennessee Eastman was insistent in the manner that it should resolve their differences through discussions before bringing the matter before the public.

In July, 1973, EPA sent to Tennessee Eastman a NPDES Fact Sheet and Public Notice that outlined most of the permit details. Edwards responded by phone and by mail, and by telephone with the District Engineer, suggesting again that a meeting should be arranged to discuss the proposed effluent limitations that "present a serious and urgent situation for us and the communities of southeast Tennessee." He went on to say that the proposed limitations would require a major reduction of Tennessee Eastman Company's employment and production. We know of no waste-water treatment system that is technically and economically feasible which will reduce the waste-water wastes to levels compatible with the proposed effluent limitations. Therefore, we request a meeting with you and your staff to determine procedures and schedules for developing and presenting factual data and meaningful information concerning the proposed effluent limitations. It is essential to complete this discussion prior to public notice.

The insistence upon staff-level discussions, out of the public eye, reflected a desire by the company to resolve differences on scientific or technical grounds. Although the effluent limitations certainly raised issues of social choice—for example, whether it was reasonable to provide such a high degree of protection for waters that were inaccessible to the public—most of the subsequent discussions centered on the technical feasibility of the model, the effects of nutrient discharges on weed growth and dissolved oxygen variation, and the reliability of a particular treatment technology for removing nitrogen from wastes.

There are a number of reasons why Tennessee Eastman may have decided to restrict its challenges to technical issues. Budding trial lawyers are taught that the first line of defense in any case is the facts. If the facts are not with you, then argue the law. And, the defense lawyers argue policy. By trying to shape the debate in technical terms, Tennessee Eastman was adhering to this old adage. Although the company was prepared to argue that it was uneconomic to protect a river that was inaccessible to the public (one Tennessee Eastman report contained a map showing how far downstream the riversheds are either on industry-owned property or are restricted for military security reasons), the law clearly provided for the protection of inaccessible rivers. Moreover, conducting the debate on technical grounds favored Tennessee Eastman because of its vast technical resources and its access to experts in the field.

As requested by Edwards, a staff meeting was held in Atlanta between Tennessee Eastman and EPA at which the company argued that the proposed effluent limitations were intolerable and unjustifiably strict. During this meeting, Tennessee Eastman agreed to submit a counterproposal to EPA that would address the subject of long-term effluent limitations from the company's perspective. Tennessee Eastman prepared this report in house and submitted it to EPA in the fall of 1973. The report, entitled Water-Borne Effluent Limits, quited predictably proposed effluent limitations that were substantially higher than those contemplated either by EPA or the Tennessee Water Quality Control Board (TWQCB). Tennessee Eastman was required to obtain permits from both EPA and the TWQCB. Although the EPA kept the state informed of its activities, the two permitting processes proceeded separately, not understanding Tennessee Eastman's efforts to telescope them into one single regulatory process.

Table I compares the initial bargaining positions of the three principals. The table is revealing in at least three respects. First, for instance in which both proposed limitations, the state and EPA were in close agreement (twist the exception of nitrates and nitrates). Second, the difference in the substances to be regulated and the way in which they were to be measured indicate the lack of coordination between the state and EPA. Finally, the major disagreements between EPA and the company centered on limits for BOD, the nutrients nitrogen and phosphorus, and on pounds per day of total suspended solids. There was substantial agreement on the other limitations.

Tennessee Eastman also hired two consultants, Peter Kronick and Vladimir Novotny, who prepared a report entitled The Assimilative Capacity of the South Fork Holston River and Holston River below Kingsport, Tennessee. The report critically reviewed EPA's modeling efforts and pointed out a number of potential weaknesses in the EPA analysis: an alleged exaggeration of the depth of the river, a failure to verify the results of the model against observed values of the river water quality parameters; and a possible miscalculation of the reaction coefficient—the rate at which oxygen is reintroduced into the stream from the atmosphere. The report also pointed out that the EPA model did not account for the effect of aquatic weed growth on dissolved oxygen levels. In respiration, aquatic plants at times consume oxygen and at other times release oxygen into the water, causing diurnal variations in dissolved oxygen (DO) levels. Lankford did not try to model this variation, in part because the EPA was imposing very strict standards for nutrient discharges—primarily nitrates and phosphates—from the assumption that reduced nutrient discharges from Tennessee Eastman would significantly reduce the magnitude of the nuisance weed problem and visually eliminate the diurnal variation in DO. This assumption became
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#### Data Negotiations

Source of heated debate in subsequent negotiations. Not surprisingly, if the consultants' assumptions were substituted for Lankford's, the model suggested that the river had much higher assimilative capacity than originally calculated by EPA.

