A Review of the Economic Impact of

Environmental Statutes, Rules and Regulations

On New Jersey Industry

A Report to the New Jersey Legislature

March, 1994

NJIT
New Jersey Institute of Technology

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March 28, 1994

Comments by
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President
New Jersey Institute of Technology

Thank you Senator Littell, President DiFrancesco, and Speaker Haytaian ...

I come today to brief you on an important dialogue on the environment and the economy which began almost two years ago with a question to me from Senator Littell and a subsequent question from Senator Littell to former Commissioner of DEPE, Scott Weiner. That dialogue resulted in this study which has involved well over 100 people including: citizens, legislative staff, DEPE, industry, and academe.

A spirit of cooperation marked the entire process. This has been an action-oriented study, as evidenced by the Department of Environmental Protection and Energy's prompt and positive response to recommendations and suggestions from NJIT and other participants during this first phase of the study.

The team found many instances where DEPE improved operations because of concern about the impact of environmental regulations on businesses -- most notably the establishment of the ombudsman for the plastics industry. Not withstanding those improvements, the report we present today calls for the Department and the Legislature to make an even greater effort to reach a balance between environmental protection and needed economic development.

A theme emerged during discussions which can be summed up simply as:

New Jersey cannot afford to adopt a simplistic approach to governance or economic development that views the state's economic and environmental challenge as an either/or situation. Industrial health and growth can coexist with effective environmental regulation.

This report identifies 24 critical issues that impact on all of New Jersey's businesses and industries. These issues affect the ability of both small and large companies to do business in New Jersey. However, the economic impact of environmental regulations is more severe on small businesses than on large businesses. Many of these issues also impact on county and municipal government, school districts and universities. The 24 critical crosscut issues fall into the following nine categories:

1. Excessive fees and fines
2. Overly adversarial relationship to business and industry
3. High compliance costs
4. Burdensome paperwork
5. Overlapping and redundant regulations
6. Unnecessary state-of-the-art technology requirements
7. Obstacles to research and development activities
8. Right-to-Know labeling and reporting requirements
9. Compliance assistance for small businesses and manufacturers

Some of the 24 issues are rather simple and the state can address them quickly at little cost. A number of reporting and paperwork problems fall into this category.

Other issues are complex, such as the need for DEPE to adopt a stronger customer focus, and will require a concentrated effort to change. Some issues, such as fees and fines, will require legislative changes.

The study team believes that a partnership including state government, business, industry, academia and citizens can resolve the identified crosscut issues in a manner that protects both the environment and the state's economy.

Towards that end, this report makes 46 recommendations.

Implementation of those recommendations should help to build trust among industry, the public and environmental regulators. The goal should be to achieve an appropriate balance between:

- assisting businesses, the public, governmental agencies, schools, colleges

and universities to meet compliance standards; and
- aggressive enforcement to catch and penalize offenders.

A number of other states serve as models for New Jersey. These states provide both a warm welcome and technical assistance in a wide array of areas, including environmental compliance, for industries seeking to develop new facilities or expand existing operations. New Jersey has no alternative but to do the same or risk the continued loss of manufacturing industries.

State government must move from a distrustful culture that views all businesses as potential violators to a client-oriented culture committed to educating and assisting all citizens and businesses to avoid dangerous health, environmental and safety risks.

The initial efforts by state regulators should be to assist citizens and businesses to comply with environmental laws, rules and regulations, rather than designing rigid processes to identify and punish violators.

The NJIT study team found that the complex collection of environmental laws, rules and regulations is, in part, the product of the public demanding legislative and executive action in response to contamination or pollution incidents.

Environmental standards should not be:
- mere reflections of "how low" a level can be measured; and
- not just a response to a public perception factor based upon a contamination or pollution incident.

Rather, environmental regulations should be based on unbiased observations, analyses and measurements of the potential risk for harm to health, safety or environmental integrity presented by an activity, process or substance.

Public Perception of Risk

The determination of risk posed by contaminants in the environment is fraught with problems due to:
- imperfect knowledge
- the limits of science
- perception of the public

Public perception of the risks posed by the environment become important to an understanding of the allocation of human and financial resources to solve problems.

Assignment of risk is a technical and scientific issue; the acceptability of the risk is often a political one and often legislative initiatives are the result of public perception of a risk.

A 1987 study by the USEPA revealed that the agency's program priorities were more reflective of the public's perception of risk than with the scientific community's assessment.

A review of New Jersey's environmental statutes and regulations indicates that New Jersey follows that national pattern.

The public often looks to laws and regulations for both technical and administrative guidance in translating environmental quality goals into practice.

There are other management strategies and technologies -- that may incorporate legal action, but do not rely solely on a regulatory control structure.

Cases in this report highlight the strengths of different management strategies -- and point to the effectiveness of environmental practice that embraces government-industry-citizen-university partnerships (e.g. recycling, HMDC).

Comparison of federal and state regulations:

This report shows that New Jersey has more inclusive or stricter regulations than those adopted at the federal level and most other states.

NJIT's study team identified over 30 pieces of important environmental legislation. This set of legislative initiatives creates a complex regulatory network that often supersedes and supplements federal statutes and regulations.

A New Approach For New Jersey

This report recommends a new approach for New Jersey, an approach that:
- begins with open and unbiased dialogue about risk;
- incorporates education on risk as an essential component of the environmental protection infrastructure;
- assists citizens, governmental agencies and businesses to comply with environmental laws, rules and regulations; and
- enforces law and sets penalties for violators that relate to the seriousness of the violation.

The state's goal should not be a massive and immediate change in environmental regulations. Rather, this report supports a thoughtful and steady movement to balance the need for economic progress with the need to maintain a safe and healthy environment for New Jersey's residents, workers, and tourists.♦

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Study Team

Dr. Peter B. Lederman, Director of NJIT's Center for Environmental Engineering and Science, served as Chair of the study team. Patrick R. Brannigan, NJIT's Executive Director of State and Federal Relations, edited the report. Other members of the study team included:

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Executive Summary of the Review of the Economic Impact of Environmental Regulations On New Jersey Industry

This report presents an analysis of the economic impact of state environmental regulations on industry in New Jersey. NJIT conducted the study at the request of Senator Robert E. Littell, Chair of the Budget and Appropriations Committee. During the Fiscal Year 1993 budget hearings, Senator Littell initiated a dialogue on two important issues facing New Jersey -- the economy and the environment. Senator Littell established a primary focus for the study as "an evaluation of all existing environmental statutes and implementing rules and regulations including the fee structure; with the goal of reducing their complexity and eliminating any contradictions or redundancies." Consistent with that focus, the study team assessed the cost, technical and administrative, incurred by industry in complying with environmental rules and regulations. The team attempted to separate fact from rhetoric and to transcend the *a priori* categories and dichotomies that have generally framed discussions of the economy and the environment.

The study has been a collaborative process involving NJIT, environmental advocates, the New Jersey Department of Environmental Protection and Energy, and numerous businesses and industries. The study focused on the chemical, electronic, pharmaceutical, plastics, and textile processing industries, all of which are critically important to New Jersey's economy. Valuable assistance was provided by: Mercer County Community College, Passaic County Community College, Stockton State College, the Partnership for New Jersey, Public Service Electric and Gas Company, the New Jersey State Chamber of Commerce and many businesses throughout the state.

This has been an action-oriented study. A spirit of cooperation marked the entire process, as evidenced by the Department of Environmental Protection and Energy's prompt and positive response to recommendations and suggestions from NJIT and other participants during this first phase of the study. Participants in the study acknowledged DEPE's initiatives but also called on the Department and the Legislature to do more to improve responsiveness to all clients. A theme emerged during discussions which can be summed up simply as: *New Jersey cannot afford to adopt a simplistic approach to governance or economic development that views the state's economic and environmental challenge as an either or situation.* All parties in this study agreed that industrial health and growth can coexist with effective environmental regulation.

The cases presented in the quality of life section of this study demonstrate substantive improvements to the physical and social environment in New Jersey. Of equal importance to the observable changes taking place is the method employed to achieve these improvements. Management and technological alternatives are numerous. Choosing the correct alternative for the problem at hand is crucial to achieving successful outcomes.

Consequently, this report does not contest that environmental regulation has improved the environment in New Jersey. In fact, the business and industry participants in this study did not take issue with the intent or goals of all environmental legislation and regulations (i.e. the need to preserve New Jersey's environment and protect the health and safety of the state's residents, workers and tourists). Rather, they raised objections to laws, rules and regulations that required major expenditures by industry to produce marginal benefits. Industry participants also identified serious problems caused by arduous and confusing compliance procedures and the attitude of some DEPE staff. In many cases, the most serious burdens on business were identified as DEPE's prescribed requirements for "how to" achieve the legislative intent rather than the specific compliance standards.

This report identifies 24 critical issues that impact on all of New Jersey's businesses and industries. These issues affect the ability of both small and large companies to do business in New Jersey. However, the economic impact of environmental regulations is more severe on small businesses than on large businesses. Many of these issues also impact on county and municipal government, school districts and universities. The 24 critical crosscut issues fall into the following nine categories:

1. Excessive fees and fines
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9. Compliance assistance for small businesses and manufacturers

Some of the 24 issues are rather simple and the state can address them quickly at little cost. A number of reporting and paperwork problems fall into this category. Other issues are complex, such as DEPE staff attitude problems, and will require a concentrated effort to change. Some issues, such as fees and fines, will require legislative changes. The study team believes that a partnership including state government, business, industry, academia and citizens can resolve the identified crosscut issues in a manner that protects both the environment and the state's economy. Towards that end, this report makes 46 recommendations.

Phase Two of the study will be a collaborative effort involving NJIT, DEPE, the Law Review Commission, industry and legislative staff to achieve a rational, consistent and cohesive statutory and regulatory framework for New Jersey's environmental protection efforts. Phase Two will include a review of the statutes to identify duplication, obsolescence or other circumstances that might warrant repeal or amendment of current statutes and regulations. Phase Two of this project will provide an effective forum to continue the dialogue and implement changes initiated by this project.

Crosscut Issues and Recommendations

The following is a set of crosscut issues and recommendations. Some issues have more than one related recommendation.

Issue: Excessive Fees and Fines

I-1. DEPE fees are excessive and often unrelated to the tasks the Department performs in reviewing permits or monitoring industrial performance. Permit maintenance fees are considerably higher in New Jersey than in other states. For example, a NJPDES annual permit fee for a major facility in New Jersey can cost as much as $750,000. In a neighboring state, a plant that has about 90% of the discharge volume at the same point as the New Jersey plant across the river pays a net annual permit maintenance fee of $11,200. Similar differences can be found in air permits and hazardous and solid wastes permits.

I-2. Fines are high and often unrelated to the seriousness of violations or damage to the environment. There is a widespread perception that DEPE raises fees and levies fines primarily to generate the revenue needed to meet its payroll. In 1988, DEPE derived just over 20% of its funding from fees and fines. Today, that amount has risen to over 80%.

In addition, millions of dollars raised by the corporate surcharge for hazardous waste cleanup have been diverted to the state's general fund in order to balance the state budget during the recent recession rather than being spent to cleanup sites.

I-3. Dedicated fees and fines which finance individual regulatory programs have the potential to inhibit executive and legislative oversight.

Recommendations

R-1. The state should abandon the current policy that treats DEPE as an agency to be funded primarily from user fees and fines. As a first step, revenue from DEPE fees and fines should be deposited into the state's general fund.

R-2. DEPE should fund its staff positions and operations through the normal state appropriation process. Staffing should be at adequate levels to allow for efficient and effective services.

R-3. Fees should relate to the tasks the Department performs or the services the Department provides. A schedule for fines should be established in which the amount of fines relates to the seriousness of the violation.

R-4. Fees and fines should be set at levels that are competitive with those set in other states, particularly neighboring states. They should be set to provide positive as well as negative incentives.

R-5. DEPE should review all of its operations to identify areas in which the Department could contract with private firms to provide services and operations now provided by Department personnel. In appropriate areas, privatization of operations holds promise to reduce costs and improve the Department's response time.

Issue: Overly Adversarial Relationship to Business and Industry

I-4. There is widespread perception throughout industry that DEPE staff members do not understand the fundamental principles that drive the industries that they regulate. DEPE staff members seem to lack a full appreciation for the importance of time as a resource to industry. Delays in processing permits seem to be a way of doing business.

I-5. In many circumstances, an adversarial relationship between DEPE and business and industry may develop as a direct result of the Department's regulatory and enforcement responsibilities. However, industry, and manufacturing in particular, tends to perceive DEPE staff as overly adversarial and unsympathetic to the cumulative burden placed on industry by environmental laws and regulations.

At the same time, some groups argue that DEPE should maintain a clear adversarial position with industry to ensure protection of the environment.

I-6. There is a perception on the part of industry that frequent personnel turnover at management levels in the Department leads to unclear understanding of state environmental policies and objectives at staff operating levels. Moreover, there is clear concern throughout industry that attempts by industry to modify permit and regulatory recommendations by discussions at higher departmental levels will result in retribution by lower levels in the bureaucracy when the same companies file future permit applications.

Recommendations

R-6. The state should expand recent efforts by DEPE Commissioners and sub-cabinet executives to increase departmental responsiveness to all clients. Responsiveness should be a value at all levels of the organization.

R-7. DEPE should conduct advisory "inspections" or "reviews" with no penalties to help industry identify and correct compliance problems.

R-8. DEPE should establish clear time frames for required action on permits and other agency decisions. All permitting processes should include a designated staff person to facilitate and expedite permit applications.

R-9 DEPE should expand to other manufacturing sectors the ombudsman service provided to the plastics industry. The ombudsman service should be part of a "circuit breaker" system to prevent unnecessary problems and damage to individual firms and to the regulated community. The ombudsman should serve as a single point of contact for complaints and requests for general information from business and industry. The ombudsman should be authorized to cut across bureaucratic and jurisdictional lines.

R-10. The state must provide training to assist DEPE staff to:

- Understand the regulated industries for which they have responsibility;
- Increase responsiveness through improved customer service attitudes;
- Improve the effectiveness and efficiency of DEPE operations through implementation of generally accepted management practices such as total quality management (TQM).

R-11. In addition to expanded training and development programs for DEPE staff, the State should establish an employee exchange program in which DEPE staff would work within selected industries to obtain a better understanding of the private sector and industrial processes.

Issue: High Compliance Costs

I-7. Complying with environmental statutes and regulations is costly to industry in a variety of terms: the loss of commercial or business opportunities, the expenditure of employee time, the purchase of new equipment, the implementation of new technologies, and the addition of legal and consultant fees. An often overlooked cost is interest payments on debt service undertaken as the result of delays in permitting. Delays by DEPE increase costs to both private and public entities.

One of the most serious delays in DEPE occurs in the Historic Bridge Review Process. That unit has delayed action on millions of dollars of road construction throughout the state. This has a negative impact on highway safety and the creation of construction jobs.

I-8. Perhaps most costly is the loss of managerial capacity during those periods of time while management is focused on environmental and bureaucratic matters arising from environmental legislation, rules and regulations.

I-9. Many environmental laws and regulations require major expenditures to remediate problems that represent lower level risks than known problems that pose greater risk. These laws and regulations often require major additional expense for marginal benefits.

Recommendations

R-12. Environmental regulations should be based on unbiased observations, analyses and measurements of the potential risk for harm to health, safety or environmental integrity presented by a process or substance. Environmental standards should not be mere reflections of "how low" a level can be measured and not just a response to a public "outrage" factor based upon a contamination or pollution incident.

R-13. There should be a realistic assessment of the true cost to the state and the true cost to industry before the implementation of proposed legislation, rules or regulations. This environmental impact analysis should be conducted as the legislation, rules and regulations are developed and again as they are implemented. For example, once a major piece of legislation clears one house, DEPE should prepare an implementation report.

R-14. DEPE should establish a council of citizens and experts from academia and industry to advise the department on the drafting and implementation of regulations. As an advisory body, the council could respond promptly to avoid the possibility of adding to the bureaucratic burden.

R-15. The state should establish a regulatory system that allows workers the flexibility and discretion to resolve issues at the lowest staff level possible within policy and statutory guidelines.

R-16. A formal process should be established to provide DEPE with increased discretion to grant variances and exceptions to certain regulations when such exceptions would cause no environmental harm but would prevent substantial negative impact on the economic viability of an enterprise. Analogous administrative flexibility is available in other public policy areas such as through the uniform construction code and local boards of adjustment.

R-17. The state should establish a formal process to require conflict resolution and negotiation strategies for resolving interagency and government and industry conflicts related to the enforcement of environmental regulations. This process should include independent mediators with the power to recommend approaches to resolve such conflicts.

R-18. A formal process should be initiated among the Department, industry, and the environmental community to find areas of agreement about legislative change and to carry forward these recommendations to the Legislature.

R-19. DEPE should encourage target manufacturing sectors to propose long-term environmental compliance contracts. This would be particularly helpful in sectors dominated by small firms. The process of negotiating these agreements would create beneficial collaborations between DEPE and industry. Typical compliance contracts might cover design and implementation of testing programs, standard setting, source reduction goals, and the determination of acceptable control technologies. Compliance contracts:

- Allow for dynamic input from industry into DEPE's regulation and enforcement planning;
- Clarify goals, schedules, and technical methods; and
- Offer protection from citations during the interim between the contract and full compliance.

Issue: Burdensome Paperwork

I-10. Paperwork related to the implementation of environmental regulations and rules is complex, confusing, burdensome, at times duplicative, and often overwhelming for industry, particularly small manufacturers.

I-11. Industry perceives that a significant amount of the unnecessary paperwork required by New Jersey regulations arises from DEPE's continuing distrust about the ability and willingness of the regulated community to comply. It appears that lack of trust is at the root of requirements to certify and recertify information and requests. Industry participants described numerous incidents whereon DEPE required excessive record keeping but did not use the recorded data for compliance monitoring or control. A specific example is the VOC (Volatile Organic Compound) record keeping requirements in N.J.A.C. 7:27-16.2[n].

One corporation created 35,000 new records each month to meet this regulatory requirement. The daily records were so complex and numerous that the firm had to

develop a computerized data collection system. According to the firm, the corporation has never:

- used the records for any reporting requirement for any permit;
- sent any information stored in the database to DEPE; or
- had to review the database with any enforcement person, except for one question during an inspection.

The company estimated that prior to the implementation of the computerized database collection system, staff took 10 weeks compiling the data manually. The computer system reduced that effort, but the company still spends in excess of seven worker weeks per year to comply with this requirement. Clearly, the requirement for excessive record keeping without a logic or need for the information is costly to business and undermines the credibility of DEPE.

I-12. Small manufacturers generally do not have specialized staff to process the technical and legal paperwork required to comply with environmental regulations. Large industry is impacted, as well, by having to add significant numbers of staff to manage the many required reports.

Recommendations

R-20. The Commissioner of DEPE should establish a special task force to begin a paperwork reduction effort as soon as possible. The task force should involve, as resources, the Cabinet and Citizen Committees on Permit Coordination and other appropriate groups.

R-21. The state should adopt a practice of writing environmental statutes, rules and regulations in clear and precise language.

R-22. DEPE should eliminate unnecessary paperwork and delays. Information and data collected should be the minimum required for enforcement. Duplicate reports should be eliminated.

R-23. Where information and data must be submitted to federal authorities, DEPE procedures should allow incorporation of that information and data in state reports by reference and not require separate reporting.

R-24. All processes should be automated with an on-line computer link supported with DEPE templates and help screens to assist those dealing with the agency. An easy to use on-line system should be developed to simplify issuance of permits and reporting by the regulated community and to reduce paperwork to a minimum.

R-25. DEPE should establish a single, agency-wide data base. A single data base would reduce the amount of repeat information required to be submitted by permit applicants and would increase agency efficiency and effectiveness. This data base system should be amortized against the savings achieved. Consequently, these improvements could be funded from savings achieved rather than by new or additional fee surcharges.

Issue: Overlapping and Redundant Regulations

I-13. Environmental regulations often are overlapping, redundant and the allocation of resources is often based on public perception of risk rather than scientific evidence.

I-14. Regulations tend to be developed piecemeal and are driven more often than not by requirements for permits.

I-15. Unpublished internal management guidelines and procedures often are more important than rules and regulations in determining DEPE actions.

Recommendations

R-26. Informal management guidelines are important to allow for flexibility in Departmental operations, but guidelines and provisions that have an impact on compliance requirements should be made known and made available to the regulated community.

R-27. The state should develop and adopt an environmental protection planning process to provide a framework for developing and evaluating environmental legislation and regulations. The planning process should focus on identifying and minimizing those risks that pose a danger to the environment and to the health, safety and quality of life of the citizens of New Jersey. The process should lead to the development of an environmental master plan that takes into consideration the needs and aspirations of all stakeholders. The master plan could provide a degree of stability by setting the framework to eliminate duplication of statutes and regulations and reducing unnecessary costs to business. The master plan should be updated every five years.

R-28. The state should eliminate redundant statutes, rules and regulations, and eliminate the incidence of multiple authority by different agencies and different levels of government.

R-29. DEPE should seek consistency with federal regulations and definitions, e.g., the New Jersey definition of hazardous materials includes oil whereas the federal definition designates oil as a recyclable. Listing oil as a hazardous waste increases

the cost of collecting and transporting the oil that, in turn, reduces the number of used oil collection centers.

R-30. Wherever possible, federal and state requirements should be combined as a single standard for business. Where New Jersey regulations or definitions differ from their federal counterparts, there should be an analysis providing both environmental and economic justifications for the difference.

Issue: Unnecessary "State-of-the-Art" Technology Requirements

I-16. Many environmental laws and regulations require major expenditures for high technology, state-of-the-art solutions to problems that represent low level risks. These laws and regulations often require major additional expense for marginal benefits.

I-17. DEPE interprets the provisions of the Air Pollution Act to require installation of "state-of-the-art" control technology whenever a new permit is required. Industries must, therefore, install new control technology even when the new permit covers a process change, a change in equipment configuration, or the desire to install an improved control device.

I-18. "State-of-the-art" requirements are costly disincentives that discourage industrial change in air permit and other regulatory programs. The requirement discourages change even when such change could result in pollution prevention, or other types of environmental improvement.

I-19. The "state-of-the-art" requirement turns almost all permit application processes into negotiations, often adversarial, which are driven by considerations of relative capabilities of various technologies rather than the level required to protect the environment and human health.

Recommendations

R-31. The state should establish an independent Office of Technology Assessment (similar to the federal office) to periodically evaluate the technical decision base used by State agencies for permits, rule making and their modification.

R-32. DEPE should re-organize regulatory priorities to maximize the effect of the limited resources available.

To facilitate public acceptance, DEPE and industry should give greater attention to educating the public on the nature of risk and the importance of issues such as:

- Non-point sources of water pollution
- Reducing levels of radon in buildings
- Incorporating pollution prevention into the design of products

R-33. DEPE should limit the use of continuous emission monitors to critical public health related issues where the measurements are meaningful and necessary.

R-34. In requiring control technology, the Department should carefully weigh the costs of compliance with the environmental benefit potentially derived. A potential marginal benefit may not justify a certain significant cost increase.

R-35. DEPE should modify the state-of-the-art technology requirement to cover only new source applications, but to allow alternative technology for modification of existing sources, where requested modification results in environmental improvement.

R-36. When selecting technology to comply with "state-of-the-art" requirements, DEPE should give first consideration to risk reduction rather than increased technical ability to detect and measure chemical entities.

Issue: Obstacles To Research and Development Activities

I-20. Research and development and high-technology manufacturing are pinions of New Jersey's economy. In many ways, the economic future of the state depends upon vigorous and productive R&D activities. Yet, the state's environmental regulatory system frequently serves as a major disincentive for establishing or maintaining R&D facilities and activities in New Jersey. For example, New Jersey requests information about every material used in a laboratory fume hood, even though in most cases, such hoods do not need a permit to operate. Frequently, DEPE delays action on requests for new R&D permits or modifications of permits for long periods of time, making it difficult to initiate critical R&D activities.

I-21. New Jersey's regulation of R&D goes beyond the federal EPA requirements. The preamble to the federal operating permit rule specifically addresses the issue of whether an R&D operation is required to have a Title V operating permit, stating:

> Although EPA is not exempting R&D operations from Title V requirements at this time, in many cases, states will have the flexibility to treat an R&D facility as separate from the manufacturing facility with

which it is co-located. Under such an approach, the facility would then be required to have a Title V permit only if the R&D facility itself would be a major source of emissions.