At this point in the process, it appeared that the battle lines were drawn. In a letter to EPA's Howard Zelby, Tennessee Eastman's vice president for manufacturing, James Mitchell, indicated that the company stood behind its consultants' analysis of effluent limitations:

It is not our intention to propose limits with the anticipation of negotiating them. This is not to say that we have closed minds on the subject; however, we have determined the basis that we can do and what is necessary to protect the river, and we are prepared to support our proposals. . . . The Tennessee Eastman river protection program will require a great effort on our part and will involve very substantial costs. It will also accomplish our mutual objective of providing proper protection for the river.

In response, EPA gathered more information, sent the Tennessee Eastman consultant's report around for critical review, and reassessed its own model in light of Kierck and Norcross's criticism.

Five months later, on February 1, 1974, EPA made its second attempt to proceed with Public Notice for the Tennessee Eastman permit. Upon receipt of a draft of the proposed permit and a tentative Public Notice date February 25, Tennessee Eastman Vice President Edwards again appealed to EPA, stressing that Tennessee Eastman still had serious problems with the terms of the proposed permit and again asking for more technical discussions prior to Public Notice. Edwards succeeded. EPA postponed the Public Notice until after a technical meeting could be held between experts for both sides. The meeting was scheduled for early March in Atlanta, the site of EPA's regional office.

**The Atlanta Meeting: The Experts' Forum**

The March technical meeting was a major event in the negotiating process. Tennessee Eastman assembled an army of consultants including Peter Kierck (Vanderbilt University), W. A. Drey (University of Tennessee), Wesley Eckenfelder, Jr. (Vanderbilt University), Carl Adam, Jr. (President, Associated Water and Air Resources Engineers), and Ruth Patrick (Chairman, Academy of Natural Sciences). Tennessee Eastman also brought along an equal number of company scientists and engineers as well as a staff member who kept a record of the proceedings. EPA was represented by its own battery of experts, including four scientists from its National Field Investigations Center (NFIC) in Oklahoma, three staff members from the regional office (including Doug Lankford, author of the EPA model), and several other EPA and state of Tennessee officials. Representa-
removing nitrogen from chemical wastes. If the nitrogen is in the form of ammonia, a chemical process called ammonia stripping is used. The ammonia is literally blown out of the waste stream. EPA had proposed a biological treatment, nitrification/denitrification, for the Tennessee Eastman Company. This treatment involves an activated sludge system in which any ammonia must first be combined with oxygen to form nitrates. Then, during denitrification, the treatment removes the nitrogen from the waste stream by converting it to nitrogen gas. These biological processes work better in warm temperatures—in Lankford's words, "in the winter the bugs get sluggish"—thus necessitating different winters and summer standards as with BOD.

Tennessee Eastman's consultants doubted whether these processes would be effective in TEC's waste streams because the organisms that achieve the necessary reactions are sensitive not only to temperature but also to the presence of inhibiting chemicals. The company was reluctant to invest in a treatment system that eventually might prove ineffective. EPA's solution was to set the nutrient limitations contingent on completion of a pilot plant that would demonstrate the feasibility of the treatment technology.

The Atlanta technical meeting ended with a glimmer of a possible voluntary resolution. EPA had indicated a willingness to yield on two major points: the importance of different winter–summer limits and the decision to make the nitrogen restrictions contingent on the effectiveness of a pilot plant. Although neither party made any other concessions during the meeting, the limits that were proposed on certain efficient categories had changed somewhat from those proposed earlier. For example, both sides had backed away from earlier positions on BOD to the point where they now stood only 2.884 lb per day apart ( Earlier they had been 7,770 lb apart.) With the possibility of different seasonal limits, a resolution to the BOD dispute was within reach. The dispute over nitrogen and phosphorus limitations persisted, but the prospect of contingent limits provided some potential for compromise. Although Tennessee Eastman did not move from its initial position on total suspended solids (6,000 lb) EPA had narrowed the gap by increasing its proposed limit from 2,370 to 4,500 lb. These gains, however, did not come easily. The struggle had been uphill and had left the participants strained and tired. Arguments had been heated at times, often over minute details. In his closing remarks, Paul Traize of EPA acknowledged that some items remained in dispute, particularly the issue of nutrient limitations, and that at the very least the parties could "agree to disagree."
###Table 2: Four Reasons for Discharges in the Holston River

<table>
<thead>
<tr>
<th>Source</th>
<th>EPA rule period</th>
<th>TSC rule period</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRP, mg/L</td>
<td>6,000</td>
<td>8,000</td>
</tr>
<tr>
<td>Total chlorinated</td>
<td>60,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Potassium, mg/L</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Sodium, mg/L</td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td>Total solids, mg/L</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>Total dissolved solids, mg/L</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Chlorides, mg/L</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Copper, mg/L</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Lead, mg/L</td>
<td>0.05</td>
<td>0.05</td>
</tr>
</tbody>
</table>

###Data Negotiation

Issues even though they recognized that these issues were often proxies for larger social justice questions. Why did the parties seek to define the dispute in purely technical terms? Why were they reluctant to discuss the real underlying question: How much should Tennessee Eastman be required to spend to clean up the Holston River? What were the consequences of restricting the agenda in this manner? In retrospect, would EPA have been better off with a broader debate?

2. Both sides claimed that what kept them at the bargaining table was a desire to resolve their differences before going public with the permit. What was so bad about conducting this debate in the public eye? Why was the threat of judicial intervention so onerous?

3. Analyze the strengths and weaknesses of the parties as they appeared at the outset of the negotiations. Was there a clear-cut winner in this dispute? Would the outcome have been different if EPA had been represented by Tennessee Eastman's experts and vice versa? Was the cost of management symmetrical? Were the differences between the parties ultimately resolved partly on the basis of technical considerations or did other factors influence the outcome?

4. Parties to negotiations often try to influence the willingness of their opposition to compromise by flaunting their own intransigence. Tennessee Eastman tacitly did this when it collected duplicate water samples to those taken by EPA, thus giving notice that it was prepared to challenge any analysis based on those samples. Contrast this rather clear signal with the company's later statement to EPA "that it is not our intention to propose limits with the anticipation of negotiating them." If you were the EPA official who received this letter, how would you have interpreted this statement?

5. Recall Thomas Schelling's discussion of commitment as a means of building bargaining power from chapter 2. We have a good example of this tactic to this case. When EPA notified Tennessee Eastman on April 11, 1977, that it had given public notice on the NPDES permit, it was, in effect, committing itself publicly to its last bargaining position. What risks were involved in this move? Did Tennessee Eastman misread the situation? What signals did this action provide to Tennessee Eastman? Did it provide any signals to anyone else? Would EPA have been better or worse if it had threatened Tennessee Eastman with public notice before actually going public?

6. Tennessee Eastman was not the only discharger located on the Holston River; it was just the largest. Would EPA have been better off trying to negotiate all of the NPDES permits for the river simultaneously? Should it have tried to negotiate with the smaller dischargers first?

###Judicial Review of Technical Decisions

In the Holston River case, the parties were clearly reluctant to have a court decide the complex issues involved in modeling the assimilative capacity of the
permits to attend in the Southeast, and staff time was limited. For whatever reason, the EPA chose to place a card that had previously been held by the EPA on April 11, 1974. George Harlow sent Mitchell a copy of the latest draft of the NPDES permit, and with it, notification that EPA had gone to public notice on the permit.

This letter marked the third cycle of proposed permit discussion. Tennessee Eastman responded in much the same manner as it had previously (by indicating serious concern with certain aspects of the permit) and by registering dismay that EPA had gone to public notice while differences still remained. On May 7, 1974, Tennessee Eastman sent a letter accompanied by a 74-page document entitled Comments by Tennessee Eastman Company. The tone of the letter was severe and threatening. It covered the major areas of disagreement and closed with the following statement:

The Tennessee Eastman Company position is environmentally, technically, and legally correct. Any more stringent limitations are not in accordance with the law, are not necessary to protect the environment, will waste valuable natural resources, and will cause severe economic and social consequences in the region. The Company has been advised by the foremost authorities in the field of water quality management and wastewater treatment technology. They have stated that the proposals by Tennessee Eastman Company represent application of the best available technology economically achievable and are appropriate for protecting the South Fork Holston River and Holston River for fish and aquatic life as well as for industrial water supply. Eastman is prepared to defend, to the extent necessary, the limits which the Company and recognized authorities have determined to be appropriate.