For New Jersey R&D operations, this should mean that as long as their VOC emissions from facilities co-located with manufacturing sites are maintained below 25 tpy, no operating permit would be required. However, the operating permit program proposed by DEPE has complicated this issue, and essentially has eliminated EPA's research and development provision. DEPE is proposing applicability criteria that will require inclusion of R&D areas in the operating permit unless a facility is used "solely" for R&D purposes. This does not acknowledge the fact that R&D is an intermittent activity.

Under the proposed criteria, no facility that carries out R&D and manufacturing operations with the same equipment can exclude the R&D emissions from the operating permit program. Many smaller operations have only one set of equipment that they utilize for both R&D and manufacturing. Larger operations have permits that allow pilot plants to be utilized for manufacturing 90 days per year and dual batch and pilot plant permits that allow both types of operations at the same time. These types of R&D operations would have to be included in the operating permit program, and would subject R&D to all the monitoring, reporting, and record keeping requirements of the program. Such inclusion would be costly and extremely burdensome to industry, with no concomitant benefit to the environment.

Recommendations

R-37. The state should target R&D as a prime industrial activity to be encouraged and supported. Rapid change is a characteristic of laboratory and related research and development activities. The state should recognize the critical nature of rapid change by establishing a fast response permit and regulatory capability.

R-38. The fast response permit and regulatory system should be based on risk reduction or minimization founded on an unbiased scientific methodology and not on a rigid interpretation of regulations designed for manufacturing operations rather than research and development.

R-39. The regulatory approach should be based upon information capabilities of a research facility and should not require collection and compilation of data that do not result in a significant increase in environmental protection. Information and paperwork demands upon researchers should be kept to an absolute minimum.

R-40. The state's environmental regulations should recognize the fact that pilot plant, pre-production and operational test activities are a critical part of the R&D

enterprise. Regulations should recognize the need for rapid change in the materials and processes being evaluated at these facilities.

Issue: Right-to-Know Labeling and Reporting Requirements (New Jersey Department of Health and DEPE)

I-22. The universal labeling requirements of the Right-to-Know program, particularly for in-process material and very small containers, are overly complex and burdensome. They have resulted in substantial increases in operating expenses for little or no increased benefit to the public's health and safety.

I-23. Detailed annual reports including the location of chemicals are onerous and do not appear to be used by emergency service personnel.

Recommendations

R-41. The Legislature should revise the Right-to-Know Law and substantially reduce reporting requirements.

R-42. Very small containers should be exempt from the Right-to-Know regulations unless the substance in the container is so toxic as to represent a hazard.

R-43. Reporting should be made more efficient by providing specific locations for large quantities only. Updates should be for changes only.

Issue: Compliance Assistance for Small Businesses and Manufacturers

I-24. Small businesses are key contributors to New Jersey's economy and generators of jobs. Economic progress in New Jersey is tied to the future success of small businesses. Yet, small businesses have limited capital and operating resources. Complying with environmental regulations is particularly difficult and costly for small enterprises.

Recommendations

R-44. New Jersey's Technical Assistance Program for Industrial Pollution Prevention (NJTAP) should be expanded to provide a comprehensive program to assist small manufacturers to comply with environmental regulations, with a continuing emphasis on pollution prevention strategies and techniques. A permanent funding mechanism for an enhanced NJTAP should be put in place.

R-45. The state should provide financing programs, such as revolving loan funds, to assist businesses to purchase and install environmental compliance equipment and processes.

R-46. DEPE should establish a series of information programs specifically to help manufacturers cope with environmental statutes and regulations. The programs should include audits or "information inspections" to assist manufacturers in identifying compliance issues without the imminent threat of fines.

General Conclusions of Phase One

The study team acknowledges DEPE's full cooperation in this study. The team found many instances where DEPE improved operations because of concern about the impact of environmental regulations on businesses. Not withstanding those improvements, the Department and the Legislature must make an even greater effort to reach a balance between environmental protection and needed economic development.

Implementation of these 46 recommendations should help to build trust among industry, the public and environmental regulators. The goal is to achieve an appropriate balance between assisting businesses to meet compliance standards and aggressive enforcement to catch and penalize offenders. A number of other states serve as models for New Jersey. These states provide both a warm welcome and technical assistance in a wide array of areas, including environmental compliance, for industries seeking to develop new facilities or expand existing operations. New Jersey has no alternative but to do the same or risk the continued loss of manufacturing industries.

State government must move from a distrustful culture that views all businesses as potential violators to a client-oriented culture committed to educating and assisting all citizens and businesses to avoid dangerous health, environmental and safety risks. The initial efforts by state regulators should be to assist citizens and businesses to comply with environmental laws, rules and regulations, rather than designing rigid processes to identify and punish violators.

The NJIT study team found that the complex collection of environmental laws, rules and regulations is, in part, the product of an "outrage" factor by the public demanding legislative and executive action in response to contamination or pollution incidents. Environmental standards should not be mere reflections of "how low" a level can be measured and not just a response to a public perception factor based upon a contamination or pollution incident. Rather, environmental regulations should be based on unbiased observations, analyses and measurements of the potential risk for harm to health, safety or environmental integrity presented by an activity, process or substance.

The comparison of federal and state regulations in this report shows that New Jersey has more inclusive or stricter regulations than those adopted at the federal level and most other states. NJIT's study team identified over 30 pieces of important environmental legislation. This set of legislative initiatives creates a complex regulatory network that often supersedes and supplements federal statutes and regulations.

A New Approach For New Jersey

This report recommends a new approach for New Jersey, an approach that begins with open dialogue about risk and incorporates education on risk as an essential component of the environmental protection infrastructure. For well over a decade, the State of New Jersey has taken pride in being a leader among other states and the federal government in the development and enforcement of strict environmental protection legislation, rules and regulations. Environmental advocates strongly support this leadership role. Industrial groups, on the other hand differ and argue that when the state moves beyond federal or regional standards, there should be an analysis providing both environmental and economic justifications for the difference.

This report concludes that the state's emphasis on being first among other states to respond to environmental issues and the practice of having the strictest regulations, has increased the cost of doing business in New Jersey and has been a particularly heavy burden on manufacturing. Those costs contribute to the perception that New Jersey is not friendly to business. Most of the industrial participants in this study, from both small and large businesses, indicated that the uncertainties related to the environmental process led them to decide not to expand in New Jersey. Time and again, participants claimed that compared to surrounding states, New Jersey is more inflexible and less willing to exercise discretionary authority to assist industry and manufacturing when such assistance could be provided without compromising environmental standards.

DEPE can begin to change this perception of unfriendliness to business by initiating a comprehensive evaluation of all operations to define performance metrics. The evaluation should identify ways to improve the delivery of services and to eliminate unnecessary paperwork burdens and costs for clients. The state should be able to recoup some of the cost for this evaluation from the savings generated through implementation of the evaluation recommendations.

Need For An Environmental Master Plan

In order to flourish, industry needs a degree of certainty. The environmental regulatory scene has been a rapidly moving target for the past 20 years. This report recommends a reassessment of the entire environmental regulatory infrastructure. The state should develop an environmental master plan that takes into consideration the needs and aspirations of all stakeholders. The master plan could provide a degree of stability by

setting a framework to maintain environmental standards while eliminating duplication of statutes and regulations and reducing unnecessary costs. The state should update the master plan on a five year cycle.

Management and Technological Strategies

The public often looks to laws and regulations for both technical and administrative guidance in translating environmental quality goals into practice. There are other management and technological strategies that may incorporate legal action, but do not rely solely on a regulatory control structure. New Jersey should move boldly to develop such programs. The cases presented in this report highlight the strengths of different management strategies and point to the effectiveness of environmental practice that actively works toward the prevention of environmental deterioration, and embraces government-industry-citizen partnerships that are so integral to their success.

The positive cooperation and collaboration among DEPE staff, industry participants and NJIT during this study are steps towards the needed government-industry-citizen partnership. The state's goal should not be a massive and immediate change in environmental regulations. Rather, this report recommends a thoughtful and steady movement to balance the need for economic progress with the need to maintain a safe and healthy environment for New Jersey's residents, workers and tourists. The study team observed that DEPE staff is convinced that the Department is moving in the right direction and is almost there. Industry, on the other hand, sees the road ahead as long and difficult.

Review of the Economic Impact of

Environmental Statutes, Rules and Regulations

On Industry in New Jersey

Introduction

This report presents an analysis of the economic impact of state environmental regulations on industry in New Jersey. NJIT conducted the study at the request of Senator Robert E. Littell, Chair of the Budget and Appropriations Committee. During the Fiscal Year 1993 budget hearings, Senator Littell initiated a dialogue on two important issues facing New Jersey -- the economy and the environment. Senator Littell established a primary focus for the study as "an evaluation of all existing environmental statutes and implementing rules and regulations including the fee structure; with the goal of reducing their complexity and eliminating any contradictions or redundancies." Consistent with that focus, the study team assessed the cost, technical and administrative, incurred by industry in complying with environmental rules and regulations. The team attempted to separate fact from rhetoric and to transcend the *a priori* categories and dichotomies that have generally framed discussions of the economy and the environment.

This study has been a collaborative process involving NJIT, environmental advocates, the New Jersey Department of Environmental Protection and Energy, and numerous businesses and industries. The study focused on the chemical, electronic, pharmaceutical, plastics, and textile processing industries, all of which are critically important to New Jersey's economy. Significant assistance was provided by: Mercer County Community College, Passaic County Community College, Stockton State College, the Partnership for New Jersey, Public Service Electric and Gas Company, and the New Jersey State Chamber of Commerce.

This has been an action-oriented study. A spirit of cooperation marked the entire process, as evidenced by the Department of Environmental Protection and Energy's prompt and positive response to recommendations and suggestions from NJIT and other participants during this first phase of the study. For example, DEPE established an ombudsman service in response to suggestions and requests from the plastics industry. Participants in the study acknowledged DEPE's initiatives but also called on the Department and the Legislature to do more to improve responsiveness to all clients. A theme emerged during discussions which can be summed up as *New Jersey cannot afford to adopt a simplistic approach to governance or economic development that views the state's economic and environmental challenge as an either/or situation*. All parties in this study agreed that industrial health and growth can coexist with effective environmental regulation. However, many described the current relationship as adversarial rather than cooperative.

The cases presented in the quality of life section of this study demonstrate substantive improvements to the physical and social environment in New Jersey. A recent Star-Ledger/Eagleton Poll indicates that 41% of the residents in New Jersey believe that the state is doing a good and 9% believed the state is doing an excellent job of protecting the environment (*The Star-Ledger*, 1993). Of equal importance to the observable changes taking place is the method employed to achieve these improvements. Management and technological alternatives are numerous. Choosing the correct alternative for the challenges at hand is crucial to achieving successful outcomes.

Consequently, this report does not contest that environmental regulation has improved the environment and the quality of life in New Jersey. In fact, the business and industry participants in this study did not take issue with the intent or goals of all environmental legislation and regulations (i.e. the need to preserve New Jersey's environment and protect the health and safety of the state's residents, workers and tourists). Rather, they raised objections to laws, rules and regulations that required major expenditures by industry to produce marginal benefits. They did identify the current climate in environmental regulation as one of the barriers to growth in the manufacturing and R&D sectors. Industry participants also identified serious problems caused by arduous and confusing compliance procedures and the attitude of some DEPE staff. In many cases, the most serious burdens on business were identified as DEPE's prescribed requirements for "how to" achieve the legislative intent rather than the specific compliance standards.

This report identifies 24 critical issues that impact all of New Jersey's businesses and industries. These issues affect the ability of both small and large companies to do business in New Jersey. However, the economic impact of environmental regulations is more severe on small businesses than on large businesses. Many of these issues also impact on county and municipal government, school districts and universities. This report also makes 46 program, policy and organizational recommendations.

II. Structure of Report

The study has two phases. Phase One, a review by NJIT, comes to conclusion with this report to the Legislature. Phase Two will be a collaborative effort involving NJIT, DEPE, the Law Review Commission, industry and legislative staff to achieve a rational, consistent and cohesive statutory and regulatory framework for New Jersey's environmental protection efforts. Phase Two will include a review of the statutes to identify duplication, obsolescence or other circumstances that might warrant repeal or amendment of current statutes and regulations. The primary goal of Phase Two will be to recommend and implement structural and functional changes that would ease the regulatory burden on business, industry and other regulated entities without compromising environmental protection. A number of Phase Two preliminary work sessions and discussions already have been held. A formal schedule for Phase Two will be set after the Legislature has an opportunity to review this Phase One report.

Scope and Methods of Phase One

Phase One of the study had four main goals:

- To identify and document the *concerns* and *perceptions* of business and industry regarding the economic impact of environmental statutes, rules and regulations.

- To analyze the economic impact or cost of regulatory compliance in terms of required new technology, new or modified systems, capital improvements, paperwork, fees, fines, personnel, and the abandonment of products, services or locations.

- To identify societal benefits that accrue from improvements to the environment as a result of the enforcement of environmental statutes, rules and regulations.

- To prepare a report with recommendations for the Legislature and Governor.

The study team conducted research and gathered information based on representative industry experience, case studies, focus group sessions, workshops and surveys. As much as possible, the team attempted to determine how the enforcement of environmental statutes, rules and regulations affect the viability and competitiveness of the business community in general and the manufacturing sector and small businesses in particular.

NJIT guaranteed anonymity and confidentiality to all participants in the study. Consequently, this report does not include the names of specific companies. All working documents have been and will continue to be treated as confidential.

Work Elements of Phase One

In Phase One, NJIT selected ten work elements:

1. Establish an open dialogue with industry on regulatory matters
2. Select core industry sectors
3. Conduct research and prepare case studies
4. Convene industry focus groups to discuss key issues and cases
5. Prepare "white papers" to articulate the perspectives of selected core industries
6. Review preliminary findings with DEPE and the industry groups
7. Conduct regional workshops and forums
8. Develop crosscut issues and recommendations
9. Review crosscut issues and recommendations by DEPE and industry groups
10. Prepare final Phase One report

III. Five Core Industry Sectors Critical To New Jersey's Economy

New Jersey's manufacturing base is made up of over 18,500 businesses that employ over 527,000 workers. New Jersey firms engage in almost all types of manufacturing from large chemical continuous and batch processing to customizing discrete electronics parts. In order to understand the impact of environmental regulation on New Jersey's manufacturing industries, NJIT selected five specific industrial sectors:

- textiles
- chemicals
- electronics
- pharmaceuticals
- plastics

These sectors represent the core of the state's industrial economy in terms of the number and distribution of firms, employment, salaries, and sales volume. These industry sectors also trade on national and international markets. Consequently, rules and regulations that are New Jersey-specific directly affect the ability of these industries to manufacture products and compete nationally and internationally for market share. In addition, these industries are strategic to the state in terms of their extensive use of advanced product and process technologies, support of research and development, and the connection to other industry sectors in the regional economy.

These five core industries provide a broad spectrum of business cultures, process technologies, and manufacturing operations that embrace the full impact of environmental rules, regulations and statutes on New Jersey's manufacturing industries. The team examined two additional process technologies -- electro-plating and printing -- to verify that the industry sectors chosen were representative of the economic impact of environmental regulation across the manufacturing industry.

From each of the five core industry sectors, NJIT selected representatives to participate in focus group sessions to discuss key issues and cases related to environmental regulations. The study team gave particular emphasis to selecting individuals familiar with process technologies and materials. A cross section of individuals were included to ensure a group that reflected market segments and the array of large and small companies in each sector. Industry representatives participated actively and presented personal and corporate experiences that described impacts of New Jersey's environmental laws and regulations on their companies. A number of industry participants described recent positive experiences in dealings with DEPE. At the conclusion of the sessions, NJIT asked all attendees to submit additional data or information they felt would help quantify the impact of regulation on the

industry. A number of focus group participants submitted additional data and reports for consideration by the study team. Subsequent to the focus group meetings, the study team conducted interviews with individuals from the focus groups and others to clarify and probe specific topics.

To maintain consistency in data gathering across the industry sectors, the study team followed a structured format and used the following questions to stimulate and direct discussion.

1. What is the level of information provided to your industry about environmental regulations? How do you obtain this information?

2. Is the technical basis of the rules/regulations too stringent? Are the rules/regulations based on minimum detection levels?

3. Is compliance feasible? Is the technology available to allow industry to comply with the regulations?

4. Are the paperwork and bureaucracy used to implement rules and regulations burdensome or overwhelming?

5. Are there rules and regulations that are duplicative, redundant or at variance with other rules and regulations?

6. Does enforcement of rules and regulations vary geographically or by industry?

7. What are the costs directly associated with compliance? What are the costs for: retrofitting equipment; analyzing data; handling the paperwork; and resolving legal issues?

8. Are there reasonable tradeoffs between environmental protection and economic costs? How can regulations be made less onerous without increasing unwanted risks to health, safety, and the environment?

9. Are there organizational or process changes that could be made to reduce the costs of regulations?

10. What technical assistance is needed by industry to improve compliance and to reduce the cost of compliance?

11. What cases best clarify the issues?

12. How could training of enforcement personnel improve the situation?

This structured format facilitated the development of the 24 crosscut issues.

Industry White Papers

One of the key objectives of this study was to determine and articulate the industry's perception of DEPE and the enforcement of New Jersey's environmental laws, rules and regulations. Where possible, the study team attempted to quantify impacts, especially economic impacts. NJIT used the information obtained through the focus groups, follow-up discussions and interviews to develop industry-specific "white papers." The study team used these white papers as working documents to develop the crosscut issues and to stimulate interaction with DEPE.

In focus group sessions and throughout the course of the study, participants cited incidents and examples that captured important aspects of the impacts being discussed. The team studied a few of these examples in detail. Some of these examples reflected positive actions by DEPE to reduce required paperwork or improve interaction between DEPE staff and industry. One of these is the pilot ombudsman program for the plastics industry. Other cases detailed economic impacts such as extended delays, duplicative reports, extensive data requirements and review processes. For example, one case described the delays related to the review of repairs to historic bridges. At the present time, millions of dollars in construction are delayed, awaiting the DEPE historic bridge review approvals. The study team utilized case studies to illustrate specific actions and impacts and not to quantify broad economic impacts.

Workshops

NJIT convened four roundtable workshops as forums to bring together DEPE staff and industry representatives to discuss recent changes in environmental statutes, regulations and DEPE practices. During the workshops, DEPE and industry representatives also reviewed and commented on NJIT's draft crosscut issues and recommendations. NJIT also convened two workshops with citizen groups, as well as municipal and county officials, and environmental advocacy groups to discuss benefits derived from environmental legislation and regulation.

IV. New Jersey a Leader Among Other States and the Federal Government

For well over a decade, the State of New Jersey has taken pride in being a leader among other states and the federal government in the development and enforcement of environmental protection legislation, rules and regulations. NJIT's study team identified over thirty pieces of important environmental legislation that affect industry. The state enacted eleven of these in the 1980's (see the Chronology of Major New Jersey Environmental Legislation which follows). This set of legislative initiatives creates a large, complex regulatory network that often supersedes and supplements federal statutes and regulations.

The comparison of federal and state regulations, which follows, shows that New Jersey often has more inclusive or stricter regulations than those adopted at the federal level. This extends from the number of materials regulated under the community Right-to-Know and labeling requirements, to the Toxic Catastrophe Prevention Act, to the Water Pollution Control Enforcement Act, to the level of clean-up required, to the requirement to use state-of-the-art technologies. This complicated regulatory patch work quilt creates an enormous challenge for all businesses and industries and, in particular, for small businesses.

Throughout this study, industry representatives continually emphasized support for a clean environment. The business and industry participants in this study took issue not with the intent or goals of environmental legislation but with those regulations which required major expenditures by industry to produce marginal benefits. The NJIT study team found that the complex collection of environmental statutes, rules and regulations is, in part, the product of an "outrage" factor by the public demanding legislative and executive action in response to contamination or pollution incidents. A major recommendation in this report is that environmental law and regulations should not be driven by "public outrage" alone. The state must utilize sound scientific methodology with risk as the measurement for setting reasonable and effective standards and not merely automatically setting standards at the lowest level that can be measured.

Public Perception of Risk

The determination of risk posed by the environment is fraught with problems due to imperfect knowledge, the limits of science, and perception of the public (Greenberg 1992). Public perception of the risks posed by contaminants in the environment becomes important to an understanding of the allocation of human and financial resources to solve problems. Assignment of risk is a technical and scientific issue; the acceptability of the risk is often a political one (Regens et al. 1983) and often legislative initiatives are the result of public perception of a risk (Rosen et al. 1992). A 1987 EPA study revealed that the agency's program priorities were more reflective of the public's perception of risk than with the scientific community's assessment. A review of New Jersey's environmental statutes and regulations indicates that New Jersey follows that national pattern.

A poll of 801 New Jersey residents by the Eagleton Institute in 1993 revealed that 75% believe that toxic waste disposal was a very serious problem, 66% believe that solid waste disposal is very serious, 55% believe water pollution is very serious and 49% believe air pollution is a very serious

problem (Associated Press 1993). The largest number of phone calls received by DEPE's Public Access Center between January and June of 1993 were about solid waste management; hazardous waste was a close second. It is important to note that experts rank the risk from hazardous waste facilities much lower than the public (Miller and Keller 1991).

A Comparison of State of New Jersey and Federal

Environmental Laws and Regulations

Which Directly Affect Manufacturing

The following is an outline of State of New Jersey and federal environmental laws and regulations which directly affect manufacturing. There are other "environmental laws," most particularly the coastal and freshwater wetlands acts, which affect business through the regulation of land use. This survey focuses on the category of pollution prevention, control and remediation. Consequently, these two acts, and others, are not included in this survey but are listed in the following chronology. The *roman numerals* pertain to the actual laws, while the letter *A* indicates the federal equivalent and the letter *B* indicates the New Jersey equivalent. The numbers contain an analysis of the differences (where both state and federal equivalents exist) or other relevant information. Much of the information was developed from interviews with DEPE staff and by analyzing various laws and regulations, including the use of citations from "*The Complete Guide to Environmental Liability and Enforcement in New Jersey*" by William P. Parkin.

I. Worker and Community Right-To-Know:

These laws establish a system to inform workers of the risks inherent in their workplaces and to provide emergency responders and the public at large with vital information about toxic substances in the environment.

A. **Federal: Occupational Safety and Health Act (OSHA)** enacted in 1970. **Emergency Planning and Community Right-To-Know Act** enacted in 1986.

1. Applies to every "employer" defined as "a person engaged in a business affecting commerce who has employees, but excludes the U.S. or any state or political subdivision of a state."

2. Any substance covered in the OSHA Hazardous Communication Standard. Reporting starts at 10,000 pounds.

3. No fee charged to run the program.

B. New Jersey: Worker and Community Right-To-Know Act

Enacted in 1983, the Worker and Community Right-to-Know Act predated the federal Superfund Amendments and Reauthorization Act (SARA) Title III).

1. Targets certain SIC codes. New Jersey imposes coverage requirements on state and local government workplaces. These requirements are mandated by the Public Employees Occupational Safety and Health Act (PEOSHA). The New Jersey Right-To-Know Act directs DEPE to develop an environmental survey to distribute to all covered employers in the state for reporting information about Environmental Hazardous Substances at their facilities. Basically, DEPE surveys the private sector and the New Jersey Department of Health surveys the public sector.

2. Any substance covered in the Environmental Hazardous Substances List or the DOT's Hazardous Materials Table. Reporting starts at zero threshold. [1]

3. Fee charged to run the program; based on $2 per employee or $50 per year (minimum).

II. Toxic Disasters:

Emergency planning and prevention initiatives were proposed after the December 1984 toxic gas disaster at the Union Carbide facility in Bhopal, India. This focused attention on the hazards associated with the use of toxic chemicals that might produce deadly gas clouds in the event of accidents.

A. Federal:

There is no actual federal equivalent to New Jersey's Toxic Catastrophe Prevention Act (TCPA). However, in 1990 Congress amended the **Clean Air Act (CAA)** and included provisions that require facilities to try to avoid and prepare for accidental releases. These provisions are strikingly similar to the requirements of TCPA. Hence, New Jersey legislation foreshadowed the creation of a comprehensive national program to prevent accidental releases.