The letter concluded with a suggestion that EPA and the company resolve their differences before the public hearing. Traina sent copies of the letter to EPA staff present at the Atlanta technical meeting and directed them to prepare the EPA's case for the May 29 hearing. Traina's memo to the staff stated that "this is a major discharger which we should be fully prepared to respond to and carry our case forward."

**The Public Hearing and the Final Permit**

An NPDES permit is a complex document that specifies all the limitations required of a plant and establishes a schedule for reaching them. It also includes information on requirements for monitoring and sampling. The real heart of the Tennessee Eastman permit, however, was embodied in the limitations that the company had to achieve by July 1, 1977. Tennessee Eastman included in its comments a copy of the draft NPDES permit that was marked up to correspond to the permit that the company considered to be acceptable. The more than 70
To get a feel for what both sides feared, read the following excerpt from South Terminal Corporation v. EPA in which the court succeeded in getting the two sides to agree.

South Terminal Corporation v. EPA
504 F.2d 646 (1st Cir. 1974)

Under the Clean Air Act, EPA is charged with promulgating ambient air quality standards for each pollutant having an adverse effect upon the public health or welfare. Each state, however, has responsibility for designing a program to see that the ambient standards are met. Typically these state implementation plans limit allowable pollution from stationary sources like factories, power plants, and incinerators as well as from mobile sources like cars, trucks, and buses. The Clean Air Act provides that if a state fails to supplement necessary measures to comply with the ambient air standards, EPA may impose an implementation plan on the state. When Massachusetts failed to adopt a transportation control plan to limit emissions from mobile sources, EPA stepped in to fill the gap. Through extensive modeling, EPA concluded that both Boston and the Merrimack Valley Region in Massachusetts would not be in compliance with ambient standards if emissions of hydrocarbons were to be reduced in metropolitan Boston by 58 percent, and carbon monoxide emissions by 40 percent. To achieve these reductions, EPA proposed that off-street and on-street parking spaces be fenced in or cut back, and the construction of new parking facilities regulated. It also proposed special bus and carpool lanes and a computer carpooling system. A vehicle maintenance and inspection program was also mandated. South Terminal Corporation was one of a number of plaintiffs that filed suit to overturn the EPA transportation control plan on the ground that the underlying technical analysis was deficient. The court’s discussion of the adequacy of the modelling as well as the legality of the transportation control plan follows [All footnotes and citations have been omitted.]

1. The Scope of Judicial Review
The questions about the plan on review are of two types: the rationality of EPA’s technical decisions [such as its determination of local photochemical oxidant and carbon monoxide levels and the amount of reductions required to meet national standards] and the rationality of EPA’s control strategy [that is, the measures adopted to reduce emissions]. The former present peculiar difficulties for reviewers to evaluate. Yet “our inquiry into the facts is to be searching and careful.” . . . and we must assume ourselves as well as we can that the Agency’s technical conclusions, so far as they are based upon data and methodology and meet minimal standards of rationality. Assuming EPA’s technical determinations are reasonably based, we must decide whether the selected controls are arbitrary or capricious. In doing so, we must bear in mind that Congress lodged with EPA, not the courts, the discretion to choose among alternative strategies. Using demonstrably capricious such as much less costly but equally effective alternatives were rejected or the requisite technology is unavailable, the Administrator’s choices may not be overturned.

III. Whether EPA Committed a Clear Error of Judgment in Computing the Need for Emission Reductions.

. . . (The plaintiff’s) arguments can be divided into attacks on EPA’s data and methodology as to (1) photochemical oxidants in the Metropolitan Boston Interstate Region; (2) carbon monoxide in the Boston core; (3) carbon monoxide at Logan Airport (East Boston).