B. New Jersey: Toxic Catastrophe Prevention Act (TCPA) enacted in 1985. The purpose of TCPA is to minimize and abate discharges once they occur, to provide for efficient plans to evacuate the public if such accidents cannot be contained and to take precautionary measures. TCPA requires the formulation and submission of plans and operating procedures for facility operations and the performance of risk assessments so that hazardous operations are identified and made safer. The DEPE administers TCPA through the Division of Environmental Safety, Health and Analytical Programs, Bureau of Release Prevention.

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[1] Proposed amendments to Right-to-Know regulations submitted in April, 1993 to change the reporting threshold to 500 pounds and eliminate the DOT List.

1. Adopted Amendments - N.J.A.C. 7:31[2]

a. New TCPA fee structure now incorporates a facility-derived fee element in addition to the base fee and inventory-derived fee elements of the original fee structure.

b. Reducing Risk Management Plan (RMP) inspection frequency from once a year to once every three years is a concept the Department is willing to consider in part. A variable inspection frequency will at least be based on considerations of the level of risk reflected by the substances, facilities and activities at a site and the level of RMP performance by that site's registrant.

III. Toxic Cleanup:

In response to the discovery of dangerous contamination at Love Canal, New York, the United States Congress and State Legislatures enacted laws intended to identify and ensure the cleanup of contaminated sites.

A. **Federal: Comprehensive Environmental Response Compensation and Liability Act (CERCLA; popularly known as "*SUPERFUND*")** enacted in 1980 and amended in 1985 by SARA. CERCLA is implemented by EPA., but specific elements allow state agency leads on site cleanups. Superfund creates a reporting scheme to assure adequate emergency response to contain and clean up unauthorized hazardous substance releases. However, Superfund's most notable purpose is to provide standards and financial assistance for site cleanups and impose liability on parties responsible for such contamination. SARA requires annual reporting of releases, called the Toxic Release Inventory.

B1. **New Jersey: Spill Compensation and Control Act** enacted in 1976. Most states, including New Jersey, have created programs similar to Superfund. In fact, the *SPILL ACT* served as the model for federal legislation (CERCLA). The Spill Act prohibits and prevents discharges of hazardous substances and petroleum, provides for the removal and cleanup of substances discharged, creates a fund for removal and cleanup actions, and compensates individuals for damages caused by spills of regulated substances. The comprehensive scope of the Spill Act has allowed DEPE to address contamination to the land and water of the State without respect to the date of the discharge. The Spill Act imposes liability for cleanup of discharges not only on the actual discharger, but on any "other person in any way responsible;" a term given broad interpretation. "Responsible parties" are all jointly and severally liable for the costs of cleanup and removal of contamination."

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[2] Summary of Public Comments and Agency Responses, April 26, 1993

1. **Regulations - Discharge Prevention, Containment and Countermeasure (DPCC) and Discharge Cleanup and Removal Plans (DCR Plans):** The DEPE regulations (DPCC Plans) covered existing facilities and required new facilities to draft plans prior to starting operations. Plans must include detailed information such as:

   a. Storage capacity of the facility

   b. Average daily throughput of the facility

   c. Steps taken to prevent discharges from the facility

   d. Proof of financial responsibility

   e. Mapping of possible affected areas from a release

   The plans must be reviewed and certified by a professional engineer, and renewed every five years with DEPE.[3]

   Note: The federal equivalent to DPCC, the ***Spill Prevention Control and Countermeasure Plans (SPCC)***, regulates the Oil Pollution Act (OPA).[4] The basic difference between the federal and state regulation is that New Jersey's rules go far beyond "petroleum products" and have many detailed requirements. New Jersey's definition of the law includes hazardous wastes and hazardous materials. DEPE is considering one plan that addresses both needs.

B2. **New Jersey: Environmental Cleanup Responsibility Act (ECRA)** enacted in 1983. In addition to Superfund-type legislation, New Jersey has gone a step further than most states. The ECRA law requires industrial establishments to disclose and remove contamination located on their properties prior to transfer of the establishment or the contaminated property, or when operations at these sites cease. The current property owners and operators (the sellers in the case of a transfer) of the properties or business are responsible for cleanup costs of all contamination, including that resulting from prior operation or ownership. In essence, ECRA imposes a precondition on the transfer or closure of an industrial site or establishment and forces the use of private funds rather than public funds like *Superfund* and the *Spill Compensation and Control Act* to clean up contaminated industrial sites. Remedies for violation of ECRA include fines and the voiding of completed transactions.

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[3] The Department may require more frequent renewal

[4] The Oil Pollution Act amended the Clean Water Act in 1990 and is covered in Section VI-A2. The Clean Water Act is covered in Section VI-A1. It was originally in the 1972 CWA.

The operative term "transfer" has been broadly interpreted by DEPE in its implementing regulations to include any change of ownership or control of a business or property of a covered business, including involuntary transfers such as bankruptcy, foreclosure or condemnation.

B. **New Jersey: Industrial Site Recovery Act (ISRA)** enacted in 1993, significantly overhauls the ECRA law. The new law calls for creation of a state fund to help finance cleanups and sets up different standards for cleanup based on health risks and planned land use. ISRA also permits alternative methods, including fences and impermeable caps to stop wastes from seeping out instead of requiring their removal. The law shifts compliance to the private sector for the 60 % of those sites with limited environmental concern, freeing the state to address more serious ones.[5] Among the provisions streamlining the ECRA process and easing the regulatory burden were:

1. Establishing expedited reviews of sites where other state-approved cleanup actions have occurred.

2. Allowing businesses to defer cleanups if the use of the property is to remain substantially the same.

3. Eliminating the need for a company to post a separate bond for a cleanup while using other financial resources to undertake the cleanup action.

4. Limiting DEPE's authority to require further cleanups once an owner undertakes a remedial action.

5. Establishing a $50 million grant and loan fund that small businesses and municipalities can tap into for cleanup actions. [6]

ISRA also sets a one-in-million cancer risk cleanup standard, which means a site must be cleaned to a level that poses a risk no greater than one additional cancer death for every one million people exposed for over 70 years to a pollutant.

IV. Pollution Prevention:

Although specific, comprehensive programs did not exist until recently, many laws and agency policies began to incorporate measures to reduce pollution by encouraging recycling and "*front end*" source reduction, recognizing that "*end-of-pipe*" treatment or disposal requirements could be augmented by such policies. What was lacking, however, was a cohesive multimedia approach to reduce the use of toxic chemicals, detailed examinations of alternative industrial and process methods and assessments of

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[5] The New York Times, "*Making Industrial Site Cleanups Easier*", July 11, 1993.

[6] The Star-Ledger, " *Legislators Vote Cleanup Law to Ease Burden on Industry*", June 11, 1993

the problems that can be created by using alternative treatment technologies. New federal and state pollution programs address these issues and concerns through pollution prevention laws.

A. **Federal: Pollution Prevention Act** enacted in 1990 affirms the United States EPA policy to reduce pollution through a series of efforts to reduce waste generation and improve the management of wastes which are produced. Among its provisions, the Act requires that Form R (the Toxic Chemical Release Inventory Reporting Form) filings include a "toxic chemical source reduction and recycling report" covering all the chemicals addressed by the Form R, on a facility-by-facility basis.

B. **New Jersey: Pollution Prevention Act** enacted in 1991 defines pollution prevention as any method or technique that reduces or eliminates the use or generation of hazardous substances by focusing on the "*front end*" of a production process. The principal aims of the law are to significantly reduce the amount of hazardous substances used by New Jersey industry and to reduce the amount of hazardous substances and hazardous wastes generated as "*nonproduct output*". These PPP's are comprised of two parts:

1. **Part I** provides a comprehensive inventory and analysis of the use and release of hazardous substances, and an accounting of the generation of hazardous waste and nonproduct output.

2. **Part II** details the techniques that will be employed to achieve the pollution reduction, and the schedule for their implementation. The New Jersey Pollution Prevention Act is more comprehensive than the federal Pollution Prevention Act. DEPE, through its Office of Pollution Prevention, is responsible for implementation of the Act, which will initially cover all industrial facilities that file a Form R report with EPA as required under SARA Title III.

V. Air Quality:

The federal government made comprehensive efforts to combat air pollution during the mid to late 1960's. Until that point, air pollution was generally viewed as a state and local issue. Congress passed the *Motor Vehicle Air Pollution Act* in 1965 which set national emission standards for automobiles. Congress then enacted the 1967 *Air Quality Act* which provided for a joint federal-state effort to combat air pollution, but unfortunately the law failed because the states lacked the resources to adequately implement the Act even with the aid of federal subsidies. Finally, in 1970, Congress passed the *Clean Air Act (CAA)* which created the air pollution control framework that exists today.

A. **Federal: Clean Air Act (CAA),** enacted in 1970, is a comprehensive environmental law designed to regulate any activities that affect air quality.

The CAA directs the United States EPA to set air quality standards and emission limitations. To implement the CAA, states are required to adopt and submit a state implementation plan (SIP) which sets forth basic strategies for implementation, maintenance and enforcement of National Ambient Air Quality Standards (NAAQS) in air quality control regions. SIP's form the blueprint for achieving air quality goals within a state, and include items such as limitations on stationary sources of air pollution and transportation planning. States must adhere to their respective plans. The Clean Air Act Amendments of 1990 require EPA to adopt minimum criteria which SIP's (submitted to EPA) must meet before EPA is required to act on the submission. The 1990 Act requires that standards be established for "air toxics."

B. New Jersey: Air Pollution Control Act, enacted in 1954, was originally implemented and administered within the New Jersey Department of Health. Legislation later transferred these functions to DEPE which implements the New Jersey Air Pollution Control Act in the following three areas:

1. Policy and Planning - Office of Air Quality Management (which consists of three bureaus)

2. Division of Field Operations Enforcement - Air and Environmental Quality Enforcement (which consists of two bureaus and four regional enforcement offices)

3. Environmental Regulations - Air Quality Regulation (which consists of five bureaus)

Many of the provisions of the State Act[7] and its accompanying regulations parallel the federal framework including:

1. Permits and operating certificates for stationary sources, including emissions controls and limitations

2. Emissions measurement and monitoring requirements

3. Ambient air quality standards developed by the DEPE

The DEPE regulations also address specific issues, such as open burning, sulfur, incinerators, diesel-powered motor vehicles, etc. In addition, to the State Act, New Jersey adopted the *Air Pollution Emergency Control Act* to authorize the Governor to declare an air pollution emergency when the DEPE determines that there is an unreasonable risk to public health.

[7] The New Jersey Air Pollution Control Act was recently amended in March, 1993.

VI. Water Quality:

The Rivers and Harbors Act of 1899 was the first federal legislation to address discharges to the nation's waterways. However, the focus of that statute was on keeping waterways free of obstruction so that navigation would not be impeded. In 1965, Congress passed the *Water Quality Act* which required states to develop water quality standards for interstate waters. The legislation failed, however, because it did not provide a mechanism for directly regulating industrial discharges; instead, the law merely established standards that were to be achieved without directly authorizing any agency to regulate discharges to waters in order to achieve these standards.

Today, water pollution control has become a much more complicated matter. Some more recent focuses in the water quality arena have been on the effects of nonpoint source discharges (such as storm water runoff from farms, roadways and parking lots) and toxic sediments. Although the drinking water laws are primarily designed to regulate the delivery of safe water to consumers rather than provide source protection, the subject of drinking water does relate indirectly to the overall framework of water pollution control. Hence, waterways that are a prime source of drinking water may be regulated in a more stringent manner than waters that are used primarily for agricultural or industrial purposes.

A1. Federal: The Clean Water Act

Since its passage in 1948, the Federal Water Pollution Control Act (FWPCA) has been amended a number of times. Two of the most important sets of amendments were enacted in 1972, as the Federal Water Pollution Control Act Amendments of 1972, and in 1977, as the Clean Water Act of 1977 (CWA). These amendments create the basic national framework for water pollution control and water quality management in the United States. Today, the complete federal law is commonly referred to as the *Clean Water Act*, or *CWA*. CWA's objective is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." Unfortunately, some of CWA's broad policies and goals have not been achieved by their scheduled deadlines.

The EPA has nationwide authority to implement CWA. However, states may be authorized to administer various aspects of the *National Pollutant Discharge Elimination System (NPDES)* and pretreatment programs, and to carry out other important CWA program implementation functions. Generally, for a state to obtain EPA authorization for CWA, the State must follow the regulatory requirements mandated by CWA (or apply more stringent ones).

1. National Pollutant Discharge Elimination System (NPDES):

CWA outlines a nationwide permit system to regulate point source discharges. NPDES requires a person to obtain a permit prior to discharging any pollutant into the waters of the United States from any point source. The scope of the NPDES program is determined in large part by interpretation of the terms

"pollutant," "discharge of pollutant," "point source," and "waters of the United States" as they appear in CWA. Whether administered by EPA or by the states, the permit system is intended to establish the level of performance that the discharging agent must maintain. NPDES permits are effective for terms not exceeding five years.

A2. Federal: Oil Pollution Act of 1990 (OPA):

Responding to growing pressure in the aftermath of the March 1989 oil spill in Prince William Sound, Congress passed the Oil Pollution Act of 1990, which amends certain provisions of CWA, increases limits on the liability of owners/operators of oil tankers and onshore and offshore facilities for cleanup and other costs resulting from oil spills into navigable waters. The *Oil Pollution Act* also establishes owner/operator financial responsibility requirements, requires double hull oil tankers, and mandates an oil spill contingency and response planning effort.

1. Regulations - Spill Prevention Control and Countermeasure Plans (SPCC):

Owners/operators of onshore and offshore facilities that have discharged, or could reasonably be expected to discharge, oil in harmful quantities into navigable waters must prepare SPCC Plans. The SPCC Plan must be reviewed and certified by a registered professional engineer. The SPCC Plan must be prepared within six months of the date a facility begins operation, and must be fully implemented within one year after such date. An SPCC Plan must be amended whenever there is a change in facility design, construction, operation or maintenance that materially affects the facility's potential to discharge oil.

B1. New Jersey: Water Pollution Control Act as amended by the Water Pollution Enforcement Act in 1990

In addition to implementing the federal CWA under EPA-delegated authority, all states are free to develop their own laws and programs for water pollution control. The *New Jersey Water Pollution Control Act,* enacted in 1977, is the state analog of CWA and generally follows the CWA framework. In fact, the legal framework of the State Act is quite simple; it directs the DEPE to regulate discharges to waters of the state and outlines the state's permit system. The State Act is, in part, intended to minimize direct federal regulation and extends authority to the DEPE to assume implementation of CWA. The State Act was substantially amended in 1990 to include measures to strengthen enforcement efforts and allow the imposition of higher penalties. The 1990 amendments also include provisions which require more comprehensive discharge reporting and affords citizens greater opportunity for involvement.

Like CWA, discharge requirements under New Jersey's water quality control framework depend on the definition of key terms. Most terms parallel their meanings in CWA. The most important difference between the State Act and CWA is the scope of the laws' application to waters. The State Act applies to all "*waters of the state*" which are defined as "*the ocean and its estuaries, all*

springs, streams and bodies of surface or ground water, whether natural or artificial, within the boundaries of [New Jersey] or subject to its jurisdiction."[8] Unlike CWA, the State Act also applies to ground water aquifers and wells in addition to surface waters of the state.

1. New Jersey Pollutant Discharge Elimination System (NJPDES):

This permit program is modeled after the federal NPDES program. Since all discharges into ground water are regulated by the State Act, permits are required. The DEPE may modify, revoke, reissue or terminate any NJPDES permit. Permits may not be issued for longer than five years. The State Act prohibits the issuance of NJPDES permits for discharges of radiological, chemical or biological warfare agents or high-level radioactive waste. The State Act also includes reporting requirements for direct and indirect dischargers. The 1990 Amendments require the reporting of specific effluent violations when they occur. The 1991 Amendments allows DEPE and delegated local agencies to issue summons which are enforceable in municipal court. The 1991 Amendments also allow delegated local agencies to issue civil administrative orders for violations of the State Act.

NOTE: The United States EPA has recently reviewed the differences between (U.S.) NPDES and (NJ) NJPDES. DEPE is proposing future substantive changes to NJPDES in the "*Water Quality Based Limits*" area. The federal level also does not have a *laboratory certification program*, but in New Jersey all analysis must be done by a certified laboratory.

A3. Federal: Safe Drinking Water Act (SDWA) enacted in 1974

The Safe Drinking Water Act gives EPA authority to require public and private water suppliers to test water provided for human consumption and to set numerical limits on allowable contaminant levels. It also regulates underground injection of waste to protect drinking water sources from contamination. Under SDWA there are two sets of standards that drinking water must meet: "*primary*" and "*secondary*" national drinking water regulations. SDWA requires EPA to develop and enforce these national drinking water standards in cooperation with the states. These drinking water regulations apply to all public water systems. EPA may delegate primary enforcement responsibility of SDWA to the states. To qualify for such authority a state must:

1. Adopt drinking water regulations that are at least as stringent as the national primary regulations;

2. Adopt and implement adequate procedures for enforcement of state regulations;

[8] N.J. Statute Annotated 58:10A-3(t).

3. Keep records and prepare reports as required by EPA;

4. Adopt and implement "an adequate plan for the provision of drinking water under emergency circumstances."

B. New Jersey: Safe Drinking Water Act (SDWA)

The state SDWA, enacted in 1977, is the state mechanism for regulating drinking water quality. The State Act parallels the federal SDWA in addition to providing for more stringent controls. In fact, DEPE adopts and incorporates drinking water standards that EPA develops under SDWA. The State Act was substantially amended in 1984 and established a program for testing public water supplies for the presence of hazardous contaminants.

The State Act also establishes the *Water Supply Replacement Trust Fund* to provide loans to individuals, municipalities, and water systems for acquiring alternate water supplies in cases where an existing water supply has been contaminated with -- or is threatened with contamination by -- hazardous substances; fails to meet the state's primary drinking water standards; or fails to meet a standard for sodium, chlorine, iron, or manganese. The State Act is implemented by the DEPE and administered by the Division of Water Resources, Bureau of Safe Drinking Water. Paralleling the federal SDWA, the State Act provides for primary and secondary standards for drinking water. DEPE regulations adopt and incorporate the national primary drinking water regulations, including all requirements pertaining to siting, MCL levels, monitoring and analytical requirements, reporting, public notification and record keeping.

DEPE also adopted additional regulations covering microbiological, inorganic and organic sampling and monitoring of consecutive systems. DEPE also promulgated recommended secondary drinking water standards for potable water. These standards apply to any substance in drinking water which may adversely affect the taste, odor or appearance, or otherwise adversely affect the public welfare. While DEPE does not mandate compliance with these secondary standards, local agencies are authorized to require compliance with them by water suppliers. DEPE is also authorized to institute a civil action in a court of competent jurisdiction for injunctive relief or other appropriate relief to prevent violations of the State Act.

Table 1: Chronology of Major New Jersey Environmental Legislation

Directly Related To Manufacturing

LAW	ENACTED	AMENDED
New Jersey Waterfront Development Act	1914	1985
New Jersey Air Pollution Control Act	1954	1967, 1993
New Jersey Radiation Protection Act	1958	1986
New Jersey Green Acres Land Acquisition Act	1961	1971, 1974, 1978, 1987, 1989, 1992
New Jersey Hazardous Substances Labeling Act	1966	
New Jersey Hackensack Meadowlands Reclamation and Development Act	1969	1992
New Jersey Department of Environmental Protection Act	1970	
New Jersey Solid Waste Management Act	1970	1975
New Jersey Freshwater Wetlands Protection Act	1970	1988*
New Jersey Noise Control Act	1971	
New Jersey Pesticide Control Act	1971	
New Jersey Coastal Area Facility Review Act	1972	1993
New Jersey Spill Compensation and Control Act	1976	1990, 1993
New Jersey Water Quality Planning Act	1977	
New Jersey Water Pollution Control Act	1977	1990, 1991
New Jersey Safe Drinking Water Act	1977	1984
New Jersey Pinelands Protection Act	1979	1988, 1992

LAW	ENACTED	AMENDED
New Jersey Water Supply Management Act	1981	
New Jersey Major Hazardous Waste Facilities Siting Act	1981	
New Jersey Clean Communities and Recycling Act	1981	
New Jersey Farmland Preservation Bond Act	1981	
New Jersey Worker and Community Right-To-Know Act	1983	1985, 1986, 1989
New Jersey Environmental Cleanup and Responsibility Act	1983	
New Jersey Hazardous Substance Discharge, Reports and Notices Act	1984	
New Jersey Toxic Catastrophe Prevention Act	1985	1991, 1993
New Jersey Coastal Sewerage Monitoring Act	1986	
New Jersey Underground Storage of Hazardous Substances Act	1986	
New Jersey Statewide Mandatory Source Separation and Recycling Act	1987	
New Jersey Comprehensive Regulated Medical Waste Management Act	1988	
New Jersey Clean Water Enforcement Act	1990	(Amended Act WPCA of 1977)
New Jersey Pollution Prevention Act	1991	
New Jersey Industrial Site Recovery Act	1993	

* Too numerous to list because of extensive amendments

V. GENERAL ECONOMIC ANALYSIS

This report looks at general economic trends and evaluates the impact of environmental regulations using focused discussions with industry groups and case studies. This section provides a rationale for this approach as well as a discussion of the general economic trends found in the industrial sectors being evaluated.

Background of Industrial Impact Analysis

The evaluation of economic benefits and costs of environmental regulation is a challenge. Many factors influence economic growth and industry decisions to locate, move, expand and contract. It is possible to show gross changes by comparing New Jersey to the United States or other regions. It is much more difficult to separate, quantitatively, the effects of one factor such as environmental regulations. Three analytical methodologies have been used, and are discussed in detail in the literature, for evaluating the economic impact of environmental regulations as well as their benefits. These methodologies include:

- Cost/benefits analysis
- Econometric Analysis
- Case Studies combined with Expert Opinion

Each of the methods has advantages and disadvantages. These are described briefly in this section and in more detail in **Appendix A**.

Cost/Benefit Analysis is an ideal evaluative tool when data of relatively equal quality can be obtained for cost and benefits. The cost of environmental regulation can be determined fairly accurately. Industry can present hard data based on actual cost of installation and operations. On the other hand, obtaining quantitative data on the value of benefits is at best difficult. These data are usually highly subjective and must be based on assumptions. Even if one can measure actual transaction cost, these all fall short of capturing the full value of the benefits attained. Thus, rigorous, or even realistic, comparison between the value of cost and benefits is not achievable.

Econometric analysis of empirical data is most recently evident in work by Meyer [1992]. Meyer correlated state economic growth from 1982 through 1989 with the stringency of environmental regulations in each state in 1982. His objective was to assess regulatory impact on economic growth. His analysis, however, did not adequately incorporate a variety of factors that other researchers have found to be related to economic growth, e.g. state population growth, tax rates, utility rates and educational expenditures. McAuliffe, as part of this research, tested Meyer's work using multivariate analysis to incorporate relevant economic factors (McAuliffe's report detailing his analysis appears in **Appendix B**).

McAuliffe finds that using multiple regression to incorporate other relevant factors yields results that agree with Meyer's major conclusion, i.e., that environmental regulation stringency is not correlated with economic growth. However, McAuliffe's results reject Meyer's findings

that growth is positively related to stringency. Furthermore, McAuliffe conducted tests to determine if economic growth prior to 1982 is related to environmental regulatory stringency in 1982 and he found a positive result. In other words, those states with high rates of economic growth in the late 1970's are the states with the most stringent environmental regulations in 1982. This circularity of cause and effect in economics is one reason why econometric analysis fails to explain persuasively the relationship between regulatory stringency and economic growth.

The third approach, and the one used for this report, is based on Duerksen's Environmental Regulation of Industrial Plant Siting published by The Conservation Foundation in 1983. Duerksen investigated the effect of regulatory costs on industrial growth by studying new plant siting decisions because such decisions are relatively uncluttered by second tier considerations. Second tier considerations are those that influence plant movement decisions such as investment in existing plant assets, effect on existing employees, labor and community relations. He concludes that environmental regulations alone do not unilaterally determine siting decisions. His findings support his conclusion that environmental regulations do not dominate economic aspects of new plant sitings and therefore have limited impact on industrial location decisions.