1. EPA is said to have overestimated the photochemical oxidant problem in the Boston region. Most pertinent are petitioners’ arguments that the key ambient air quality reading taken on one day at a monitoring device located at Wellington Circle must have come from a defective instrument. This single reading, inserted by EPA in its so called rollback formula for “model 1,” was the basis for a region-wide estimate of the amount of hydrocarbon reduction required. If it was incorrect, so were the conclusions about how much reduction was necessary to achieve the primary standard. Petitioners point to a computer printout taken at that monitoring station showing a number of “9999” readings which may indicate instrument malfunction. EPA’s response is that the designations may also result from “instrument calibration, instrument erasing, transmission box, and depletion of ion gas, all of which causes are unrelated to any malfunction.” That petitioners contend that the irregular readings occurred too often to be attributable solely to innocent causes. On the present record, we cannot say with confidence that the use of a single reading from a monitoring site at which objective readings suggest a substantial possibility of malfunction is sufficient to support EPA’s photochemical oxidant determination.

We find less persuasive petitioners’ assertions that the rollback model itself because of its purported failure to take account of local topography and meteorology. EPA’s technical support document appears to consider these influences, and the only expert to stress Boston’s unique features did not include gasoline in his analysis. Petitioners further claim that EPA incorrectly related oxidant concentrations directly to emission of
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federal standards. After reviewing the conflicting evidence the court reached the following conclusion.

The method of sampling at Logan, Massport's own testing, and the lack of monitoring in East Boston, collectively, on the present record, prevent us from holding that the data are sufficient to support EPA's conclusion as to carbon monoxide in East Boston.

4. While we are unable at this time to uphold EPA's conclusions as to photochemical oxidant and carbon monoxide levels and reductions, we do not say that they are necessarily incorrect. Petitioners forcefully contended that the Agency's measurements are without reliable foundation, and hence, in effect, arbitrary and capricious. Thus, as we are in no position to know how much ultimate weight to give to these arguments, based as they are on technical assumptions. We can only say that the objections as to data and methodology were too serious to us to simply pass by; they demand investigation and answer. While reviewing courts are not to substitute their judgment for that of the agency, they are to establish parameters of rationality within which the decision must operate. A court would abdicate its function were it, when confronted with important and seemingly plausible objections, to go to the heart of a key technical determination, to presume that the agency could never behave irrationally. The objections are faced in a proper procedural setting and satisfactory answers provided demonstrating careful agency consideration. The court consequently remanded the case to EPA for an explanation of the agency's measurement procedures.

V. Whether Transportation Controls Are Arbitrary and Capricious

1. The "freeze" boils down to the requirement that no new parking spaces be created after October 15, 1973, in the more congested portions of Boston, Cambridge, and some other outlying areas. There are important exceptions: residential parking spaces adjacent to homes, apartments, condominiums, etc., employee parking outside the Boston core (as long as it complied with the separate employee parking restrictions), and free customer parking. Our rule, of course, is not to decide whether the freeze device is an ideal solution; Congress delegated to EPA the authority to select the preferred means. We cannot say that such a freeze is arbitrary and capricious. Assuming EPA is able to support by credible data its position as to the magnitude of the need for carbon monoxide emission reductions, in relevant segments of the region. Indeed, the enlargement of parking facilities in areas where the public health requires curtailment of the flow of traffic would seem irrational. The exemption for residents, customers and, in part of the area, employees, would seem a reasonable attempt to ameliorate the hardship upon individuals and businesses.

The court went on to uphold other aspects of EPA's plans that included a ban on on-street parking between the hours of 7 to 10 a.m. weekdays, a reduction in the availability of off-street parking, a 250% reduction in parking provided by employers, and a requirement that if parking was
to be expanded at Logan Airport by more than 10%, such increases must be offset by setting spaces elsewhere in the freeze zone. Finally, the plaintiffs contended that the entire transportation control plan was arbitrary because the EPA had paid too little attention to its economic and social impact. The court rejected this argument as well.

The material portions of the Clean Air Act itself do not mention economic or social impact, and it seems plain that Congress intended the Administrator to enforce compliance with air quality standards even if the costs were great. Particularly in the case of primary standards—those set as "necessary to protect public health"—Congress' intention is not extreme or unprecedented. Minimum public health requirements are often, perhaps usually, set without consideration of either economic impact. Thus, insofar as petitions claim that either EPA or others would be empowered to reject measures necessary to ensure compliance with primary air quality standards simply because after weighing the advantages of sale air against the economic detriment, we thought the latter consideration took priority, petitions would be incorrect. Congress has already made a judgment the other way, and EPA and the courts are bound.