Two cautions about Duerksen's work are important here. First, he did his research during a time when environmental regulations were less stringent (1978-82) than now and his conclusions need reexamination in light of the changes enacted in the mid-1980's. Second, research based on anecdotal information has problems of its own. The interactions among business organizations, communities and governments are very complex and it is not possible to accurately determine cause and effect of a single variable. Thus, like the other two methods, case studies combined with expert opinion incorporate analytical methods that mislead if not used cautiously. Nevertheless, Duerksen's methodology provides a useful approach for the reexamination of New Jersey. Therefore, the study team selected his methodology for this research report.

Industrial Growth in New Jersey

New Jersey always has had a balanced economy with a mix of manufacturing and service industries. Historically, 25% of the state's employment came from manufacturing. However, manufacturing now is less than 20% of the employment in New Jersey, and continues to decline. In order to evaluate the effects of environmental regulations specific to the State of New Jersey, a basis for those comparisons must be established. This study compares the manufacturing trends for New Jersey and the United States. This is done on a total basis as well as on an industrial sector basis. Two measures that are used are jobs and number of industrial establishments. They are representative of the growth or decline of an industry but are not the measures of manufacturing viability.

Employment for the period of 1980 to 1990 grew in New Jersey at an average rate of 3%, as shown in Figure 1, Appendix A. However, the mix of employment in New Jersey during that period was no longer balanced between manufacturing and non-manufacturing. In New Jersey, as shown in Figure 2, Appendix A, manufacturing jobs declined 2.0% annually as

compared to a 0.6% decline for the nation as a whole. Thus, New Jersey experienced a more rapid shift of employment from manufacturing to non-manufacturing than did the rest of the nation.

However, if one looks at trends for a specific industry, as shown in Table 1, both the number of establishments and the number of employees declined faster in New Jersey for the period of the 1980's than they did in the rest of the United States. A number of factors influence this shift, including wage rates, tax rates, utility rates, land costs and environmental considerations.

The 1980's was a period of growth for New Jersey's economy. During that time the Corporation for Enterprise Development (CED) showed in its annual rating of "state economic climate" that New Jersey's overall rating improved from a score of "B" with a national ranking of eleventh to a ranking of fourth in the nation or an "A" rating in 1989. CED evaluation is based on a large number of factors that indicate the attractiveness of a state for industry. At the same time that the overall ranking of industrial attractiveness increased, the CED's "Environmental Health and Safety" showed that New Jersey ranked poorly in the lower quartile when considering all environmental factors.

The 1991-92 Green Index (1991) by Hall and Carter supports this by ranking New Jersey twenty-eight in its environmental conditions but third in its environmental policy, considering all the states. When environmental conditions and environmental policies are aggregated, New Jersey ranks fourth in the nation. Thus, in the 1980's New Jersey had a favorable industrial climate while maintaining leadership in environmental policies and regulations. We are not able to determine whether this carries over into the 1990's at this point.

Three of the industries examined showed particularly noticeable divergence from the U.S. base. The plastic products industry shows a decline in the 1980's of -0.5% per year as compared to an increase in the overall U.S. industrial employment index of 3.8% a year. Electroplating expanded at a growth rate of 1.6% per annum in the U.S. and declined at a rate of 1.4% per year in New Jersey. The electronics components and accessories increased at the rate of 1.1% per annum in the United States and decreased at the rate of 3.5% in New Jersey. At least for these three industries, there were state specific and, perhaps, firm specific effects that impacted on the decline of the industrial base in those sectors. A more detailed discussion of the environmental impacts and the data for various industrial sectors is found in **Appendix A**.

VI. New Jersey's Core Manufacturing Sectors

Chemical Industry

In New Jersey, the chemical process industry employs 110,200 people (including approximately 55,000 pharmaceutical employees), or one out of every five manufacturing related jobs. The industry provides an annual payroll of $6.6 billion (including $2.9 billion from the pharmaceutical industry), the third largest in the State. The New Jersey Chemical Industry is responsible for $24.6 billion in shipments (second only to Texas), $2.79 billion in exports, and a gross state product of $10.9 billion.

A high percentage of New Jersey's chemical companies are multi-national and multi-state corporations with plants in more than one location. The industry is in competition with other international and national firms for new products, facilities and cost of product. The national and international nature of the chemical industry increases the vulnerability of the New Jersey chemical corporations to New Jersey specific environmental regulations. Because the chemical industry depends upon R&D for a competitive edge, it is particularly sensitive to environmental constraints that New Jersey places on R&D. The industry is split between larger firms that have significant environmental support groups and the ability to access state and federal agencies and small firms that struggle to cope with many issues including environmental compliance.

A group of eight industrial managers, responsible for corporate compliance with environmental regulations, assisted the NJIT study team in reviewing the economic impact of environmental regulations on the chemical industry. The group represented a broad spectrum of the industry in New Jersey including petroleum refining, chemical raw material manufacturer, catalyst manufacturer and specialty chemical manufacturer. The group represented companies with annual sales ranging from $1 million to multi-billion dollars. A number had facilities outside New Jersey. Several firms operated R&D facilities in New Jersey.

The chemical industry participants in this study acknowledged that a number of factors, other than environmental regulations, affect business siting, expansion, downsizing or closure decisions. A consensus exists, however, that environmental regulations and the uncertainty about changing regulations, play a significant role in decisions by chemical companies to move or not to locate facilities in New Jersey.

The industry believes that it has done a credible job in improving environmental conditions. Reductions in air and water pollution releases of up to 80% have been achieved. The industry participants in this study strongly objected to the increased paperwork requirements, particularly in the pollution prevention area. The industry representatives called for a new approach in which DEPE would set performance standards and/or values and industry would adopt technology and methodology to achieve the desired results. The industry expressed strong support for regulations which would encourage recycling rather than developing barriers to the industry such as categorizing items such as precious metals as hazardous.

Electronics Industry

The electronics industry, one of the most significant industries in the state, includes not only manufacturing but also telecommunications. Data from the U.S. Department of Labor for 1992 indicated that New Jersey's electronics industry comprises approximately 2,000 companies with a total of approximately 90,000 employees. These numbers include: computer hardware and software, telecommunications, instrumentation, data processing, aerospace, defense, consumer products, capital equipment, and miscellaneous (e.g. system integrators and resellers) companies.

New Jersey's electronics industry has an annual payroll of approximately $3.2 billion with roughly $12.1 billion in annual goods and services produced. This level of services and products ranks the electronics industry as one of the state's largest industrial sectors. Further analysis of American Electronics Association (AEA) data indicates that of the approximately 90,000 people employed in the industry, 43,000 people are employed by AT&T and 47,000 people by other companies. In addition, 86% of the electronics companies in New Jersey have annual sales of under $20 million dollars, while 78% of the companies have annual sales under $10 million. These data indicate that the majority of companies are small rather than large or medium in size. AEA data indicate that the average number of people employed by these small companies is approximately 20 to 25.

Because most of New Jersey's electronics companies are small and fragmented, they have a unique challenge in confronting environmental issues. Environmental regulations often require large expenditures that represent a significant percentage of a smaller company's operating budget. Many small companies cannot afford to employ full or part-time persons on staff to assure compliance with environmental regulations. They also cannot afford to hire a consultant to carry out these activities. Expenditures resulting from regulations that may not carefully weigh the cost with the benefit derived often provide marginal benefits at costs that result in lost opportunities and business for the electronics firm.

The representatives from the electronics industry who participated in this study recognized the value of an effective and goal oriented environmental protection program. The participants expressed the desire to develop improved working relationships with DEPE and to move away from relationships based upon distrust and towards a problem solving partnership founded on scientific and technical principles. Such a partnership between the state and industry can be mutually beneficial and facilitate economic goal setting, cost benefit analysis, definition of predictable timetables for the application of environmental regulation, and agreement on permit conditions.

The electronics industries expects the State to adopt a strong environmental protection program and trust that the Legislature will include the industry as partners in its development. However, and not withstanding basic agreement with the State's goals, there is considerable unease about the present pattern and practicality of legislation and regulation. From the industry's view, the original purpose of environmental regulations, i.e., improving the environmental standard of life in New Jersey, has become obscured.

The study team and the industry representatives discussed expansion and relocation of manufacturing facilities many times. Several representatives indicated that their firms would not expand in New Jersey. In fact, they indicated that their firms avoided doing anything, such as expanding or re-equipping facilities, that would require obtaining a permit. Most were seriously evaluating ways of exiting from the business or moving their operations to other states or nations with more lenient environmental regulations.

Plastics Processing Industry

The plastics processing industry converts polymer into finished products. This includes operations such as blending, extrusion and molding. According to data reported in the New Jersey County Business Patterns (CBP) in 1987, the plastics processing industry (SIC 308 -- Miscellaneous Plastics Products) contained 613 firms and employed over 32,000 workers with an annual payroll of $666 million. On the basis of the most recent CBP (1990) data, the industry comprises 578 firms with a total of 27,400 employees. Small firms dominate the industry with only two companies having greater than 500 employees and none employing more than 1,000.

According to the Society for the Plastics Industry, approximately 500 additional companies in New Jersey are closely associated with the plastics processors. This includes machinery manufacturers, tool and die shops, and resin producers. The industry is more important to New Jersey's economy than these statistics imply because plastic is a basic industry linked to New Jersey's larger electronics, metalworking, food processing and pharmaceutical sectors. Consequently, the health and competitiveness of the plastics industry are critical to the State's economy and future economic growth.

The recent decision by DEPE to assign a plastics industry ombudsman was a direct response to discussions between the Department and industry. Both the industry and DEPE agree that closer interaction will lead to more predictable timetables for the application of environmental regulations and help clarify permit conditions.

Pharmaceutical Industry

The pharmaceutical industry is one of the largest manufacturing employers in the state of New Jersey. During the 1980's employment by the industry in New Jersey increased by 3.6%, payrolls increased by 90%, the value of products shipped increased 100% and investment in research and development increased by 265%. In 1992, the employment by the industry in New Jersey was just under 55,000 and the total payroll was $2.9 billion. From 1990 to 1992, the pharmaceutical industry increased its payroll in the state by 11.6%, while the overall manufacturing payroll in New Jersey declined 7.6%.

The pharmaceutical industry represents a technological area in which the United States retains competitive leadership worldwide. New Jersey and it's citizens contribute substantially to that worldwide leadership position. New Jersey hosts 10 of the 18 largest worldwide

pharmaceutical companies operating in the United States. Of the 15 pharmaceutical companies listed among the Fortune 500, seven have headquarters in the state. Despite the traditionally robust health of the pharmaceutical industry, increased competition and potential changes in the health care system are threatening the competitive position of the industry. Many companies have already begun reducing their workforce.

The pharmaceutical industry in New Jersey has made significant capital and operating investment in environmental programs during the last ten years. Data from one company in the state shows a total direct capital expenditure for this purpose of $28 million since 1982. Other companies have reported even greater expenditures. The results of these investments and resulting changes in operating practices demonstrate positive movement regarding the industry's impact on the environment. Clear progress can be documented. For example, total release and transfers for the industry as reported by the Toxic Release Inventory data have changed from 65 million pounds for 1987 to 24 million pounds in 1990, the most recent year for which data are available. This represents a reduction of 63.9% in total releases and transfers. The effort to achieve this degree of reduction has been voluntary on the part of the pharmaceutical companies in New Jersey and has resulted from an increased awareness and improved technology, and not from increased environmental regulations. All of the releases and transfers fall within the limits set by the appropriate permits and regulatory parameters.

The pharmaceutical industry participants in this study recognized that there is a new environmental dynamic developing at the national level based upon a realization that American society has obtained about as much environmental improvement and protection from a "command and control" system as can be readily achieved. The new dynamic is seeking alternative systems, likely based upon more effective cooperation between government, industry, and communities. In New Jersey, the pharmaceutical industry would welcome that debate and discussion as a way to develop a new relationship with environmental regulatory agencies to produce an enhanced environmental improvement and protection program. The industry has committed to a policy of good corporate citizenship. This includes retaining a leadership position in corporate responsibility for environmental protection and improvement.

Textile Industry

The size of New Jersey's textile printing and dyeing industry has decreased significantly over the past twenty years. In 1970, the sector employed more than 30,000 workers. The growth of textile and apparel imports and the shift of the U.S. garment industry to the South and West caused most of the erosion of employment since that time. However, in the view of the remaining firms, the high costs of environmental compliance and the perception that the state is hostile to textile finishers have contributed significantly to the decline.

In 1993, the New Jersey textile finishing industry consisted of 74 firms and 3,535 workers. Company size ranges from 50 to 200 employees. Revenues are typically between $1 million and $10 million. Almost all firms are organized by the Amalgamated Clothing and Textile Workers Union. Wages and benefits are competitive with other industries, with an aggregate annual payroll exceeding $85 million.

The finishing industry is a key supplier to the larger apparel and home furnishings sectors. Garment contractors in New Jersey employ 30,000 workers. In the region, the textile product industry employs more than 125,000. If finishing firms decline further, there will be little reason to bring raw textiles to New Jersey from southern mills for transformation into bedspreads, tablecloths, draperies, jackets, skirts, and blouses. The chain of value added that extends from major retailers and famous designers to mills, finishers, contractors and consumers would soon disintegrate.

The representatives from the industry who participated in this study indicated that the industry had achieved a great deal by improving operations and updating technologies to be more environmentally responsive. For instance, over the last ten years, finishing firms have eliminated the use of carcinogenic "benzene" dyes, replacing them with water-based dyes that are more expensive. The industry has absorbed the increased costs. Similarly, these firms have abandoned the use of ammonia in the pre-treatment of raw textiles, replacing ammonia with soda ash that is more expensive.

They have also discontinued the use of dangerous solvents, such as toluene and xylene. Recent technical advances enable the industry to use orange peel-based and similar organic solvents that also are more expensive. They are also beginning to use solvent recycling technology. However, the industry, which consists of small firms, has difficulty funding significant process changes that are not revenue enhancers.

VII. The Environment and Quality of Life in New Jersey

> Quality of life: it is both a perennial concern...and a rather recent preoccupation. It is a topic that permits many different definitions, and for which there is no widely agreed-upon index which allows us to monitor changes in that quality.
>
> *-Report of the President's Commission on The Quality of American Life in the Eighties (1980)*

Quality of life can be defined as an individual's happiness or satisfaction with life and environment (Cutter 1985). Assessing the quality of life in New Jersey as a result of the enforcement of environmental regulations is both an objective and subjective process. Direct measurement of social and environmental indicators are combined with our own individual perceptions of the quality of the social and physical environment to define a quality of life. Factors related to environmental regulation that affect the quality of life in New Jersey include:

1. Objective scientific assessments of environmental quality and risks posed to residents;

2. The subjective perception of residents of the quality of the environment;

3. The efficiency and effectiveness of agency administration of environmental programs influenced, in part, by annual budgets, management capability, and discretionary authority.

Direct measurement of the quality of life is a daunting task. Arriving at a mutually agreed upon set of social and physical variables is difficult (DEPE, Office of Policy and Research 1993). Clean air, a safe drinking water supply, the presence of wildlife, an aesthetic view, personal health - these are a few of the many factors that contribute to an assessment of the quality of life in New Jersey. When forced to identify these attributes for purposes of evaluation, we are often constrained in the factors we choose by the data that exist. There is currently no comprehensive program to assess the success of environmental regulation in improving the quality of the environment in New Jersey. The DEPE is actively working on the development of environmental indicators that will provide the public with an understandable picture of the quality of the environment in New Jersey (DEPE, 1993). Federal and state agencies have a wealth of data but much of it is collected to evaluate the success of a particular program (Eisenhauer and Cordes 1992). In many instances, we must rely on anecdotal information to complete the picture.

Attributing an improvement in the quality of the social or physical environment to a specific environmental rule provision is difficult. Benefits that accrue as a result of the enforcement of environmental statutes, rules and regulations are difficult to separate out due to a number of factors including legislative language, public perception and the obscuring of success by offsetting circumstances. More often than not, there are no specific goals on improvement to

be made in the environmental legislation that would allow for a direct assessment of success. Identification of benefits is further complicated by the fact that environmental statutes are not always resource-based; they address one specific media and not the overall health of an ecosystem. Success in one policy area can be masked by less than adequate progress in another. Cross-media relationships, where stringent standards and aggressive policies for one area can transfer environmental stress to another area, can obscure the overall success of an environmental rule. We can only infer that if improvements have occurred then the presence of environmental regulations must be included as one of the factors influencing the outcome.

Methodology Utilized For Quality of Life Section

As part of the study of the economic impact of environmental regulations, NJIT convened two focus groups to discuss quality of life improvements in New Jersey that could be attributed in whole or in part to the enforcement of environmental statutes, rules and regulations. NJIT selected potential focus group participants with consideration given to recommendations from faculty, DEPE and the Partnership for New Jersey. The participants in these two focus group sessions represented a range of public and private nonprofit groups including environmental, conservation, public health, local government and county planning, and community development. Members of DEPE's Division of Policy and Planning also attended both sessions.

NJIT's invitation included a list of 'thought provoking' questions listed in Table 2 which follows. The questions were used to elicit positive cases that could demonstrate or document improvements to the environment as a result of the enforcement of environmental regulations. The first focus group session was held at Stockton State College on June 8, 1993. The second focus group session was held at NJIT on July 14, 1993. The first focus group was facilitated by Dr. John Opie, Dean of the College of Science and Liberal Arts at NJIT. The second focus group session was facilitated by Dr. Susan Lederman, Director of the Graduate Program in Public Administration at Kean College of New Jersey. Each session lasted approximately two hours. The participants explored a number of environmental issues including administration, legislation, priority setting, the efficacy of environmental policy, the costs of environmental improvement and specific cases that highlight environmental improvements.

The sessions were taped and transcribed. The transcriptions formed the basis for the development of a white paper and subsequent case studies. The first draft of the white paper was made available to each participant for review and modification. The final was submitted to each participant for review.

In addition to the two Quality of Life focus group sessions, members of the Study Team met with DEPE staff on June 23, 1993 to discuss research in progress at DEPE that might relate to the project such as the environmental indicators project and the benefit analysis of the municipal sector study.

Table 2. Focus group discussion questions, Stockton State College, June 7, 1993.

The following questions are intended to stimulate discussion in three areas:

- the quality of the environment in New Jersey;
- the effectiveness of New Jersey's environmental legislation and regulations; and,
- the influence of private and not-for-profit interest groups, including citizens, on the State environmental regulation process.

Your perception and your organization's perception of the improvements to the environment in New Jersey over the past decade.

- What are the most significant environmental achievements in New Jersey over the last decade?
- In what specific ways has the quality of the environment improved and the risks posed to the environment decreased over the last decade?
- How would you compare the environmental improvements in New Jersey to the rest of the nation?

Your perception and your organization's perception of the effectiveness of the New Jersey Department of Environmental Protection and Energy (DEPE).

- Are there indicators that DEPE has succeeded in fulfilling its mandate to uphold and enforce environmental regulations? Are these indicators measurable?
- In what ways has DEPE succeeded in exercising its discretionary authority when enforcing environmental regulations?
- Please give examples of instances with which you are familiar when DEPE responded in a timely and appropriate fashion to hazardous accidents or potential problems.
- Has increased knowledge and awareness of environmental issues by the public-at-large led to increased public concern for the quality and effectiveness of DEPE's efforts? If yes, in what ways?

Your perception and your organization's perception of the influence of private and not-for-profit groups and individual citizens on environmental regulation and enforcement.

- What role have private and not-for-profit organizations, as well as individual citizens, played in promoting environmental legislation and regulation and promoting enforcement of regulation? Please give concrete examples.
- Please provide examples of DEPE's responsiveness to the opinions, views and concerns of citizens regarding environmental quality issues.

Purpose of *Environment and Quality of Life in New Jersey* Section

The purpose of this *Environment and Quality of Life in New Jersey* section is to highlight cases which demonstrate some of the benefits that have accrued to New Jersey residents as a result of environmental regulation. For ease of presentation these benefits are grouped as:

- Air
- Water
- Land
- Land/Water Interface

An attempt is made to include improvements that have occurred to the physical environment and resulting improvements to the social environment over the last ten years.

Environmental Improvements in New Jersey

New Jersey is considered an environmental leader. Rankings of state environmental initiatives have consistently placed New Jersey in the top ten and often in the top five states in the nation (e.g. Fund for Renewable Energy and Environment 1987; Renew America 1989). Despite these high marks, a question remains. Has the quality of New Jersey's environment improved? Scott Weiner, former Commissioner of DEPE (1991-1993) answered yes in a July 1993 interview with *The Star-Ledger*. Weiner indicated as evidence the fact that "people see shad returning to the Delaware River, whales along the Atlantic coastline and a more visible New York City skyline when they drive down Route 3" (Johnson 1993). Others point out that shore visitors during the summer of 1993 were able to observe marine life in coastal waters (Borondy 1993).

Previous studies of the impact of environmental regulations have focused on infrastructure and the effect on municipalities (Singh 1991; The Foundations of the New Jersey Alliance for Action 1991; DEPE, Office of Policy and Planning 1993). In *Municipal Sector Study Phase II: Impacts of Environmental Regulations on New Jersey's Municipalities*, DEPE documented the benefits which accrue as a result of regulations governing drinking water, solid waste, and waste water management (DEPE, Office of Policy and Planning 1993). These areas also were the focus of the first phase of the study, *Municipal Sector Study-Phase I: Impacts of Environmental Regulations on New Jersey's Municipalities*, and are of primary concern to municipalities (Singh 1991). The results demonstrate the costs avoided in water treatment, solid waste disposal and tourist income that could occur in the absence of regulation.

The study team selected the following cases from suggestions and recommendations of focus group participants and the available data. The purpose of the following cases is to provide narratives of environmental improvements that have occurred. In many cases, a single rule or provision cannot be isolated as the reason for the improvement. The intent is to demonstrate that the overall effect of environmental regulations has improved the quality of life in New Jersey.

Where possible, we have relied on the published literature to guide our assessment of improvement and the benefits derived from such improvements. Some of the information presented is anecdotal; until we are able to develop a more comprehensive methodology for monitoring the overall health of the environment around us, we remain reliant on the narratives of others who have witnessed change through time.

Air

Three problems associated with poor air quality are:

- Increase in health problems (Cody, et.al. 1992)
- Decrease in yields of crops that are sensitive to changes in ozone levels (Clark, et.al. 1990)
- Increase in soiling of public buildings due to particulate matter (Creighton, et.al. 1990)

New Jersey has not exceeded the standard for carbon monoxide over the past year, and the frequency at which the federal ozone standard is exceeded has decreased (Johnson 1993). This is particularly important as an indicator of an improved quality of life based on findings of previous investigations relating ozone levels to asthma attacks among residents and to crop yields in the state.

- Cody et.al. (1992) revealed a statistically significant association between ozone levels and the frequency of hospital visits between the months of May and August in central and northern New Jersey.
- Ambient ozone levels in New Jersey have been linked to significant reduction in tuber yield of sensitive white potato genotypes when foliar injury exceeds 20-40% (Clarke, et.al. 1990).
- Damage to private and public property has been related to air pollutants. The EPA estimated, in a 1987 report, that criteria air pollutants resulted in $20 billion in property damage costs (Stansfield 1988).

Preventing Toxic Emissions

The Toxic Catastrophe Prevention Act (TCPA) is a program directed at preventing industrial accidents that lead to releases of toxic substances at facilities. The law was enacted in response to 19 incidents of chemical releases to the air in northern New Jersey over a five month period in late 1984 (Stansfield 1984). There were a total of 600 businesses affected by the provisions of the TCPA when first promulgated. There are now only 140. There were originally 800 sites affected; the current figure is less than half. Reasons given by the DEPE

for the reduction are that it is cheaper and easier to move dangerous amounts of toxic substances off-site or to use other less toxic materials (Curtis, personal communication).

Water

Contamination of the state's waters can result in:

- Habitat destruction,
- Impairment and mortality of marine organisms, and,
- Adverse affects to human health.

Improvements to Drinking Water Quality

The 1984 amendments to the New Jersey Safe Drinking Water Act mandated that public community water supplies monitor water delivered to consumers for 22 synthetic organic contaminants. The DEPE adopted maximum contaminant levels (MCL) for 16 of these 22 contaminants in 1989 (DEPE, Bureau of Safe Drinking Water and Division of Science and Research 1992). Table 2 presents the percentage of public community water systems reporting the presence of at least one of 16 hazardous contaminants. Accepting the limitations of the data (sampling, testing procedures) the numbers show a decrease in the number of systems reporting hazardous contaminants exceeding the maximum contaminant level (DEPE, Bureau of Safe Drinking Water and Division of Science and Research 1992). The majority of volatile organic contamination was found in ground water sources. Treatment, new facility construction and development of alternative sources have reduced the number of facilities producing water with detected contaminants greater than the MCL.

Table 3. Percentage of public community water systems reporting detectable levels of hazardous contaminants greater or less than the maximum contaminant level (MCL).

Year	No Detected Contaminants	Detected Contaminants <MCL	Detected Contaminants >MCL
Initial	80	4	16
1985	75	4	21
1986	78	10	12
1987	81	8	11
1988	73	11	16
1989	75	15	10
1990	71	21	8

Source: (DEPE, Bureau of Safe Drinking Water and Division of Science and Research 1992)

Environmental regulations have proved successful in improving surface water quality. The Passaic Valley Water Commission has cut its budget for chlorine by approximately 50% because of improvements to water quality and closer attention to operations. A fish study conducted several years ago on the Passaic River found 4 species of fish present at the Passaic Valley Water Commission's water intake area at Little Falls. Recently there were 27 counted (Filippone, personal communication).

Saving an Estuary: Delaware Bay

The Delaware estuary is approximately 134 km long, extending from the mouth of the Delaware Bay to the falls at Trenton, New Jersey (AMS 1992). The watershed area includes four states and covers over 13,000 square miles (AMS 1992). As outlined in the *Preliminary Conservation and Management Plan* (American Management Systems, Inc. 1992; Gastrich 1992) the estuary has a history of multiple uses:

- 70% of the oil arriving at U.S. east coast ports is transported through the combined ports of Philadelphia.
- 20 million people rely on the Delaware River basin as a source of drinking water.
- Over 162 industrial and municipal concerns discharge to the estuary.
- The estuary is the largest spring staging site for migratory shorebirds on the eastern seaboard of North America.
- Over half a million people use the estuary for recreation.

The overall health of the estuary continues to be affected by point and nonpoint source discharges that degrade water quality and result in decreases in habitat, living resources, and recreational opportunities (American Management Systems 1992). Despite numerous potential threats to water quality in the estuary, environmental controls and management efforts have resulted in significant improvements over the past 27 years. For example:

- Secondary treatment at municipal treatment plants has reduced organic loading by more than 75% since the early 1970s.
- The size of the American shad spawning population and the area in which spawning takes place has increased.
- The average catch of young-of-year striped bass has increased by more than an order of magnitude.

- Some raptors, such as the osprey and bald eagle, have increased in numbers due to the banning of DDT and subsequent reduction of DDT residue in the estuary.

The Delaware estuary case highlights the importance of a planning process to identify activities that can threaten the health of fragile ecosystems. The efforts of several agencies and educational institutions from three states have developed a successful resource-based program that is focused on establishing baseline data and a method for long-term monitoring that will enable managers to track environmental quality and target limited resources on the most pressing problems.

The Hackensack Meadowlands: Successful Regulation and Effective Public/Private Partnerships

In just over twenty years, wildlife management, planning, environmental laws and regulation, and effective corporate and governmental leadership have helped the Hackensack Meadowlands bloom from a virtual wasteland to a thriving economic zone and an important estuary and habitat for birds, fish and invertebrates. Prior to passage of the New Jersey Hackensack Meadowlands Reclamation and Development Act in 1969, lax environmental laws and dumping in area landfills had rendered the Meadowlands an eyesore and an uninviting location for first class economic development. The landfills had been initiated and flourished during a period when there were few or no regulations to prescribe their operations.

Most of the landfills ceased to operate before, or shortly after the creation of the Hackensack Meadowlands Development Commission (HMDC). The current landfill operations are subject to strict regulation by the HMDC, the Board of Public Utilities and DEPE. Today, the 32 square mile Meadowlands, which wind through Seacaucus, East Rutherford, Rutherford, Lyndhurst and Kearny, is a well-known rest stop for blue herons, peregrine falcons and yellow-legged sandpipers. Striped bass and snapping turtles swim the channels and even a bald eagle has been sighted.

The public/private effort to revive the Meadowlands serves as a model for other reclamation projects and environmental management in general. The HMDC orchestrates a reclamation, planning, development and redevelopment effort that includes extensive educational and research programs. The keynote for HMDC's success in balancing economic growth with environmental protection has been collaboration and industry-government-citizen-educational partnerships.

Land

Land use decisions (i.e., setting the location and density of activity) are of great concern to local residents. Keeping development away from wetlands and flood hazard areas, preventing potentially threatening activities from locating over critical ground water supplies, and setting policy on waste disposal practices are preventative measures that decrease the potential costs of remediation (Cooper, personal communication).

There is no question that benefits accrue due to wetland protection. Wetlands provide a measure of flood protection, habitat for fish and wildlife, and a buffer zone to protect water quality (Fair 1990). A 1978 study by the Department of Biology and Economics at Tufts University demonstrated that one acre of wetland provides between $153,000 and $190,000 (1978 dollars) of public value (Fair 1990). Public value was defined as the benefit that accrued from flood prevention, water pollution reduction, and recreational amenities (Thibodeau and Ostro 1978).

Recycling: Environmental Improvement and Job Generation

Although Pennsylvania leads the nation in recycling efforts (Sloanne 1993), New Jersey has developed a strong track record in this area with participation from the public and private sectors (Rabe 1991; DEPE, Division of Solid Waste Management 1992). The State of New Jersey adopted the Statewide Mandatory Recycling Act in 1987 in response to the growing costs and environmental problems associated with land filling solid waste.

The Act mandates that all municipalities recycle a minimum of three materials from the municipal solid waste stream (Sudol 1993). The success of the program relies on the participation of residents. A *Star Ledger/Eagleton* poll in 1993 revealed that 97% of New Jersey residents recycle, an increase of 48% since 1985.

The recycling effort in the City of Newark exemplifies the benefits of this environmental strategy to achieving environmental quality goals and increasing the opportunity for job generation. Since 1986, and the publication of its "Waste Utilization Study," the City has reduced solid waste disposal costs by approximately 50% through the use of source reduction strategies, recycling, and waste to energy conversion. The recycling rate in the City of Newark during 1992 was 48.1% compared to the state-wide recycling rate of 52% (Sudol 1993). Recycling is conducted through the use of some 80 recycling markets and secondary material processors located in Newark. In 1992, the city saved $4 million in disposal costs and collected $33,000 in direct revenue from recycling (Newark Department of Engineering 1993). Recycling has added to the economic base of the city. The following are two examples of businesses that are profitable due to environmental regulation in the state.

- Distributor's Recycling (Recycling Enterprises, Inc.), opened in Newark in 1983 to process New York's "bottle bill" containers, expanded in 1988 to accept recyclable material from New Jersey's recycling program. The plant employs approximately 100 people; many reside in Newark (Sudol 1993).

- Newark Boxboard recycles all of the city's newspapers, junk mail, telephone books and other waste paper. The company is able to pulp, produce chipboard and convert to product in one location. This integrated approach to paper recycling insures a product market for the city's recycled paper products even in declining regional markets (Sudol 1993).

The Land/Water Interface

It is difficult to speak about New Jersey without mentioning the Shore. The Jersey Shore is a vital resource to both the quality of life of New Jersey residents and the economy of the state. An estimated $8.9 billion is generated annually from the shore-oriented tourist economy.

In the summers of 1987 and 1988, floatable debris washing up on the Jersey shore became a serious public policy issue. Of particular concern was the medical waste that was found on the beaches and too frequent beach closures. The Hudson-Raritan estuary is the primary source of floatable debris to the Atlantic Bight area. Debris was being flushed from the estuary during the spring freshet (Swanson and Zimmer 1990). Floatables can result in public safety problems, potential public health effects, impacts on marine organisms and shore birds, and added costs of cleanup. Swanson and Zimmer (1990) report that the 1988 incident resulted in an estimated loss of 6.7 - 37 million user days and a loss in direct beach related expenditures estimated to be in the range of $239 million -- $1,420 million in 1987 dollars.

Operation Clean Shores

The State of New Jersey responded to the debris wash-up problem by establishing a cleanup operation. Operation Clean Shores is not a regulatory program but a cooperative effort between DEPE, the State Department of Corrections, local municipalities and private industry. A total of 23.4 miles of shoreline from the George Washington Bridge to Sandy Hook were cleaned of debris using prison labor and equipment from the participating municipalities. Approximately 6 million pounds of floatable material were removed from these beaches during the first year of the program, preventing the washing up of this debris on the bathing beaches to the south (DEPE, Division of Water Resources 1990). By 1992, the total had reached 36 million pounds and the length of shoreline cleaned increased to 84.8 miles to include the ocean and bayside of Gateway National Recreation Area at Sandy Hook, the Atlantic barrier islands and the Delaware River and Bay (DEPE, Office of Enforcement 1992). Table 3 presents data on beach closings forced by floatable debris and bacteria for the years 1988-1993. These figures reveal the success of the Operation Clean Shores Program.

Table 4. Beach closing forced by floatable debris or excessive bacteria.

Year	Debris	Bacteria	Total
1988	19	784	803
1989	9	35	44
1990	10	22	32
1991	0	10	10
1992	0	27	27
1993*	0	0	0

* as of June 1993 (Source: Johnson 1993)

The benefits of this program are significant. The shoreline is significantly cleaner and a recent *Star Ledger/Eagleton Poll* (1993) indicates that the public believes this to be true. Seventy-three percent of New Jersey residents believed that ocean pollution was a very serious problem when surveyed in 1989; in 1993 the number had reduced to 50%. Shoreline that was previously rendered unusable was identified as adequate for recreational activity, and the return of wildlife was observed in areas where floatables had been removed (DEPE, Division of Water Resources 1990).

The Operation Clean Shores program is successful at remediating some of the spillover effects of environmental practice in other states. This highly visible, low-cost program demonstrates the effectiveness of cooperative, nonregulatory efforts to tackle seemingly unmanageable problems. As federal and state governments continue to sort out the complexity of environmental problems that transcend political boundaries, efforts in the spirit of Operation Clean Shores offer a cost-effective approach that demonstrably improves the quality of life.

Conclusions: Environmental Practice and the Quality of Life in New Jersey

The cases presented in this section demonstrate substantive improvements to the physical and social environment in New Jersey. Of equal importance to the observable changes taking place is the method employed to achieve these improvements. Management alternatives are numerous; choosing the correct alternative for the problem at hand is crucial to achieving successful outcomes. It must also be recognized that the "quality of life" depends on many more factors than just environmental improvement.

The public often looks to laws and regulations for both technical and administrative guidance in translating environmental quality goals into practice. There are other management strategies that may incorporate legal action, but do not rely solely on a regulatory control structure. New Jersey should move boldly to develop such programs. Each of the cases presented in this review highlights the strengths of different management strategies and points to the effectiveness of environmental practice that actively works toward the prevention of environmental deterioration and embraces government-industry-citizen partnerships that are integral to their success.

VIII. Crosscut Issues and Recommendations on the Economic Impact of Environmental Regulations

Over the last two decades, New Jersey has set a standard by which other states judge their environmental progress. The cost to business and industry for this leadership progress has been significant. This study attempts to separate fact from rhetoric and to move beyond the a priori categories and dichotomies that have generally framed discussions of the economy and the environment. The recommendations in this report attempt to move beyond the traditional arguments to seek a common ground on which industrial health and growth can coexist with effective environmental regulation.

This report identifies 24 critical issues that impact on all of New Jersey's businesses and industries. Many of these issues also impact on county and municipal government, school districts and universities. While these issues affect the ability of both small and large companies to do business in New Jersey, the economic impact is more severe on small businesses than on large businesses.

The increased burden on small business is caused primarily by the lack of financial resources and in-house expertise to process the complex and often confusing paperwork related to regulations. Small companies often have one, or at most a few, managerial level employees. These people do marketing, personnel management, technical and financial management, as well as environmental compliance. The study team found that the owners of small businesses tended to blur the line between federal and state regulations. Consequently, DEPE, because it is the prime enforcement agency, often is "blamed" for the impact of both state and federal regulations. The 24 critical crosscut issues fall into the following nine categories:

1. Excessive fees and fines
2. Overly adversarial relationship to business and industry
3. High compliance costs
4. Burdensome paperwork
5. Overlapping and redundant regulations
6. Unnecessary state-of-the-art technology requirements
7. Obstacles to research and development activities
8. Right-to-know labeling and reporting requirements
9. Compliance assistance for small businesses and manufacturers

Some of the 24 issues are rather simple, and the state can address them quickly at little cost. A number of reporting and paperwork problems fall into this category. Other issues are complex, such as DEPE worker attitude problems, and will require a concentrated effort to change. Some issues, such as fees and fines, will require legislative changes. The study team believes that a partnership including State government, business, industry, academia and citizens can resolve the identified crosscut issues in a manner that protects both the environment and the state's economy. Towards that end, this report makes 46 recommendations that address the identified issues.

Crosscut Issues and Recommendations

Each of the following issues and recommendations is numbered. Some issues have more than one related recommendation.

Issue: Excessive Fees and Fines

I-1. DEPE fees are excessive and often unrelated to the tasks the Department performs in reviewing permits or monitoring industrial performance. Permit maintenance fees are considerably higher in New Jersey than in other states. A NJPDES annual permit fee for a major facility in the State of New Jersey can cost as much as $750,000. In a neighboring state, a plant that has about 90% of the discharge volume at the same point as a New Jersey plant across the river pays a net annual permit maintenance fee of $11,200. Similar differences can be found in air permits and hazardous and solid wastes permits.

I-2. Fines are high and often unrelated to the seriousness of violations or damage to the environment. There is a widespread perception that DEPE raises fees and levies fines primarily to generate the revenue needed to meet its payroll. In 1988, DEPE derived just over 20% of its funding from fees and fines. Today, that amount has risen to over 80%.

In addition, millions of dollars raised by the corporate surcharge for hazardous waste cleanup have been diverted to the state's general fund in order to balance the state budget during the recent recession rather than being spent to cleanup sites.

I-3. Dedicated fees and fines which finance individual regulatory programs have the potential to inhibit executive and legislative oversight.

Recommendations

R-1. The state should abandon the current policy that treats DEPE as an agency to be funded primarily from user fees and fines. As a first step, revenue from DEPE fees and fines should be deposited into the state's general fund.

R-2. DEPE should fund its staff positions and operations through the normal state appropriation process. Staffing should be at adequate levels to allow for efficient and effective services.

R-3. Fees should relate to the tasks the Department performs or the services the Department provides. A schedule for fines should be established in which the amount of fines relates to the seriousness of the violation.

R-4. Fees and fines should be set at levels that are competitive with those set in other states, particularly neighboring states. They should be set to provide positive as well as negative incentives.

R-5. DEPE should review all of its operations to identify areas in which the Department could contract with private firms to provide services and operations now provided by Department personnel. In appropriate areas, privatization of operations holds promise to reduce costs and improve the Department's response time.

Issue: Overly Adversarial Relationship to Business and Industry

I-4. There is widespread perception throughout industry that DEPE staff members do not understand the fundamental principles that drive the industries that they regulate. DEPE staff members seem to lack a full appreciation for the importance of time as a resource to industry. Delays in processing permits seem to be a way of doing business.

I-5. In many circumstances, an adversarial relationship between DEPE and business and industry may develop as a direct result of the Department's regulatory and enforcement responsibilities. However, industry, and manufacturing in particular, tends to perceive DEPE staff as overly adversarial and unsympathetic to the cumulative burden placed on industry by environmental laws and regulations.

At the same time, some groups argue that DEPE should maintain a clear adversarial position with industry to ensure protection of the environment.

I-6. There is a perception on the part of industry that frequent personnel turnover at management levels in the Department leads to unclear understanding of state environmental policies and objectives at staff operating levels. Moreover, there is clear concern throughout industry that attempts by industry to modify permit and regulatory recommendations by discussions at higher departmental levels will result in retribution by lower levels in the bureaucracy when the same companies file future permit applications.

Recommendations

R-6. The state should expand recent efforts by DEPE Commissioners and sub-cabinet executives to increase departmental responsiveness to all clients. Responsiveness should be a value at all levels of the organization.

R-7. DEPE should conduct advisory "inspections" or "reviews" with no penalties to help industry identify and correct compliance problems.

R-8. DEPE should establish clear time frames for required action on permits and other agency decisions. All permitting processes should include a designated staff person to facilitate and expedite permit applications.

R-9 DEPE should expand to other manufacturing sectors the ombudsman service provided to the plastics industry. The ombudsman service should be part of a "circuit breaker" system to prevent unnecessary problems and damage to individual firms and to the regulated community. The ombudsman should serve as a single point of contact for complaints and requests for general information from business and industry. The ombudsman should be authorized to cut across bureaucratic and jurisdictional lines.

R-10. The state must provide training to assist DEPE staff to:

- Understand the regulated industries for which they have responsibility;
- Increase responsiveness through improved customer service attitudes;
- Improve the effectiveness and efficiency of DEPE operations through implementation of generally accepted management practices such as total quality management (TQM).

R-11. In addition to expanded training and development programs for DEPE staff, the State should establish an employee exchange program in which DEPE staff would work within selected industries to obtain a better understanding of the private sector and industrial processes.

Issue: High Compliance Costs

I-7. Complying with environmental statutes and regulations is costly to industry in a variety of terms: the loss of commercial or business opportunities, the expenditure of employee time, the purchase of new equipment, the implementation of new technologies, and the addition of legal and consultant fees. An often overlooked cost is interest payments on debt service undertaken as the result of delays in permitting. Delays by DEPE increase costs to both private and public entities. Perhaps the most serious delays in DEPE occur in the Historic Bridge Review Process. That unit has

delayed action on millions of dollars of road construction throughout the state. This has a negative impact on highway safety and the creation of construction jobs.

I-8. Perhaps most costly is the loss of managerial capacity during those periods of time while management is focused on environmental and bureaucratic matters arising from environmental legislation, rules and regulations.

I-9. Many environmental laws and regulations require major expenditures to remediate problems that represent lower level risks than known problems that pose greater risk. These laws and regulations often require major additional expense for marginal benefits.

Recommendations

R-12. Environmental regulations should be based on unbiased observations, analyses and measurements of the potential risk for harm to health, safety or environmental integrity presented by a process or substance. Environmental standards should not be mere reflections of "how low" a level can be measured and not just a response to a public "outrage" factor based upon a contamination or pollution incident.

R-13. There should be a realistic assessment of the true cost to the state and the true cost to industry before the implementation of proposed legislation, rules or regulations. This environmental impact analysis should be conducted as the legislation, rules and regulations are developed and again as they are implemented. For example, once a major piece of legislation clears one house, DEPE should prepare an implementation report.

R-14. DEPE should establish a council of citizens and experts from academia and industry to advise the department on the drafting and implementation of regulations. As an advisory body, the council could respond promptly to avoid the possibility of adding to the bureaucratic burden.

R-15. The state should establish a regulatory system that allows workers the flexibility and discretion to resolve issues at the lowest staff level possible within policy and statutory guidelines.

R-16. A formal process should be established to provide DEPE with increased discretion to grant variances and exceptions to certain regulations when such exceptions would cause no environmental harm but would prevent substantial negative impact on the economic viability of an enterprise. Analogous administrative flexibility is available in other public policy areas such as through the uniform construction code and local boards of adjustment.

R-17. The state should establish a formal process to require conflict resolution and negotiation strategies for resolving interagency and government and industry conflicts

related to the enforcement of environmental regulations. This process should include independent mediators with the power to recommend approaches to resolve such conflicts.

R-18. A formal process should be initiated among the Department, industry, and the environmental community to find areas of agreement about legislative change and to carry forward these recommendations to the Legislature.

R-19. DEPE should encourage target manufacturing sectors to propose long-term environmental compliance contracts. This would be particularly helpful in sectors dominated by small firms. The process of negotiating these agreements would create beneficial collaborations between DEPE and industry. Typical compliance contracts might cover design and implementation of testing programs, standard setting, source reduction goals, and the determination of acceptable control technologies. Compliance contracts:

- Allow for dynamic input from industry into DEPE's regulation and enforcement planning;
- Clarify goals, schedules, and technical methods; and
- Offer protection from citations during the interim between the contract and full compliance.

Issue: Burdensome Paperwork

I-10. Paperwork related to the implementation of environmental regulations and rules is complex, confusing, burdensome, at times duplicative, and often overwhelming for industry, particularly small manufacturers.

I-11. Industry perceives that a significant amount of the unnecessary paperwork required by New Jersey regulations arises from DEPE's continuing distrust about the ability and willingness of the regulated community to comply. It appears that lack of trust is at the root of requirements to certify and recertify information and requests. Industry participants described numerous incidents whereon DEPE required excessive record keeping but did not use the recorded data for compliance monitoring or control. A specific example is the VOC (Volatile Organic Compound) record keeping requirements in N.J.A.C. 7:27-16.2[n].

One corporation created 35,000 new records each month to meet this regulatory requirement. The daily records were so complex and numerous that the firm had to develop a computerized data collection system. According to the firm, the corporation has never:

- used the records for any reporting requirement for any permit;
- sent any information stored in the database to DEPE; or

- had to review the database with any enforcement person, except for one question during an inspection.

The company estimated that prior to the implementation of the computerized database collection system, staff took 10 weeks compiling the data manually. The computer system reduced that effort, but the company still spends in excess of seven worker weeks per year to comply with this requirement. Clearly, the requirement for excessive record keeping without a logic or need for the information is costly to business and undermines the credibility of DEPE.

I-12. Small manufacturers generally do not have specialized staff to process the technical and legal paperwork required to comply with environmental regulations. Large industry is impacted, as well, by having to add significant numbers of staff to manage the many required reports.

Recommendations

R-20. The Commissioner of DEPE should establish a special task force to begin a paperwork reduction effort as soon as possible. The task force should involve, as resources, the Cabinet and Citizen Committees on Permit Coordination and other appropriate groups.

R-21. The state should adopt a practice of writing environmental statutes, rules and regulations in clear and precise language.

R-22. DEPE should eliminate unnecessary paperwork and delays. Information and data collected should be the minimum required for enforcement. Duplicate reports should be eliminated.

R-23. Where information and data must be submitted to federal authorities, DEPE procedures should allow incorporation of that information and data in state reports by reference and not require separate reporting.

R-24. All processes should be automated with an on-line computer link supported with DEPE templates and help screens to assist those dealing with the agency. An easy to use on-line system should be developed to simplify issuance of permits and reporting by the regulated community and to reduce paperwork to a minimum.

R-25. DEPE should establish a single, agency-wide data base. A single data base would reduce the amount of repeat information required to be submitted by permit applicants and would increase agency efficiency and effectiveness. This data base system should be amortized against the savings achieved. Consequently, these improvements could be funded from savings achieved rather than by new fee surcharges.

Issue: Overlapping and Redundant Regulations

I-13. Environmental regulations often are overlapping, redundant and the allocation of resources is often based on public perception of risk rather than scientific evidence.

I-14. Regulations tend to be developed piecemeal and are driven more often than not by requirements for permits.

I-15. Unpublished internal management guidelines and procedures often are more important than rules and regulations in determining DEPE actions.

Recommendations

R-26. Informal management guidelines are important to allow for flexibility in Departmental operations, but guidelines and provisions that have an impact on compliance requirements should be made known and made available to the regulated community.

R-27. The state should develop and adopt an environmental protection planning process to provide a framework for developing and evaluating environmental legislation and regulations. The planning process should focus on identifying and minimizing those risks that pose a danger to the environment and to the health, safety and quality of life of the citizens of New Jersey. The process should lead to the development of an environmental master plan that takes into consideration the needs and aspirations of all stakeholders. The master plan could provide a degree of stability by setting the framework to eliminate duplication of statutes and regulations and reducing unnecessary costs to business. The master plan should be updated every five years.

R-28. The state should eliminate redundant statutes, rules and regulations, and eliminate the incidence of multiple authority by different agencies and different levels of government.

R-29. DEPE should seek consistency with federal regulations and definitions, e.g., the New Jersey definition of hazardous materials includes oil whereas the federal definition designates oil as a recyclable. Listing oil as a hazardous waste increases the cost of collecting and transporting the oil that, in turn, reduces the number of used oil collection centers.

R-30. Wherever possible, federal and state requirements should be combined as a single standard for business. Where New Jersey regulations or definitions differ from their federal counterparts, there should be an analysis providing both environmental and economic justifications for the difference.