Courts and Technical Issues

As so often happens in lawsuits, the decision in the South Terminal case did not please either side. The court reprimanded EPA for what it viewed as shoddy technical analysis. EPA's numbers were called into question, and consequently, so was EPA's authority to regulate emissions of hydrocarbons. (If the reading taken at Wellington Circle proved inaccurate and Boston was in compliance with ambient standards for photochemical oxidants, EPA would lack authority to act.) On the other hand, the court rejected the petitioners' arguments that the severe measures ordered by EPA were either unnecessary, excessively costly, or otherwise illegal. To the contrary, the court ruled that EPA had broad discretion to fashion the appropriate response. In many ways, the court's decision was predictable. As we have noted before, the judges are reluctant to second-guess decisions of federal agencies.

As the South Terminal case suggests, courts are often uncomfortable rendering decisions in cases that turn on highly technical or scientific issues. Judges are fast and foremost generalists. They hear an extraordinary range of cases dealing with issues as diverse as Indian land claims, antitrust matters, products liability actions, and civil rights complaints. On succeeding days, a federal judge may be forced to serve as an amateur historian, economist, sociologist, psychologist, or scientist. Except for those judges who sit in Washington, D.C., where a large number of regulatory cases are filed, most judges will hear only a handful of complex environmental cases in their careers on the bench. Thus, the challenge for an attorney arguing such a case is to teach the judge enough science so that he can understand the merits of the attorney's argument. Because the attorney is himself or herself usually a layman, this is a very difficult task.

Unfortunately, judges have relatively little opportunity to consult with experts in the field. Our adversary system leaves it to the litigants to call expert witnesses; they, in turn, inevitably offer testimony favorable to the side that has expert witness to be summoned, this procedure frequently does nothing more than reinforce the judge's initial conclusion. Moreover, some cases like South Terminal are appealed directly from an agency to the Court of Appeals. Because appeals courts must base their decisions entirely on the written record developed during the course of the regulatory process (and the oral argument of counsel), appellate judges do not hear any expert testimony firsthand. Consequently, judges who would like to consult privately with experts often finds themselves thwarted by the canons of judicial ethics that greatly limit such discussions.

The one resource to which judges have ready access is their clerks. Federal District, Circuit, and Supreme Court judges each employ from two to five clerks to assist in legal research and drafting of opinions and orders; typically, these clerks have high-ranking recent graduates of prestigious law schools. Often judges take a liberal view of what constitutes legal research. (For example, when the Brown v. Board of Education case was decided, a group of clerks was charged with the task of mapping out every house in schools could be integrated. Similarly, in environmental cases, the task of masterfully the vast technical record often falls to the clerks. If a judge knows in advance that he will be hearing a lengthy and complex case, he may seek a clerk with special expertise, but this is a rare luxury. Clerks, like judges, tend to be generalists.

Largely because the courts lack the capacity to make substantive policy decisions, the law of judicial review limits the circumstances under which a reviewing court may overturn a decision of the executive branch. Administrative law is distinctive from questions of substantive and questions of procedure or law. Agencies have a comparative advantage in deciding the law and procedures courts are better equipped to decide the latter. Accordingly, the matters and only permits judicial reversal of an agency decision if the court finds a procedural requirement (e.g., the agency failed to hold a statutorily required hearing prior to rendering a decision); (3) violated a statutory duty (e.g., the agency ignored its obligation to consider alternatives that might be less harmful to the environment); (4) acted in an unconstitutional manner; or (5) abused its
discretion or otherwise acted arbitrarily or capriciously. The latter requirement empowers courts to reverse only for gross errors of judgment and is rarely invoked.

Discrimination between substance and procedure and questions of law and questions of fact are more easily stated than they are made in practice. For example, in the South Terminal case, the question of whether EPA acted properly in imposing a transportation control plan on Boston was nominally a question of law; the agency had legal power to do so only if Boston was in compliance with ambient air standards. But to make such a determination, the court was forced to review EPA's testing procedures, a highly technical inquiry that the court was clearly uncomfortable in performing. Similarly, many regulatory statutes are written in such a way that they thrust reviewing courts into the position of second-guessing the substantive decisions of agencies.