Issue: Unnecessary "State-of-the-Art" Technology Requirements

I-16. Many environmental laws and regulations require major expenditures for high technology, state-of-the-art solutions to problems that represent low level risks. These laws and regulations often require major additional expense for marginal benefits.

I-17. DEPE interprets the provisions of the Air Pollution Act to require installation of "state-of-the-art" control technology whenever a new permit is required. Industries must, therefore, install new control technology even when the new permit covers a process change, a change in equipment configuration, or the desire to install an improved control device.

I-18. "State-of-the-art" requirements are costly disincentives that discourage industrial change in air permit and other regulatory programs. The requirement discourages change even when such change could result in pollution prevention, or other types of environmental improvement.

I-19. The "state-of-the-art" requirement turns almost all permit application processes into negotiations, often adversarial, which are driven by considerations of relative capabilities of various technologies rather than the level required to protect the environment and human health.

Recommendations

R-31. The state should establish an independent Office of Technology Assessment (similar to the federal office) to periodically evaluate the technical decision base used by State agencies for permits, rule making and their modification.

R-32. DEPE should re-organize regulatory priorities to maximize the effect of the limited resources available.

To facilitate public acceptance, DEPE and industry should give greater attention to educating the public on the nature of risk and the importance of issues such as:

- Non-point sources of water pollution
- Reducing levels of radon in buildings
- Incorporating pollution prevention into the design of products

R-33. DEPE should limit the use of continuous emission monitors to critical public health related issues where the measurements are meaningful and necessary.

R-34. In requiring control technology, the Department should carefully weigh the costs of compliance with the environmental benefit potentially derived. A potential marginal benefit may not justify a certain significant cost increase.

R-35. DEPE should modify the state-of-the-art technology requirement to cover only new source applications, but to allow alternative technology for modification of existing sources, where requested modification results in environmental improvement.

R-36. When selecting technology to comply with "state-of-the-art" requirements, DEPE should give first consideration to risk reduction rather than increased technical ability to detect and measure chemical entities.

Issue: Obstacles To Research and Development Activities

I-20. Research and development and high-technology manufacturing are pinions of New Jersey's economy. In many ways, the economic future of the state depends upon vigorous and productive R&D activities. Yet, the state's environmental regulatory system frequently serves as a major disincentive for establishing or maintaining R&D facilities and activities in New Jersey. For example, New Jersey requests information about every material used in a laboratory fume hood, even though in most cases, such hoods do not need a permit to operate. Frequently, DEPE delays action on requests for new R&D permits or modifications of permits for long periods of time, making it difficult to initiate critical R&D activities.

I-21. New Jersey's regulation of R&D goes beyond the federal EPA requirements. The preamble to the federal operating permit rule specifically addresses the issue of whether an R&D operation is required to have a Title V operating permit, stating:

> Although EPA is not exempting R&D operations from Title V requirements at this time, in many cases, states will have the flexibility to treat an R&D facility as separate from the manufacturing facility with which it is co-located. Under such an approach, the facility would then be required to have a Title V permit only if the R&D facility itself would be a major source of emissions.

For New Jersey R&D operations, this should mean that as long as their VOC emissions from facilities co-located with manufacturing sites are maintained below 25 tpy, no operating permit would be required. However, the operating permit program proposed by DEPE has complicated this issue, and essentially has eliminated EPA's R&D provision. DEPE is proposing applicability criteria that will require inclusion of R&D areas in the operating permit unless a facility is used "solely" for R&D purposes. This does not acknowledge the fact that R&D is an intermittent activity.

Under the proposed criteria, no facility that carries out R&D and manufacturing operations with the same equipment can exclude the R&D emissions from the operating permit program. Many smaller operations have only one set of equipment

that they utilize for both R&D and manufacturing. Larger operations have permits that allow pilot plants to be utilized for manufacturing 90 days per year and dual batch and pilot plant permits that allow both types of operations at the same time. These types of R&D operations would have to be included in the operating permit program, and would subject R&D to all the monitoring, reporting, and record keeping requirements of the program. Such inclusion would be costly and extremely burdensome to industry, with no concomitant benefit to the environment.

Recommendations

R-37. The state should target R&D as a prime industrial activity to be encouraged and supported. Rapid change is a characteristic of laboratory and related research and development activities. The state should recognize the critical nature of rapid change by establishing a fast response permit and regulatory capability.

R-38. The fast response permit and regulatory system should be based on risk reduction or minimization founded on an unbiased scientific methodology and not on a rigid interpretation of regulations designed for manufacturing operations rather than research and development.

R-39. The regulatory approach should be based upon information capabilities of a research facility and should not require collection and compilation of data that do not result in a significant increase in environmental protection. Information and paperwork demands upon researchers should be kept to an absolute minimum.

R-40. The state's environmental regulations should recognize the fact that pilot plant, pre-production and operational test activities are a critical part of the R&D enterprise. Regulations should recognize the need for rapid change in the materials and processes being evaluated at these facilities.

Issue: Right-to-Know Labeling and Reporting Requirements (New Jersey Department of Health and DEPE)

I-22. The universal labeling requirements of the Right-to-Know program, particularly for in-process material and very small containers, are overly complex and burdensome. They have resulted in substantial increases in operating expenses for little or no increased benefit to the public's health and safety.

I-23. Detailed annual reports including the location of chemicals are onerous and do not appear to be used by emergency service personnel.

Recommendations

R-41. The Legislature should revise the Right-to-Know Law and substantially reduce reporting requirements.

R-42. Very small containers should be exempt from the Right-to-Know regulations unless the substance in the container is so toxic as to represent a hazard.

R-43. Reporting should be made more efficient by providing specific locations for large quantities only. Updates should be for changes only.

Issue: Compliance Assistance for Small Businesses and Manufacturers

I-24. Small businesses are key contributors to New Jersey's economy and generators of jobs. Economic progress in New Jersey is tied to the future success of small businesses. Yet, small businesses have limited capital and operating resources. Complying with environmental regulations is particularly difficult and costly for small enterprises.

Recommendations

R-44. New Jersey's Technical Assistance Program for Industrial Pollution Prevention (NJTAP) should be expanded to provide a comprehensive program to assist small manufacturers to comply with environmental regulations, with a continuing emphasis on pollution prevention strategies and techniques. A permanent funding mechanism for an enhanced NJTAP should be put in place.

R-45. The state should provide financing programs, such as revolving loan funds, to assist businesses to purchase and install environmental compliance equipment and processes.

R-46. DEPE should establish a series of information programs specifically to help manufacturers cope with environmental statutes and regulations. The programs should include audits or "information inspections" to assist manufacturers in identifying compliance issues without the imminent threat of fines.

IX. General Conclusions of Phase One

The study team acknowledges DEPE's full cooperation in this study. The team found many instances where DEPE improved operations because of concern about the impact of environmental regulations on businesses. Not withstanding those improvements, the Department and the Legislature must make an even greater effort to reach a balance between environmental protection and needed economic development.

Implementation of these 46 recommendations should help to build trust among industry, the public and environmental regulators. The goal is to achieve an appropriate balance between assisting businesses to meet compliance standards and aggressive enforcement to catch and penalize offenders. A number of other states serve as models for New Jersey. These states provide both a warm welcome and technical assistance in a wide array of areas, including environmental compliance, for industries seeking to develop new facilities or expand existing operations. New Jersey has no alternative but to do the same or risk the continued loss of manufacturing industries.

State government must move from a distrustful culture that views all businesses as potential violators to a client-oriented culture committed to educating and assisting all citizens and businesses to avoid dangerous health, environmental and safety risks. The initial efforts by state regulators should be to assist citizens and businesses to comply with environmental laws, rules and regulations, rather than designing rigid processes to identify and punish violators.

The NJIT study team found that the complex collection of environmental laws, rules and regulations is, in part, the product of an "outrage" factor by the public demanding legislative and executive action in response to contamination or pollution incidents. Environmental standards should not be mere reflections of "how low" a level can be measured and not just a response to a public perception factor based upon a contamination or pollution incident. Rather, environmental regulations should be based on unbiased observations, analyses and measurements of the potential risk for harm to health, safety or environmental integrity presented by an activity, process or substance.

The comparison of federal and state regulations in this report shows that New Jersey has more inclusive or stricter regulations than those adopted at the federal level and most other states. NJIT's study team identified over 30 pieces of important environmental legislation. This set of legislative initiatives creates a complex regulatory network that often supersedes and supplements federal statutes and regulations.

A New Approach For New Jersey

This report recommends a new approach for New Jersey, an approach that begins with open dialogue about risk and incorporates education on risk as an essential component of the environmental protection infrastructure. For well over a decade, the State of New Jersey has taken pride in being a leader among other states and the federal government in the development and enforcement of strict environmental protection legislation, rules and

regulations. Environmental advocates strongly support this leadership role. Industrial groups, on the other hand, call for New Jersey to maintain a sound but not always forefront position in environmental regulation, except when meeting environmental standards requires the state to move beyond federal or regional positions.

This report concludes that the state's emphasis on being first among other states to respond to environmental issues and the practice of having the strictest regulations, has increased the cost of doing business in New Jersey and has been a particularly heavy burden on manufacturing. Those costs contribute to the perception that New Jersey is not friendly to business. Most of the industrial participants in this study, from both small and large businesses, indicated that the uncertainties related to the environmental process led them to decide not to expand in New Jersey. Time and again, participants claimed that compared to surrounding states, New Jersey is more inflexible and less willing to exercise discretionary authority to assist industry and manufacturing when such assistance could be provided without compromising environmental standards.

DEPE can begin to change this perception of unfriendliness to business by initiating a comprehensive evaluation of all operations to define performance metrics. The evaluation should identify ways to improve the delivery of services and to eliminate unnecessary paperwork burdens and costs for clients. The state should be able to recoup some of the cost for this evaluation from the savings generated through implementation of the evaluation recommendations.

Need For An Environmental Master Plan

In order to flourish, industry needs a degree of certainty. The environmental regulatory scene has been a rapidly moving target for the past 20 years. This report recommends a reassessment of the entire environmental regulatory infrastructure. The state should develop an environmental master plan that takes into consideration the needs and aspirations of all stakeholders. The master plan could provide a degree of stability by setting a framework to maintain environmental standards while eliminating duplication of statutes and regulations and reducing unnecessary costs. The state should update the master plan on a five year cycle.

The public often looks to laws and regulations for both technical and administrative guidance in translating environmental quality goals into practice. There are other management strategies that may incorporate legal action, but do not rely solely on a regulatory control structure. New Jersey should move boldly to develop such programs. The cases presented in this review highlight the strengths of different management strategies and point to the effectiveness of environmental practice that actively works toward the prevention of environmental deterioration, and embraces government-industry-citizen partnerships that are so integral to their success.

The positive cooperation and collaboration among DEPE staff, industry participants and NJIT during this study are steps towards the needed government-industry-citizen partnership. The state's goal should not be a massive and immediate change in environmental regulations. Rather, this report recommends a thoughtful and steady movement to balance the need for

economic progress with the need to maintain a safe and healthy environment for New Jersey's residents, workers and tourists. The study team observed that DEPE staff is convinced that the Department is moving in the right direction and is almost there. Industry, on the other hand, sees the road ahead as long and difficult.

X. Manufacturing Challenges

Beyond Environmental Compliance

X. Manufacturing Challenges Beyond Environmental Compliance

This report has concentrated on the environmental compliance challenges and problems confronting businesses and, in particular, manufacturers. While the compliance issues are of great magnitude, the competitive challenges confronting New Jersey's manufacturers are much broader than compliance with environmental regulations. The myriad of problems facing manufacturing includes:

- increasing international competition
- rapidly changing products and process technology
- shifting markets
- changing customer and workforce requirements

In the research conducted for this review, the study team found that environmental regulations have a significant economic impact on the state's businesses and industries. However, the team also found other important factors that influence business decisions related to moving, locating or expanding an enterprise. These include the availability of a skilled workforce, labor rates, taxes and utilities rates.

In any particular corporate move in or out of the state, or any expansion decision, "climate" is as important as the hard numbers. Simply put, decreasing negative issues and increasing the issues that can be placed as "positives," leads to a stronger case for business expansion and growth.

To create jobs and strengthen its economy, New Jersey **must** have a strong, competitive manufacturing sector in addition to a strong service sector. To achieve a continuing manufacturing presence, the state must address not only undue regulatory burdens, but also must provide a full service manufacturing modernization program to include:

- Technology transfer
- Information services
- Training
- Capital support.

This manufacturing technical assistance should complement existing management, marketing, capital development and modernization services being provided by a number of colleges, universities and federal and state agencies. The states to which so many of our businesses are moving provide such vigorous and comprehensive programs to assist manufacturing.

Appendix A

Economic Analysis

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Economic Analysis

Introduction

New Jersey, like all industrial states in the United States, desires to achieve a cleaner environment to improve the quality of life for its citizens. Much has been done to improve the environment of New Jersey, and recent statistics describing air and water pollution demonstrate progress. Additional efforts to achieve even greater cleanliness are more complex to develop and more difficult to accomplish. At this point, the opportunities for misunderstanding, disagreement and conflict increase and the need for cooperative efforts between industry, the community and government becomes ever more common. Resolving these concerns become vital to economic progress. It is apparent that extremely tough regulations will provide a pristine environment but will be so economically burdensome as to essentially prohibit all industrial activity. At the same time, it is clear that, unfettered, industry has historically polluted both air and water with some devastating effects.

But, a new view towards environmental cleanliness is emerging in society today. The benefits of a clean environment are now understood by industry. Leaders of industry, government and society now look toward a day when industrial firms work hand in hand with the community and government to assure that pollution is reduced and the environment is made comfortably livable.

The question of importance to New Jersey is whether progress is being made toward this new view. Is there a process of industry, community and government cooperation that permeates environmental regulation in New Jersey? The popular press suggests that cooperation does not yet exist and that the economy is adversely affected. Industry has been portrayed as in distress. Industrial leaders claim that State government and advocates of environmental cleanliness are treating industry as uncooperative and even criminal violators. As such, industrial firms are fined, assessed fees, and inspected to the point of panic.

The important question in New Jersey is what progress has the State made toward achieving the cooperative industry-community-government relationship that will deliver progress toward a cleaner, economically viable environment. The answer to this question requires a mix of economics, sociology, and political science analyses. This section addresses the first two.

The purpose of this section is to provide an initial examination of the impact of environmental regulations upon the major manufacturing industries in New Jersey. Part 1 reviews the principle issues that cloud what might appear to be a rather straightforward analysis. It identifies three commonly applied research methodologies. First, it discusses the conventional methodology of cost-benefit analysis, widely used in economic analyses. This discussion demonstrates that differences in methodologies and perspectives make a direct comparison of costs and benefits difficult and unacceptable to important and influential publics. Next it evaluates the application of econometric techniques intended to relate environmental regulations to economic growth. This methodology is fraught with economic assumptions

that fail to persuade. Third, it evaluates the methodology of combining descriptive data analysis, expert interviews, and case studies. Although this method is less "academically rigorous," earlier research provides a very successful and persuasive example of this method. So, NJIT adopts this method.

Part 2 of this section provides the descriptive data analysis portion of this report by examining the existing evidence on economic growth of New Jersey's industry during the decade of the 1980s with specific focus on the changes in employment of selected industries believed to be the most environmentally sensitive. These changes are compared to the nation as a whole to gain some insight as to whether New Jersey has fared better or worse than the nation. This analysis shows that although New Jersey experienced a greater rate of decline in manufacturing jobs during the 1980s, it easily made up for this with greater growth in non-manufacturing jobs so that its overall growth in employment was greater than the nation as a whole. Still, the more rapid decline in manufacturing employment raises questions about New Jersey's economic environment. One of the possible causes of this decline is environmental regulations.

Part 1: Background of Industrial Impact Analysis

Previous efforts at determining economic impact of environmental regulation upon industrial development provide guidance to the development of the methodology used in this report. This section reports on the previous research to determine what methodology is appropriate for the analysis of New Jersey.

In social science research, cause and effect cannot be determined directly because controlled experiments are impossible and not all causes are identifiable, let alone measurable. Thus, searches for the impact of a single cause must carefully identify and sort out the effects of all other causes; otherwise, effects may be attributed to the wrong cause. This will become more apparent as we describe the methodologies. Three methodologies dominate current discussions: cost/benefit analysis, econometric analysis such as Meyer's correlational analysis, and case studies combined with expert opinion and data analysis.

Economic cost and benefit analysis is a staple of economic policy research so it is discussed first. Econometric analysis is discussed next, because a recent study by Meyer has been received enthusiastically by environmental associations and advocates. And, lastly, a carefully crafted, comprehensive analysis published by The Conservation Foundation, using descriptive data analysis combined with case studies and expert opinions, is discussed because it provides a excellent example of the analytical methodology that has been adopted for use in this report.

Before proceeding, another historically relevant methodology should be mentioned -- political analysis. Political decisions made (laws enacted) in a democratic society are, theoretically, expressions of the public's interests. Under the assumption that the public will vote its interests through the democratic election process, it can be argued that the current regulatory status represents the publicly preferred balance between industry-community-government. There is, however, considerable debate about how well a democratic political system

accurately expresses the interests of the public majority. Therefore, many questions can be asked about whether public interests are really expressed in the current state of regulation. Regardless of the weight of these arguments, political analysis will not be discussed here, because the objective of this study is to focus on economic, not political, issues. However, the reader should be aware that this report's analysis of economic impact is only one aspect of the total issue.

The Futility of Cost/Benefit Analysis

The appropriateness of applying economic cost/benefit analysis to determine the impact of environmental regulation upon industrial development has been hotly debated. The primary reason for this debate is that application of cost/benefit analysis is fraught with methodological problems that almost always result in finding regulation unreasonably costly compared with the benefits. The basic reason is that determination of benefit values is a highly subjective process, whereas calculation of pollution abatement costs are very objective and specific.

Typically, cost/benefit analyses place dollar values upon benefits received from a clean environment and compare these with dollar costs for pollution abatement procedures. The methodological conflict arises from the nature of the measurement methods. On the one hand, environmental advocates argue that benefit analyses require elaborate and often subjective measures of the dollar value of benefits. For example, a study done by Elwood Shafer at the Pennsylvania State University [1991] uses an interview questionnaire to determine the benefit value of a visitor catching fish in a well known trout stream. Shafer interviewed the visitors who came to the stream asking what each spent and how much each would pay for the opportunity to fish in the stream even though the stream was free to the public. Using these numbers, Shafer reports that the out-of-pocket expenditures per visitor day were $13.80. But the contingent value method (CVM) used in the personal interviews obtained the visitors estimates of the total benefit value of their visit. The "CVM net economic value per visitor day" was $44.50. The latter number produces an annual benefit value of $70,515 per stream mile, over three times the "out-of-pocket value."

Although this methodology and CVM calculation has a degree of "face validity", economists criticize it as highly subjective, based upon unrealistic assumptions, and lacking scientific rigor. Economists want to measure actual transaction costs -- the out-of-pocket costs -- to determine rigorous dollar values. Invariably, when out-of-pocket costs are used, the total benefit values fall far short of the pollution abatement costs. Abatement costs were not a part of Shafer's research, but it is obvious that his "net economic value" is much more likely to support purely economic arguments for pollution abatement than the "out-of-pocket" value.

Most economists will admit that measurement of actual transaction costs falls short of capturing the full benefit values. Ideally, measurement of benefit values would be accomplished by erecting a barrier to the fish-filled stream and establishing a "toll gate" to determine how much a visitor is willing to pay to pass through the barrier. But, social science research cannot use such experimental methods without creating an unbearable outcry from the public. The stream is a public stream and cannot be walled off to satisfy the interests of

research scientists. Thus, the economists' needs for rigorous scientific evidence in benefit determination cannot be satisfied. And, Penn State's effort to approximate the "toll" through subjective measurement simply does not satisfy the economists' requirements for rigor.

On the other hand, pollution abatement costs can be measured very rigorously. Industry can present hard data drawn from accurate calculations of installation and operating costs. These are no-nonsense dollar and cents figures that meet the quantitative and scientifically rigorous standards preferred by economists.

Given the different nature of benefits and cost methodologies, it is rare to find a economically rigorous study of costs versus benefits that does not conclude that costs outweigh benefits. For this reason, environmental advocates largely discount economic analysis as biased and misleading. Their claim is that benefits cannot be quantified but can only be realized in terms of the physical and emotional well being of every individual -- the quality of life. These benefits they want for themselves, their children, and all citizens. They want to smell fresh, clean air; to wade in clean streams populated with fish; and to see a sunset without the presence of filtering smog. Who is capable of putting a meaningful dollar value on such benefits?

This cost/benefits argument is without resolution since the two sides are committed to concepts and methods that seem antithetical. Even if the cost/benefits argument could be resolved, it would not resolve the central question which is whether environmental regulations are causing industrial activity to decline. The economic growth balance is not only based upon local regulatory costs but also on regulatory costs relative to alternative locations, both in the U.S. and abroad. One recent effort to directly address this issue is Meyer's research [1992].

Econometric Analysis of Regulatory Impact: Meyer's Work

Econometricians are so named because they apply sophisticated statistical methods to economic and sociological data taken from the real world. Meyer [1992] has prepared such a statistical analysis relating state by state economic growth during the 1980s to the relative stringency of environmental regulations in each state at the beginning of the period. Meyer uses evaluations of the degree of regulatory controls existing in each of the contiguous 48 states in 1980-82 as one variable and a measure of economic growth rate in these states from 1982 through 1989 as a second variable. All together, he examines five measures of economic growth: (1) growth in gross state product; (2) growth in employment; (3) growth in construction employment; (4) growth in manufacturing labor productivity; and (5) growth in overall labor productivity. Meyer postulates that economic growth will be negatively correlated with the degree of regulatory control -- that is, states with a high degree of regulatory control will experience lower growth rates than states with less stringent controls.

Meyer groups the states into three regulatory categories: those with the most stringent regulations; those with less stringent regulations; and those with the least stringent regulations. He uses bivariate correlational analysis to find the greatest rates of economic

growth within the states with the most stringent regulations and the smallest growth rates within the least stringent states. This, he concludes, suggests that stringent environmental controls do not inhibit economic growth.

But, Meyer's analysis is flawed by several factors. These flaws are examined by an analysis prepared by Robert McAuliffe for this report (see the second part of this Appendix A). McAuliffe notes that Meyer overlooked the fact that multiple factors, economic and sociological, simultaneously influence economic growth. Meyer's observed positive correlations between degree of environmental regulations and economic growth overlook the influence of these other factors. For example, the states with more stringent environmental regulations may also have younger, growing populations, spend more on education and have better tax bases from which to draw revenue. Other researchers have shown that these factors influence economic growth. Thus, Meyer's bivariate correlation technique does not appropriately test the relationship between controls and economic growth because there are other variables that also effect economic growth and he has not controlled for these.[9]

Another criticism of Meyer's work has been brought to Meyer's attention and he addresses it in "An Update" [1993] to his work. This second criticism is that state economic growth rates may be causes of environmental regulation stringency rather than vice versa. For example, the wealthiest states have greater population growth rates, are the states with the greatest industrial concentrations, largest populations, and the greatest historical economic growth rates. These are also the states that have the greatest pollution and therefore, the greatest need for stringent controls. And, they are the states with greatest taxable population and industrial property base to raise revenues required to establish and enforce environmental regulations. Thus, Meyer's observed variable relationship may only indicate that economic growth leads to the imposition of environmental controls.

Meyer tested this latter proposition in "An Update" [1993] to his work. But in this case, McAuliffe [1993] notes that Meyer incorrectly specified the model because the cause/effect linkage becomes backward -- that is, regulatory control must be postulated as the outcome of economic activity, not the cause. Meyer uses the same methodology as before but measures economic growth prior to 1982. This methodology is valid for regulations-cause-growth but not valid for growth-causes-regulation.

McAuliffe's Evaluation of Meyer's Research

McAuliffe begins by testing Meyer's proposition using the same bivariate model and conventional least squares regression analysis. The two variables are the actual environmental regulation scores, rather than the rank categories used by Meyer, and inflation adjusted gross state product. McAuliffe finds that this more rigorous test of Meyer's methodology affirms Meyer's bivariate relationship results. Then, McAuliffe conducts a second regression using

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[9] Meyer acknowledges that other causes exist when explaining his refusal to accept the hypothesis that growth is caused by environmental regulation. Later, he adds "An Update" wherein he attempts to demonstrate that adding these other causes to his analysis has no effect on his results. But, again, he adds only one cause at a time rather than analyzing all causes at once.