This is a situation that, like the weather, everyone complains about, but no one seems capable of rectifying. Two general types of reforms are commonly suggested: better precision in drafting of statutes by Congress and the creation of courts with special substantive expertise. The first reform clearly stands little chance of success. In theory, if Congress was capable of being more precise in giving guidance to regulatory agencies, the courts would have less of a substantive nature to review. For example, had Congress been more precise in specifying the procedures to be followed in determining whether a municipality was in compliance with the Clean Air Act, the court in South Terminal would not have had to wade through a mass of technical material to decide the case. But, in practice, Congress appears incapable of greater precision for at least two reasons. First, the legislature frequently settles in the hands of executive agencies like EPA precisely because they possess the expertise that Congress lacks. Just as judges throw up their hands in frustration in trying to determine the proper procedures for assessing air quality, so do senators and congressmen.

Second, Congress, for political reasons, is often not interested in being more precise. Acts of Congress represent the result of a political bargaining process that relies upon in gaining agreement. In this process, ambiguity and indecision--oftentimes, for example, the courts have difficulty in determining its impact. We began this chapter by noting that most environmental disputes involve disagreements over how ecosystems are likely to respond to various types of human activities. If policymakers possessed a clear idea of the results, the range of disagreement in environmental controversies would be narrowed substantially. Instead of arguing over the impact of the proposed changes on the Holston River, we would simply debate whether the costs of achieving a given reduction in discharge were justified by the resulting benefits. Although this would still not be a trivial dispute to resolve, at least the parties would be arguing from the same basic set of facts.

In an article entitled "The Technical and Judgmental Dimensions of Impact Assessment," 1 Env. Impact Assess. Rev. 109, 115–120 (1980), Lawrence Bacow has suggested that policymakers typically overestimate the degree to which science can supply unambiguous answers to complicated environmental questions. Although we would like to believe that science is dispassionate and value free, Bacow has argued that, in fact, the process of modeling is often very subjective. Although the article is concerned with the role of substantive analysis in impact assessment, it also sheds light on how technical analyses often mask
important judgments in other types of environmental decisions. As you read the following excerpt, consider these questions:

1. If Bacon's thesis is correct, what are the implications for environmental dispute resolution?
2. What is the appropriate role for experts in the dispute resolution process?
3. Should everything be negotiated, including science?

Conceptually, making predictions about the future consequence of a proposed action involves three distinct activities. First, the analyst must decide where to focus his attention. Since analytic resources are always in short supply, choices have to be made about which impacts will be documented in depth, which will be analyzed only briefly, and which will be ignored entirely. Second, a prediction must be made of how the ecosystem or social system under study will evolve over time in the absence of the proposed project. Finally, an estimate must be made of how the proposed action will cause these systems to depart from their normal ecological patterns. The difficulties encountered in specifying the impacts to be studied can best be illustrated by telling a story. For many years, the Massachusetts Department of Public Works has conducted widening Route 2, a major artery linking Boston with its affluent northwest suburbs. Widening the highway from two to four lanes would affect the natural environment in a lot of different ways. Land would be consumed. Some flora and fauna would be lost. Noise levels would increase during the construction period. Increased traffic would generate more noise and more air pollution along the route. The highway would also have a number of less obvious effects. Increasing access to the suburbs would probably increase development on the current suburban fringe, thus affecting employment patterns among suburban construction workers. If the new development did have occurred elsewhere but for the widening of Route 2, then widening of the highway would have affected employment patterns in other parts of the Boston metropolitan region as well. Similarly, since Route 2 is an integral link in an independent transportation system, increasing its traffic capacity will also affect traffic density (and air pollution and noise pollution) in other parts of the transportation network. It is possible to keep working back through this maze of probable impacts almost indefinitely. It is like pulling on a loose thread of a knitted fabric; it just keeps unraveling. Although it is easier to illustrate interdependencies for impacts that affect social systems like transportation networks, ecologists are quick to point out that ecological systems are perhaps even more interdependent.

Given the multitude of possibilities, which impacts should the author of an environmental impact statement address? It is tempting to say all of them. But the resources available to assess impacts are not limitless. Moreover, even if it were possible to produce a truly comprehensive EIS, its sheer size would ensure that it would never be read. Thus we must somehow define the boundaries of analysis for assessing impacts. If we are only going to

to assess a limited number of impacts, then the rational strategy would be to concentrate our efforts on "the most important impacts." [Bacon argues that each constituency affected by a project is likely to have a different opinion of which impacts are the most important. If the modeling effort relies upon the models to scope the impacts, important value judgments will be masked, and the model is likely to be criticized for being biased or uninformed.] Even if we are unanimous in our view of what is important, it still may not be obvious how to evaluate these impacts. Suppose in the Route 2 example, people are concerned about air quality and noise. Although we may be able to say that these conditions have changed as a consequence of the highway widening, it is often very difficult to state unambiguously whether they have gotten better or worse. For many environmental conditions, there is no single accepted index for evaluating the state of the condition. Consider the problem of assessing air quality. We care about air quality because air pollution affects human health, aesthetics, plant and animal life, and the durability of materials exposed to air. A given change in air quality will affect each of these conditions to a different degree. It is not possible to construct a single index for air quality unless we are first willing to weigh each of its components—a process that necessarily depends upon the preferences of the person constructing the index. Even if we cared only about one aspect of air quality—its effect on human health—it still would be difficult to construct a single objective index because of the complex way individual pollutants interact to produce air pollution. For example, the relationship between the airborne concentration of a pollutant and human health may be nonlinear. Similarly, two pollutants may interact synergistically. In some cases, controlling one source of pollution, such as carbon monoxide from internal combustion engines, may actually increase the level of another pollutant, specifically, nitrogen oxide. Assessing the environmental impacts of noise is even a more difficult task than evaluating air quality. Technically, noise is measured as the ratio of energy transmitted across a unit surface to the minimum energy that can be perceived in the air. What is bothersome about noise, however, is not just the amount of energy transmitted. The annoyance value of noise is determined not only by amplitude but by pitch, frequency of occurrence, the information content of the noise, background sounds, and the dispersion capacity of the physical environment. For example, it may be far more difficult to sleep if a truck roars by every 20 minutes than if there is a steady, uninterrupted stream of trucks. Similarly, although almost inaudible, a small scratch on an otherwise perfect recording of a Beethoven concerto is likely to be extremely annoying even to someone who is not an aficionado of classical music. The point to be made is that even the simple task of measuring change in the environment forces the analyst to make judgments about the relative importance of the different components of the change. Moreover, these are not trivial decisions; different indices can lead to different conclusions.
of the environment without making some assumptions about the future impact of regulation and technological change. For example, future air quality in urban areas will be determined, in large part, by the success (or failure) of federal efforts to produce a nonpolluting car. Thus, our ability to predict the evolution of the atmospheric environment is directly related to our ability to predict the success of regulation or the rate of change in technological innovation.

Because our predictions of what the world would look like without any additional government intervention are so uncertain, it is difficult to isolate changes that are attributable solely to new projects. Furthermore, our capacity to make confident predictions about impacts varies in a rather perverse way with the contentiousness of the issue. While we can state quite conclusively that the U.S. Air Force's new long-range radar station on Cape Cod will destroy 10 acres of flora, we have little knowledge of the long-term effects of prolonged exposure to low-level ionizing radiation—and that is what everyone on the Cape is upset about.

In practice, it is unreasonable to expect impact statements to be anything more than speculative documents. We rarely have the time available to do the research necessary to answer the questions that lie at the root of the controversy over development proposals. Instead, we are forced to culled the available evidence to draw conclusions. More frequently than not, however, the available evidence is ambiguous; it can support a host of different conclusions. In some cases, we simply do not understand causal relationships well enough to draw inferences about stimuli and response. In other cases, the consequences of interventions are subtle and difficult to document. And, in still other cases, synthetic interactions make it hard to determine why something has changed. The lack of references people are willing to draw from such ambiguous evidence varies with both their professional training and their personal stake in the outcome. Scientists tend to be a very conservative lot—they are reluctant to conclude, for example, that an observed increase in the cancer rate is attributable to exposure to a particular chemical unless they are at least 95 percent certain that the increase is not attributable to chance. In contrast, people at risk are in no more willing to conclude that a hazardous condition exists on the basis of information that the scientist would deem inconclusive. Thus, it should not be surprising that the process of collecting information about impacts is divisive: the information collected is grist for the mill of both sides. Instead of looking for opportunities to resolve differences between competing interests, we have created a system that amplifies existing differences. Moreover, we have done so because we have underestimated the degree to which impact assessment is a subjective, judgmental, meta-technical activity.