Meyer's categorical ranking variable instead of the scores and finds the same results. From these two regressions, McAuliffe concludes that the results confirm Meyer's bivariate findings and demonstrate the applicability of Meyer's categorical ranking variable. Therefore, McAuliffe uses inflation adjusted gross state product and Meyer's regulatory ranking variable in his further analysis.

Next, McAuliffe develops a multivariate model to properly examine Meyer's hypothesized negative relationship between economic growth and regulatory control. McAuliffe uses the growth rate in inflation adjusted gross state product as the dependent (effect) variable and Meyer's environmental regulation categorical ranks as the regulatory control variable (independent). In addition, McAuliffe includes five additional independent variables which have been used by other researchers studying causes of state economic growth: (1) state population growth rate, (2) educational expenditures growth rate, (3) total tax growth rate, (4) population density growth rate, and (5) median population age growth rate. Growth rates were measured as percent change from 1982 through 1989.

McAuliffe conducts a conventional least squares multiple regression on this model and finds that three of the independent variables are significant in relationship to economic growth rate -- population growth rate, population density growth rate, and state tax growth rate. Noticeably absent from this model is the environmental regulation rank variable. It is found to be insignificant -- that is, regulation is neither positive nor negative in its affect on economic growth. A second regression substituting the actual environmental regulation scores for Meyer's categorical ranks yielded the same results. Environmental regulation is not a significant variable.

McAuliffe's regression results demonstrate that Meyer's significant and positive correlations exist by coincidence because the influence of other factors actually explain growth -- in other words, population growth, population density growth and state tax growth are the correlates of economic growth while stringency of environmental regulations have zero influence. On the other hand, McAuliffe's results add supporting evidence to Meyer's conclusions that the degree of regulatory control does not negatively influence economic growth. McAuliffe's analysis shows that regulatory stringency has no significant correlation with economic growth. At the same time, McAuliffe's results do not support Meyer's findings that show regulatory control is positively related to economic growth.

McAuliffe goes on to test Meyer's "An Update" [1993] reverse proposition that economic growth may influence the development of regulatory controls. Testing this proposition requires a more complex methodology to adjust for Meyer's categorical rankings as the dependent variable. McAuliffe applies PROBIT analysis to this analysis to adjust for the categorical dependent variable and includes other economic and sociological variables, measured prior to 1981, as independent variables. Here the results show that states' median age of population and educational expenditures are positively related to stringency of regulatory control. However, state economic growth shows mixed results. Economic growth is positively related to regulatory control in the lower and middle rank categories of states. But in the states with the most stringent regulatory rank category, economic growth has a negative effect upon stringency of regulation.

Overall, results of McAuliffe's PROBIT analysis refute Meyer's conclusion that economic and social conditions during the 1970's have no affect upon environmental regulatory stringency existing in 1982. McAuliffe's PROBIT results also stimulate interest in further research with this hypothesis but do not provide answers to the questions raised by the mixed effects of economic growth upon regulation stringency.

Summary of Econometric Analysis

In summary, McAuliffe provides multivariate analysis that clearly demonstrates the weakness inherent in Meyer's use of bivariate correlation methods in a complex economic/sociological world. On the other hand, McAuliffe's results confirm Meyer's findings that environmental regulations do not influence economic growth rate. But, while Meyer found positive correlation between economic growth rate and environmental regulation stringency, McAuliffe finds that neither negative nor positive correlation exists. Furthermore, McAuliffe's results demonstrate that various social and economic variables do influence the degree of regulatory stringency but do not answer the question of the degree to which regulatory stringency is influenced by economic growth.

But, McAuliffe's more rigorous econometric modeling demonstrates a conventional problem in economics, circular cause/effect relationships. Economic events are often diagrammed as a circle with one event seen as the result of others while becoming the cause of still others. With his multiple regression model McAuliffe finds no relationship between environmental regulatory stringency and subsequent economic growth. With the PROBIT model, he finds a relationship between economic/social growth and subsequent environmental stringency. One cannot dispel the feeling that the cause/effect linkages between these variables are more complex than can be captured in mathematical models. Other forms of analysis are necessary to fully express the social and economic factors that are at work in American society.

A Model for Economic Impact Analysis

Duerksen's Environmental Regulation of Industrial Plant Siting [1983], published by The Conservation Foundation, directly addresses the question of how environmental regulations influence the growth activity of industrial plants. Duerksen acknowledges that industrial firms are concerned about the economic effects of increased manufacturing costs caused by the rising cost of meeting environmental regulations. Such rising costs can cause manufacturing firms to loose their competitive advantages as increased costs drive up their prices or reduce their profitability. Loss of competitive advantages can lead to decline or termination of firms. Alternatively, firms can move their operations to other areas that have less stringent regulations and avoid the increased costs. Either way, the area with the costly environmental regulations losses jobs and its economy declines.

To investigate the effect of regulatory costs on industrial growth, economic development specialists focus on the factors that influence firms' decisions to locate new, expansion plants

in various geographical locations. They study new plants because these "plant siting" decisions are relatively uncluttered by considerations about the costs and locations of existing plants. Duerksen provides a thorough analysis of the problems and costs associated with environmental regulations upon major plant siting decisions during the 1970s and early 1980s. He does this by using the available descriptive economic data supported by expert analyses and case studies.

Duerksen argues that some plants were never installed and some chose alternative sites because of the processes and costs of environmental regulations. On the other hand, several troubled siting decisions blazed a trail to regulatory revisions that made the next siting effort easier. Furthermore, some of the siting decisions were made not because of environmental regulations but because of changes in industrial market conditions such as a decline in market demand for outputs.

In summary, Duerksen makes a persuasive argument that environmental regulations alone do not unilaterally determine siting decisions, not in the U.S., not in Canada, and not in Europe. This conclusion suggests that environmental regulations do not define economic competitiveness of industrial firms and therefore do not have significant impact upon economic growth. However, Duerksen notes that the regulatory process is not the smooth, cooperative effort that it should be in order to assure that industry can use a systematic, planned approach to plant citing with the expectation of meeting regulations and receiving the permits in a timely fashion. Lack of cooperation, confusion about responsibility and technology, and lack of finality of decisions are more common than cooperation between industry, community and government. He recommends that, "Quite reforms focusing on regulatory procedures and institutional changes offer the most promise of effective, long-lasting improvement in the siting process."

Duerksen's study is now somewhat dated because many new and more stringent regulations were implemented during the last ten years. However, his methodology provides a useful pattern for this report's analysis of current conditions in New Jersey, and a sound basis for determining the extent to which the regulatory process has improved as the regulations become more stringent in order to assure continued progress in achieving a clean environment.

PART 2: INDUSTRIAL GROWTH IN THE DECADE OF THE EIGHTIES

As mentioned earlier, cause and effect cannot be determined directly in social science research. Thus, this report's analysis of the impact of environmental regulations upon industrial activity must be tempered with recognition of major phenomena, global and national, that are simultaneously affecting industrial activity. To accommodate this type of comparative analysis, this section describes the statistical measures of New Jersey's manufacturing activity relative to the overall U.S. under the assumption that the differences observed are indicative of New Jersey specific causes. This assumption will be examined carefully where ever such differences exist.

This part begins with commentary about industrial activity in the U.S. as a whole. It then proceeds to a comparative analysis of statistical data on industrial activity looking at the relative growth rates in numbers of establishments and employees during the decade of the 1980s. Next, the section compares growth rates in seven industries selected by NJIT as representing major New Jersey industries that are experiencing above average economic problems associated with environmental regulations.

Before beginning the analyses, it is appropriate to explain the selection of the time period of the analyses and the seven industries. The time period selected is 1980 through 1990. This "decade" has several advantages for our analysis. First, it covers one full business cycle, from a period of growth ending in 1980, through a recession in 1981-82, followed by a long period of economic expansion beginning in 1982, and ending in the last year of growth (1990) before the beginning of the next recession.[10] Second, ten years is typically an adequate time period for the effects of economic factors to become apparent. Third, full and complete data are available from federal and state statistical sources for this entire period. Fourth, the complications of irregular and unusual regional variations in economic growth observed during the recession of 1991-92 (and beyond?) are avoided. Fifth, this decade began with relatively stringent environmental regulations in place and significant new regulations were added during the entire decade.

One additional caveat is necessary here. Industrial activity is a process of producing goods and services. Firms invest capital in productive assets in anticipation of selling their outputs of goods and services. To accomplish the production process, firms hire workers to perform essential activities. Thus, measurement of industrial activity should measure investment and output. But, these measures are difficult to produce with accuracy in New Jersey because of interstate movement of both capital and outputs. New Jersey lies between two major industrial and financial capitals of the U.S., New York City and Philadelphia. To avoid this complexity, we have selected employment as a surrogate measure of industrial output and number of establishments as a surrogate measure of investment. Both of these measures are available with good accuracy. However, we acknowledge that these are imperfect surrogates. Employment must be adjusted for labor productivity increases to accurately reflect output changes. Establishment counts should be adjusted for the amount of investment made in each. Such adjustments cannot be done with accuracy and therefore we are left with imperfect surrogates for industrial activity. Readers are cautioned that the research reported here is biased by these imperfections. As noted below, we are aware of the direction of bias in the employment counts since the direction of productivity changes is well known as described below. And, it is also known that in manufacturing, establishment size is declining when measured by employment. However, the bias in investment is not known.

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[10] One possible complicating factor is that the 1983-90 economic expansion is the longest period of continuous economic expansion in the recorded economic history of the U.S.

The Decline of U.S. Manufacturing Employment

It is a widely known fact that manufacturing in the United States has shown below average employment growth rates since the early 1970s. Although many perceive this trend as indicative of a declining industrial base, others recognize that technological improvements have fostered growing worker productivity. In turn, growing productivity has resulted in fewer workers producing more and better products. Growing productivity is the reason that employment is the imperfection that makes employment a crude surrogate for industrial output.

Nonetheless, employment means jobs and incomes for citizens. Thus, most Americans equate job growth with economic growth. There is a great deal of truth to this equation since national income is distributed to the vast majority of the population through wages and salaries from employment. Without jobs, citizens must rely upon government programs for income to sustain their existence, a condition wherein they receive less income.

The decline in manufacturing jobs due to the growing productivity of labor in manufacturing is analogous to that experienced in farming during the first half of the Twentieth Century. Over one third of the U.S. work force was engaged in farming in 1900 but by 1950, fewer that one in twenty were farming. During the same fifty years, farm output in the U.S. grew substantially and the purchase of food declined as a share of disposable personal income. The rise in disposable personal income emerged from the growth of new, high paying jobs in manufacturing while the price of food did not rise as rapidly as wages. Thus, on average, U.S. workers experienced a substantial increase in their standards of living.

The second half of this Century is experiencing a decline in manufacturing employment coincident with a growth in overall output of manufactured goods. However, in contrast to the first half of this century, manufacturing jobs are being replaced with lower paying service jobs. Thus, while prices of manufactured goods are not rising rapidly, disposable personal income per worker has been declining. Thus, on average, workers have experienced a declining standard of living. Families have overcome this decline by sending a second member into the work force. This process of declining manufacturing jobs due to rising productivity is irreversible unless demand for manufactured goods should suddenly grow more rapidly than productivity. In the current world economy, technology is driving productivity growth at a high rate. Thus the trend of declining manufacturing employment has not run its full course.

Statistical Evidence of Employment Growth

New Jersey has historically been a balanced economy with a mix of service and manufacturing firms providing jobs for its citizens. Overall, employment in New Jersey grew from 1980 to 1990 at an annual average rate of growth of 3.0%. This compares favorably with the U.S. which shows an average rate of growth of only 2.6%. Figure 1 is a graph of annual employment in the U.S. and New Jersey from 1980 through 1990. Note that whereas the U.S. experienced a slight decline in total employment during and after the recession of 1981-82, New Jersey did not and therefore records a greater over-decade growth rate in

employment. However, New Jersey experienced a decline in employment in 1990 whereas the U.S. did not. Most economists agree that the 1990 decline is because the 1991 national recession actually began in New Jersey in 1990.

But, during the decade, the traditional mix of jobs in New Jersey was no longer balanced between manufacturing and non-manufacturing. In New Jersey, manufacturing jobs declined at an annual rate of 2% whereas the U.S. as a whole experienced only a 0.6% annual decline. As shown in Figure 2, both New Jersey and the U.S. manufacturing employment declined from 1980 through 1983 and both recovered in 1984. But, unlike the U.S., New Jersey's manufacturing employment began a continuous decline in 1985. It is this period after 1985 that gives New Jersey its much greater rate of decline.

The rate of decline in manufacturing employment combined with the rate of growth in overall employment is indicative that New Jersey is experiencing a faster shift of employment from manufacturing to non-manufacturing jobs than the rest of the nation. This could be a sign of a strong vital economy in the midst of change. Or, alternatively, the precipitous decline in manufacturing employment after 1985 may indicate a problem specific to New Jersey's manufacturing sector.

Manufacturing Conditions in New Jersey

In the face of this nation-wide decline in manufacturing, it is not likely that any analysis of manufacturing in New Jersey is going to demonstrate robust growth in employment. In fact, the average growth rate of both establishment and employment counts in the seven industries in New Jersey is less than that for the same industries in the U.S. These growth rates are shown, industry by industry in Table 1. Note that on average (last row at the bottom of Table 1), the establishment growth rate in New Jersey is 1.3 % below that in the U.S. The establishment growth rate in New Jersey is a negative 1.3 % whereas it is zero percent for the U.S.[11]

Employment growth in New Jersey shows an even greater divergence from the national figures.[12] On average, employment growth rates in New Jersey are 2.5 % less than the nation. As noted earlier, both the nation and New Jersey show negative growth rates, but New Jersey's rate is 2.5 % "more negative." This means that employment in these seven industries is declining faster in New Jersey than in the nation as a whole. This suggests that New Jersey is suffering from some state originating factors or from greater effects from factors that are affecting the nation as a whole.

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[11] Growth rates for each indicator are computed using the conventional econometric time series trend calculation. This entails a logarithmic transformation to adjust for non-linearity of compound growth functions that are common in economic measures. Graphs of each industry are shown beginning on page 69.

[12] The pharmaceutical industry in New Jersey is one of the few that have shown real employment growth during this decade. However, in Table 1, the pharmaceutical industry is categorized in the chemical industry sector and its unique employment experience is not evident.

The greater rate of decline in New Jersey is not by itself indicative of effects of environmental regulation as there are numerous additional causes that may influence this rate of decline. Such factors include, but are not limited to, wage rates, tax rates, utility rates, worker unionization, land costs, and even pollution itself can cause firms to limit expansion or reduce operations in the state. Perhaps of greater importance is that the population of the U.S. is shifting from the north and northeast to the more pleasant climates of the south and south east. As the customers for manufactured consumer goods move south, so might we expect the manufactures to move as well. For example, one often noted reason that automobile manufacturing has moved from the northern states to the central states, especially Tennessee, is that this places production midway between the existing markets of the north, west coast, and east coast, and the growing markets of south and south west.

Thus, New Jersey's more rapid decline in industrial employment may indicate nothing more than changing patterns of population growth in the U.S. On the other hand, it is useful to examine New Jersey's relative attractiveness for industrial citing.

New Jersey's Industrial Attractiveness Rating

The Corporation for Enterprise Development (CED) produces an annual rating of the "state economic climate" based on a variety of criteria that are widely believed to affect siting of industrial plants as well as formation of new firms. In 1987, CED's overall evaluation gave New Jersey a score of "B" with a national ranking of eleventh. In 1989, CED rated New Jersey as "A" and ranked it fourth in the nation. Thus, even as New Jersey's manufacturing employment was declining at a faster rate than the nation as a whole, its industrial attractiveness ranking was improving.

In 1987, CED did not evaluate the environmental quality as a specific index. However, in 1989, CED added an index titled "Environmental Health and Safety." New Jersey does not fare well on this index. An overall ranking is not provided but New Jersey ranks 44th to 48th on all of the separate indicators except infant mortality rates (rank 21). Nonetheless, the advantages New Jersey possesses for businesses overshadows the environmental problems so that New Jersey ends up as fourth in the nation.

CED's environmental ranking is similar to that produced by Bob Hall and Mary Lee Kerr in their 1991-1992 Green Index [1991]. Hall and Kerr rank New Jersey 28th on its environmental conditions but third on its environmental policies. Both the CED and Hall and Kerr indices include air quality, super fund sites, hazardous waste generation and similar indicators in their evaluations. Since New Jersey has long been a center of industrial activity, it ranks poorly on such measures as super fund sites and hazardous waste discharge. However, both indices also note that when New Jersey's policies towards environmental regulation and industrial development are factored into its ranking, it moves into the top three or four.[13]

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[13] Duerksen [1983] ranked New Jersey as third in the nation on the stringency of environmental controls in 1982.

Establishment and Employment Growth

It is possible to gain additional insight into the relationship between New Jersey and the U.S. by comparing the year to year variations from trends in establishment and employment counts for each of the seven industries. In all seven industries, the variations in New Jersey establishment counts are consistent with those for the U.S. In other words, in years when the U.S. establishment counts rise, so do New Jersey's counts, and vice a versa. This is also true for employment count variation except in three industries wherein employment variations in New Jersey differ from those in the U.S. These industries are plastics, electro-plating and electronics.[14]

Miscellaneous Plastic Products - SIC 308: Differences in variations reside in this sub-industry within the plastics industry. The annual percent change in employment for this industry are shown in Figure 3 for New Jersey and the U.S. In this industry, U.S. employment increased at a rate of 3.8 % per year while New Jersey employment declined at -0.5 % per year. Note that during the period 1980 through 1986, the pattern of annual percent changes are essentially in the same direction for both New Jersey and the U.S. In other words, both the light (New Jersey) and dark (USA) bars are in the same direction in these years. Beginning in 1987 and continuing through 1989, New Jersey's plastics industry shows consistent decline in employment while the U.S. shows increases. This pattern suggests that beginning in 1986, New Jersey experienced a impediment to employment growth that did not exist in the nation as a whole.

Electroplating - SIC 3471: Figure 4 shows annual percent changes in employment in the U.S. and New Jersey. During the 1980-90 period, the growth rates for employment were 1.6 and -1.4 % respectively. The difference in growth rates is largely attributable to the period after 1985. Prior to this, the annual changes in employment were in the same directions, as shown in Figure 4. However, after 1985 and continuing through 1989, New Jersey shows consistent annual declines in employment while the U.S. shows consistent annual increases. As with plastics, this difference in annual changes suggests that after 1985, New Jersey was experiencing causes of employment decline not experienced by the nation as a whole.

Electronic Components and Accessories - SIC 367: Employment change differences occur in this sub-industry of electronics. Figure 5 shows annual percent changes in employment for the U.S. and New Jersey. During the decade, this industry experienced employment growth rates of 1.1 and -3.5 % respectively. The differences in annual percent changes occur throughout the decade. In only four of the ten years is there agreement between the U.S. and New Jersey. Apparently, there are firm specific effects hidden in these statistics such that the rise and fall in demand for specific products is influencing the changes in employment. Nonetheless, New Jersey was experiencing much greater percentage declines beginning in 1985 than the nation as a whole. These results suggest that New Jersey was experiencing different causes of employment decline after 1984 than the nation as a whole.

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[14] Graphs depicting the annual employment and establishment totals for each industry are provided.

Summary

That is, the change to negative growth occurs about the middle of the decade, between 1984 and 1986. This is also true of the State's overall manufacturing employment as shown in Figure 2. This analysis focuses attention on these three years as periods of change in trend. Thus, it is reasonable to search for possible causes of these differences during these time periods. This search will be accomplished through an analysis of each industry's self reported list of environmental problems and the case studies.

Conclusions Economic Analysis (Appendix A)

It is evident that the methodology of industry analysis combined with interview data and case studies provides the most reliable methodology for a topic that defies rigorous empirical analysis of the type commonly found in economic research. Our initial analysis into available economic data on New Jersey industry as compared to the U.S. as a whole reveals that New Jersey is experiencing a more severe case of a malaise that is affecting all states in the U.S. Manufacturing, while becoming more efficient and productive, is declining as an employer in the U.S. This is a phenomena driven both by domestic and global competitive factors.

The reasons for New Jersey's more severe decline in manufacturing employment are not clear although environmental regulation may well be among them. Industry focus groups and case studies are the best mechanisms for identifying the relative contribution of environmental regulations to New Jersey's manufacturing decline.

TABLE 1
COMPARISON OF TEN YEAR GROWTH RATES OF ESTABLISHMENT AND EMPLOYMENT BETWEEN NEW JERSEY AND THE U.S. FOR SELECTED INDUSTRIES

SIC - Industry Name	Number of Establishments			Number of Employees		
	NJ	US	US - NJ Diff.	NJ	US	US - NJ Diff.
22 Textiles	-1.7%	-0.2%	1.5%	-5.5%	-2.2%	3.3%
275 Printing	-4.4%	-3.9%	0.5%	-4.3%	-3.8%	0.5%
28 Chemicals	-0.6%	-0.8%	-0.2%	-2.4%	-0.8%	1.6%
30 Plastics	0.3%	2.6%	2.3%	-0.8%	2.5%	3.3%
3471 Electroplating	-0.6%	0.3%	0.9%	-1.4%	1.6%	3.0%
36 Electronics	-0.9%	1.9%	2.8%	-5.8%	-2.4%	3.4%
AVERAGE	-1.3%	-0.0%	1.3%	-3.4%	-0.9%	2.5%

FIGURE 1 - TOTAL EMPLOYMENT IN NEW JERSEY AND THE U.S. (1980 - 1990)

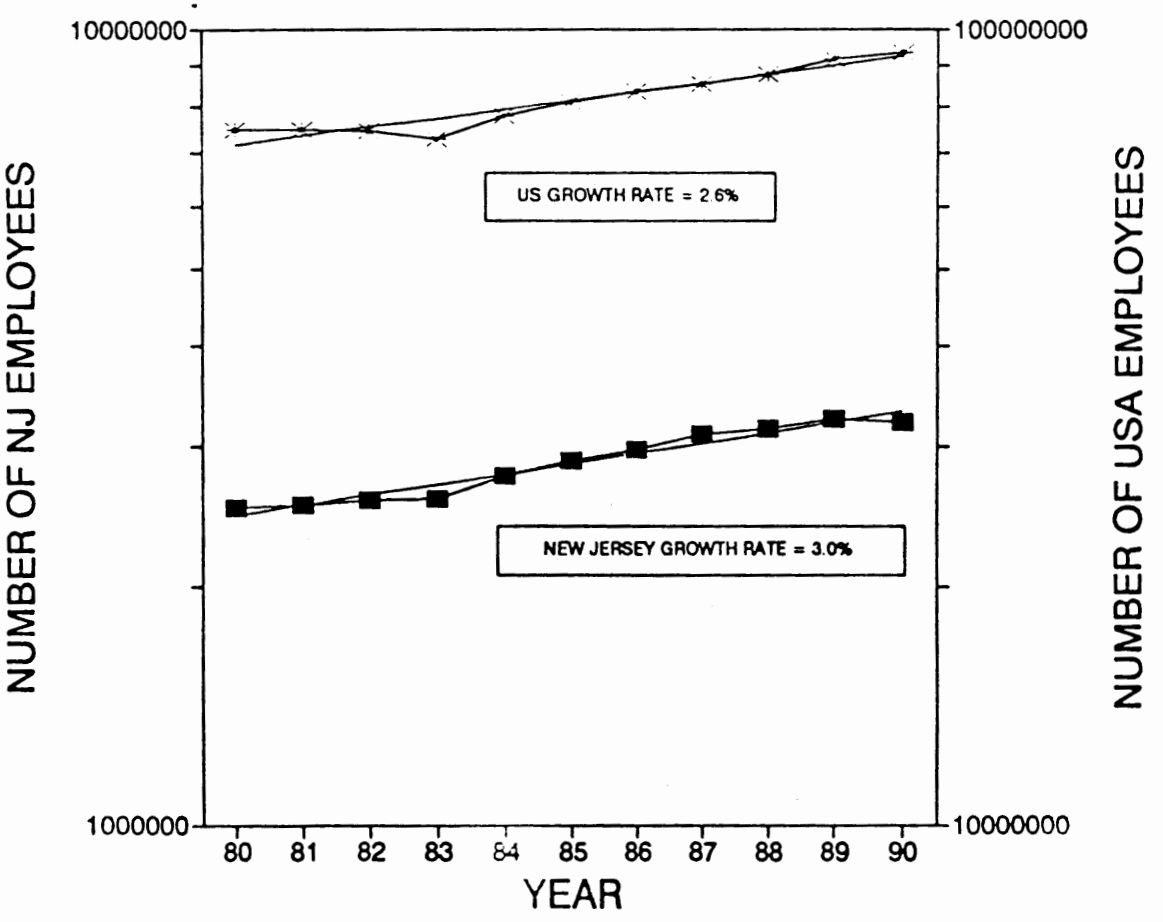


FIGURE 2 - MANUFACTURING EMPLOYMENT IN NEW JERSEY AND U.S. (1980 - 1990)

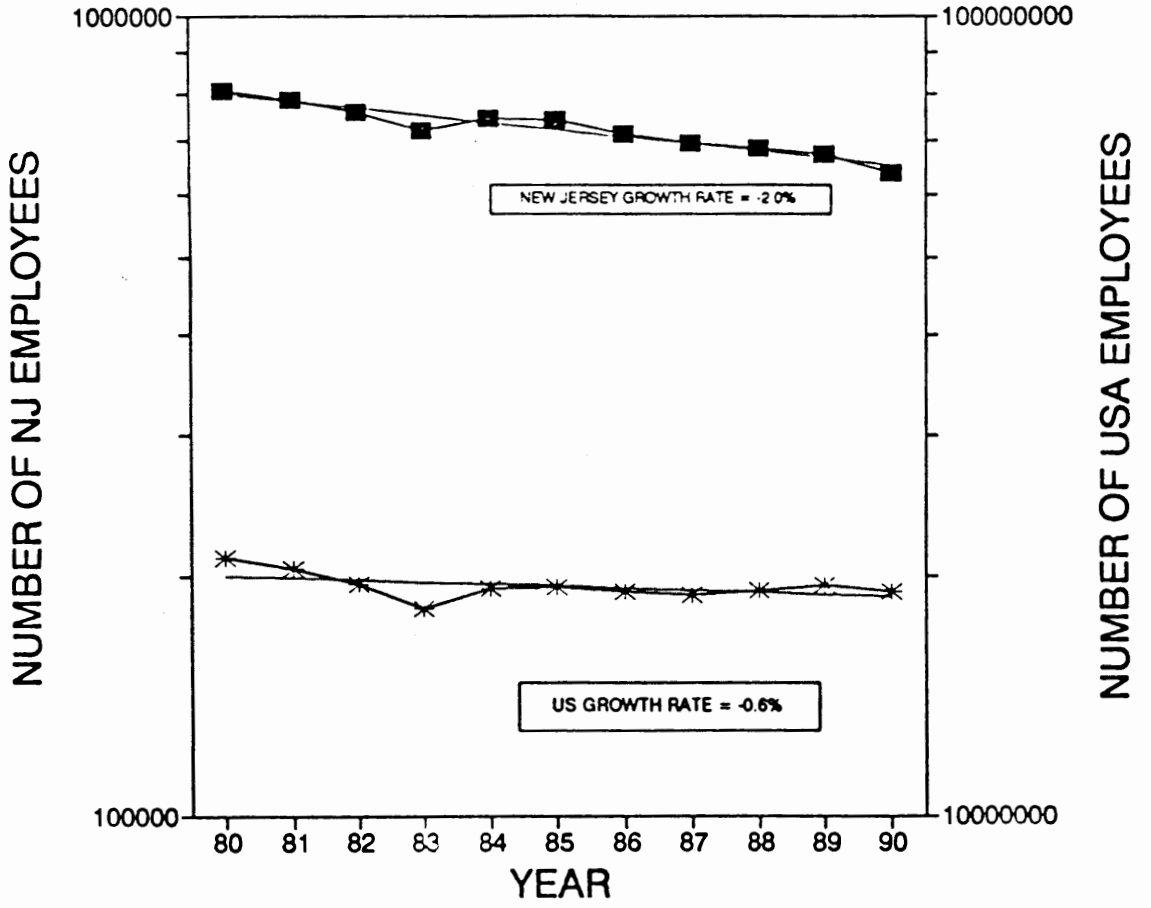


FIGURE 3 -- SIC 308 MISC. PLASTIC PROD.
COMPARISON OF EMPLOYMENT CHANGES

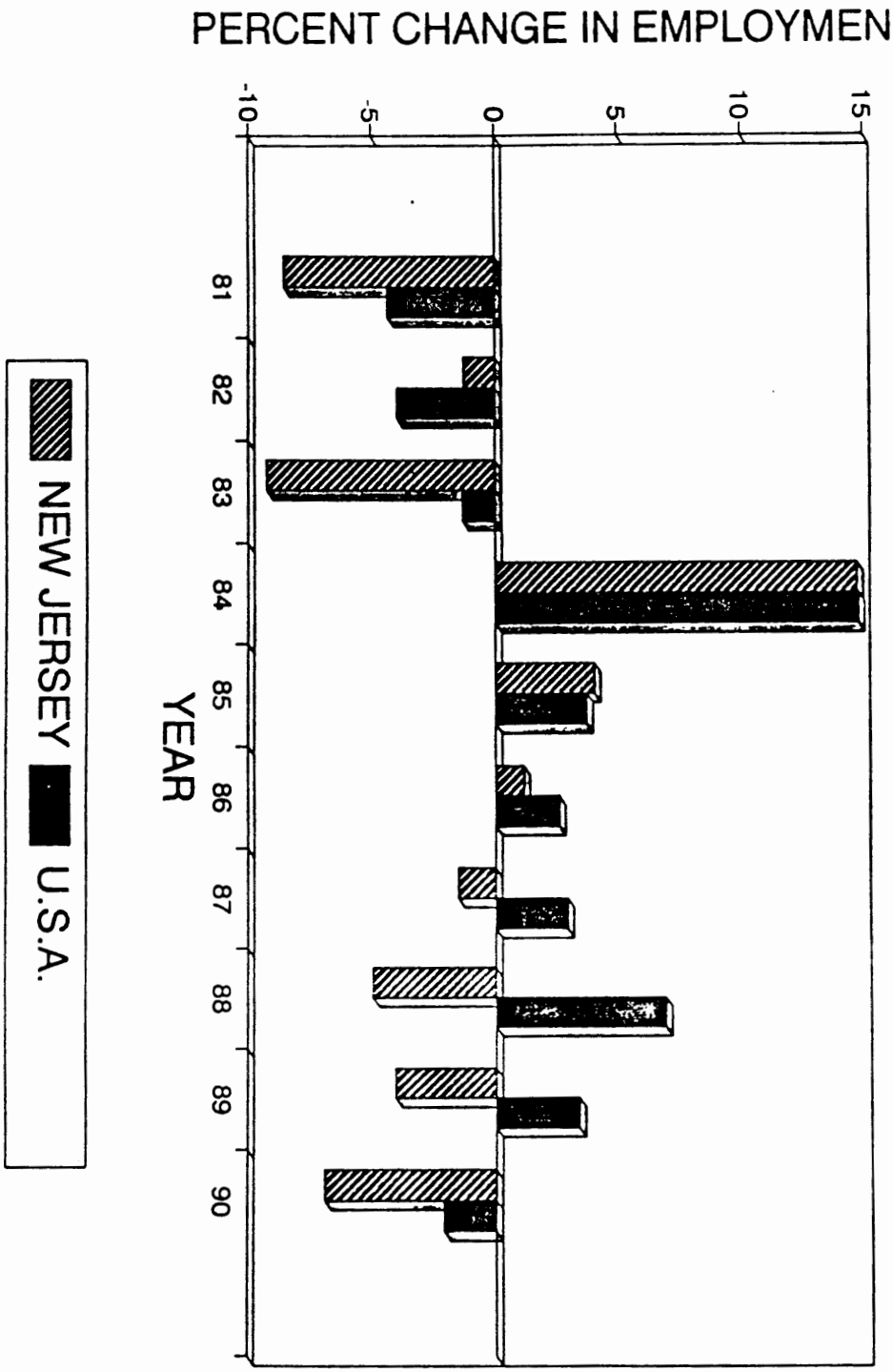


FIGURE 4 -- SIC 3471 ELECTROPLATING
COMPARISON OF EMPLOYMENT CHANGES

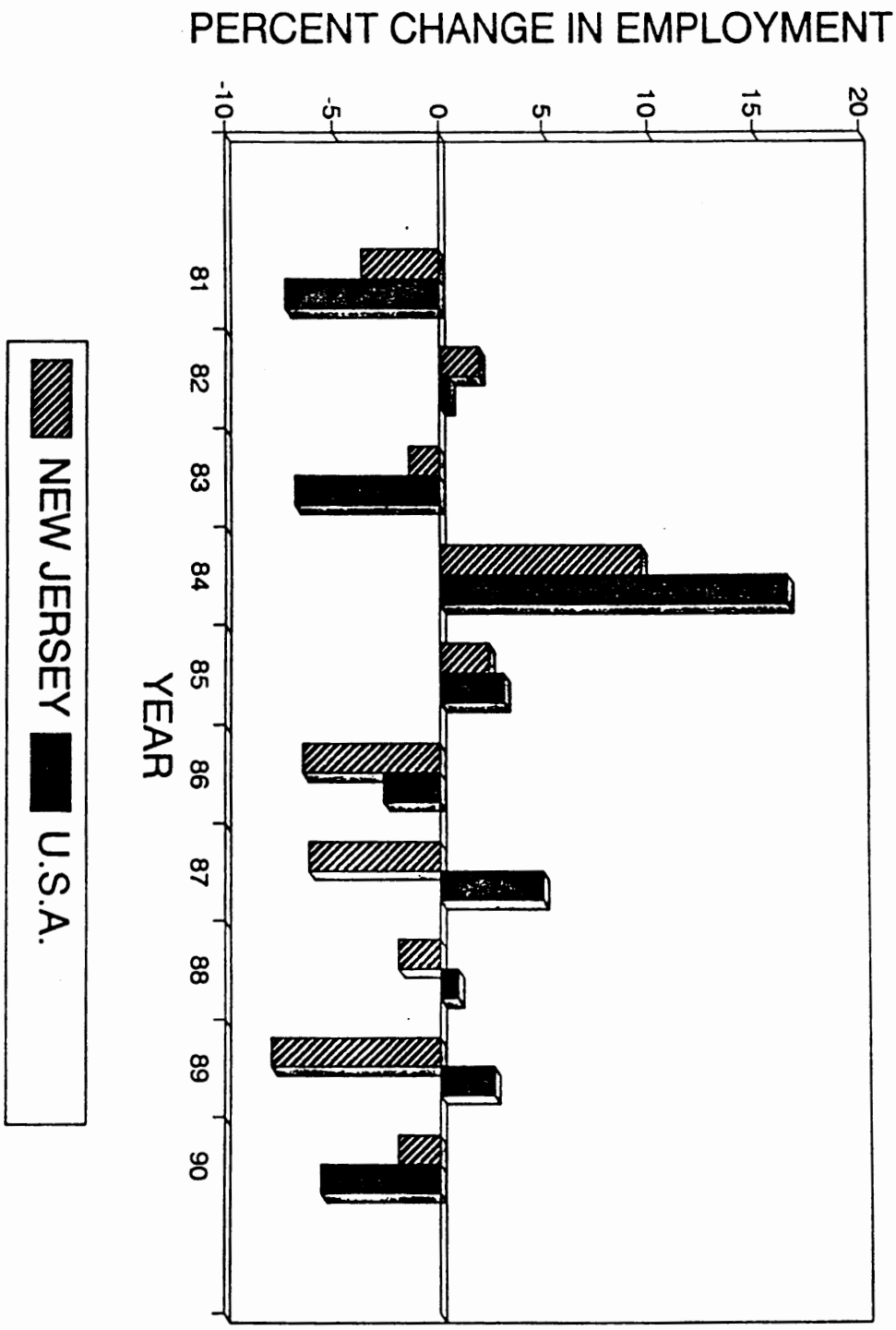


FIGURE 5 - SIC 367 ELECTRON. COMPONENTS COMPARISON OF EMPLOYMENT CHANGES

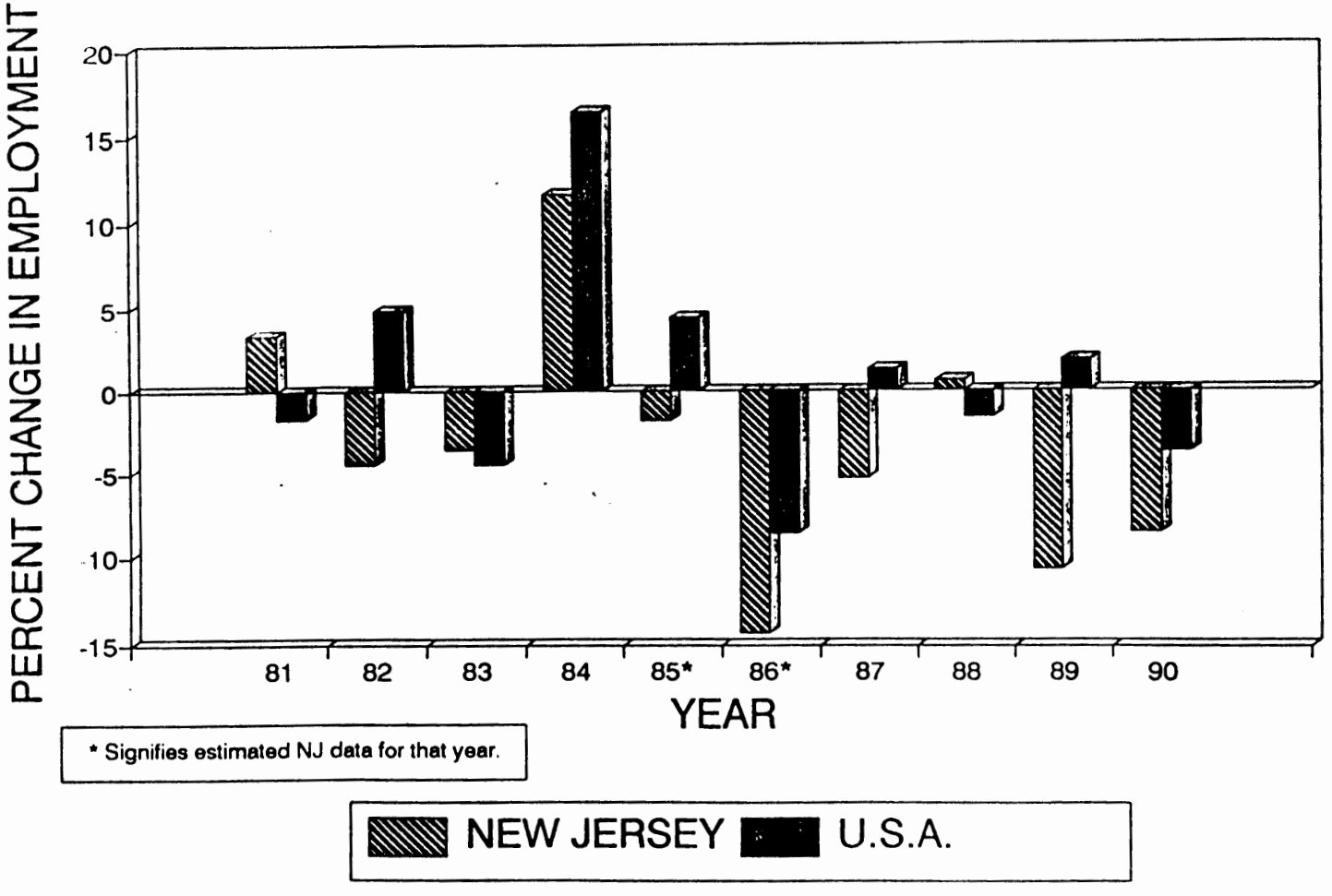


FIGURE 6

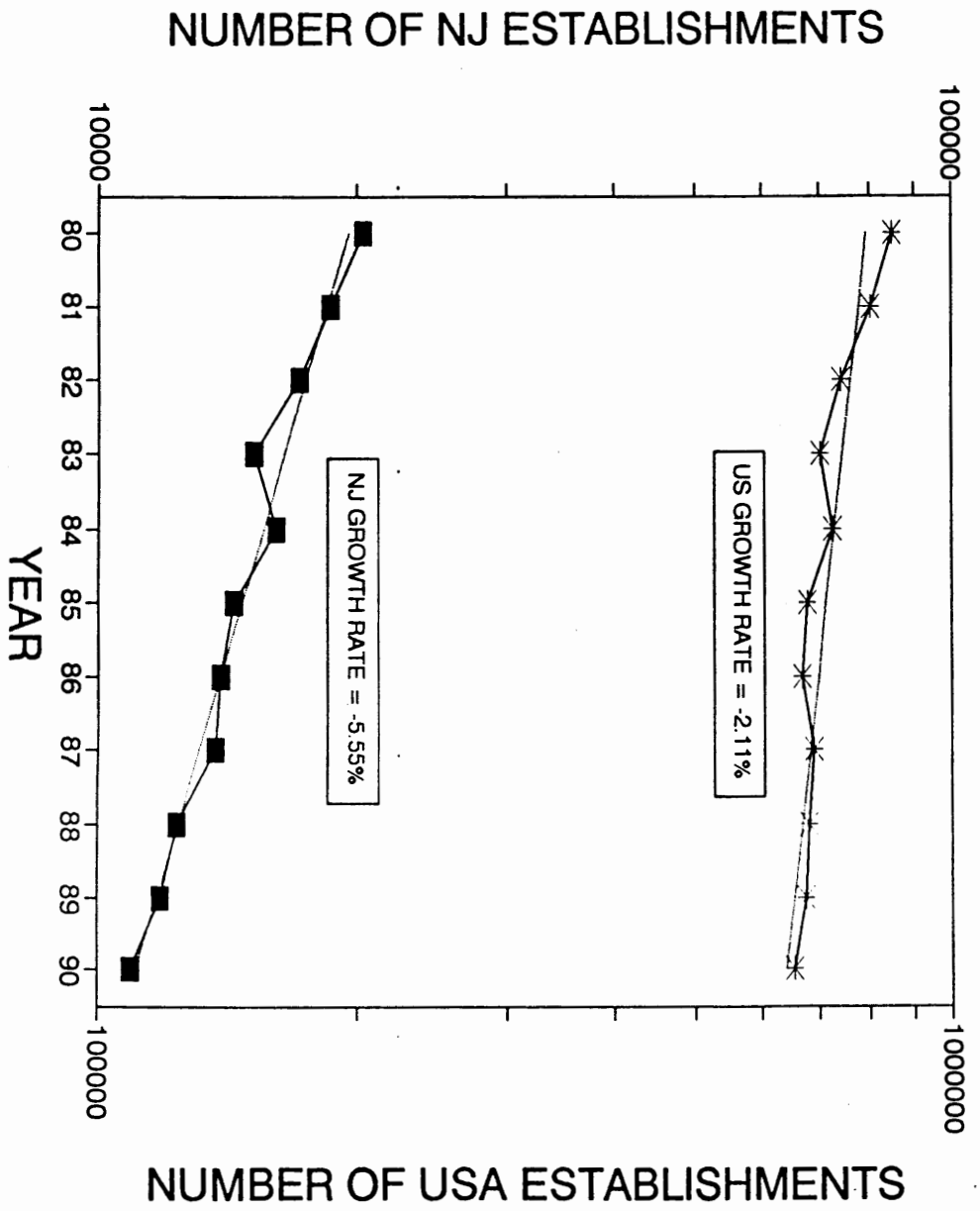

SIC 22 - TEXTILES NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE
NUMBER OF NJ ESTABLISHMENTS
NUMBER OF USA ESTABLISHMENTS
YEAR
US GROWTH RATE = -2.11%
NJ GROWTH RATE = -5.55%
10000
100000
1000000
80
81
82
83
84
85
86
87
88
89
90

FIGURE 7

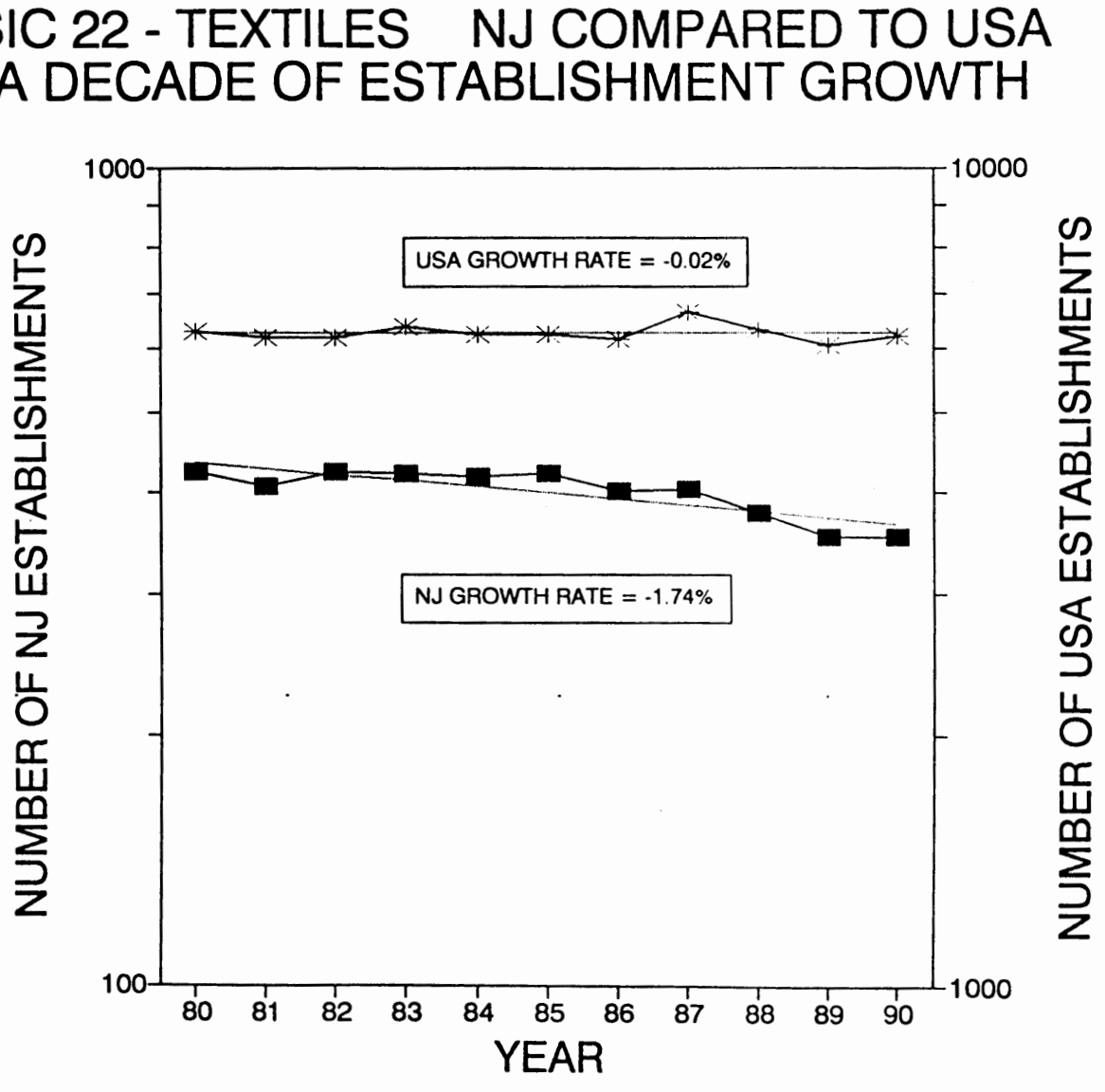

SIC 22 - TEXTILES NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH
NUMBER OF NJ ESTABLISHMENTS
NUMBER OF USA ESTABLISHMENTS
1000
100
10000
1000
USA GROWTH RATE = -0.02%
NJ GROWTH RATE = -1.74%
80
81
82
83
84
85
86
87
88
89
90
YEAR

FIGURE 8

SIC 275 - PRINTING NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE

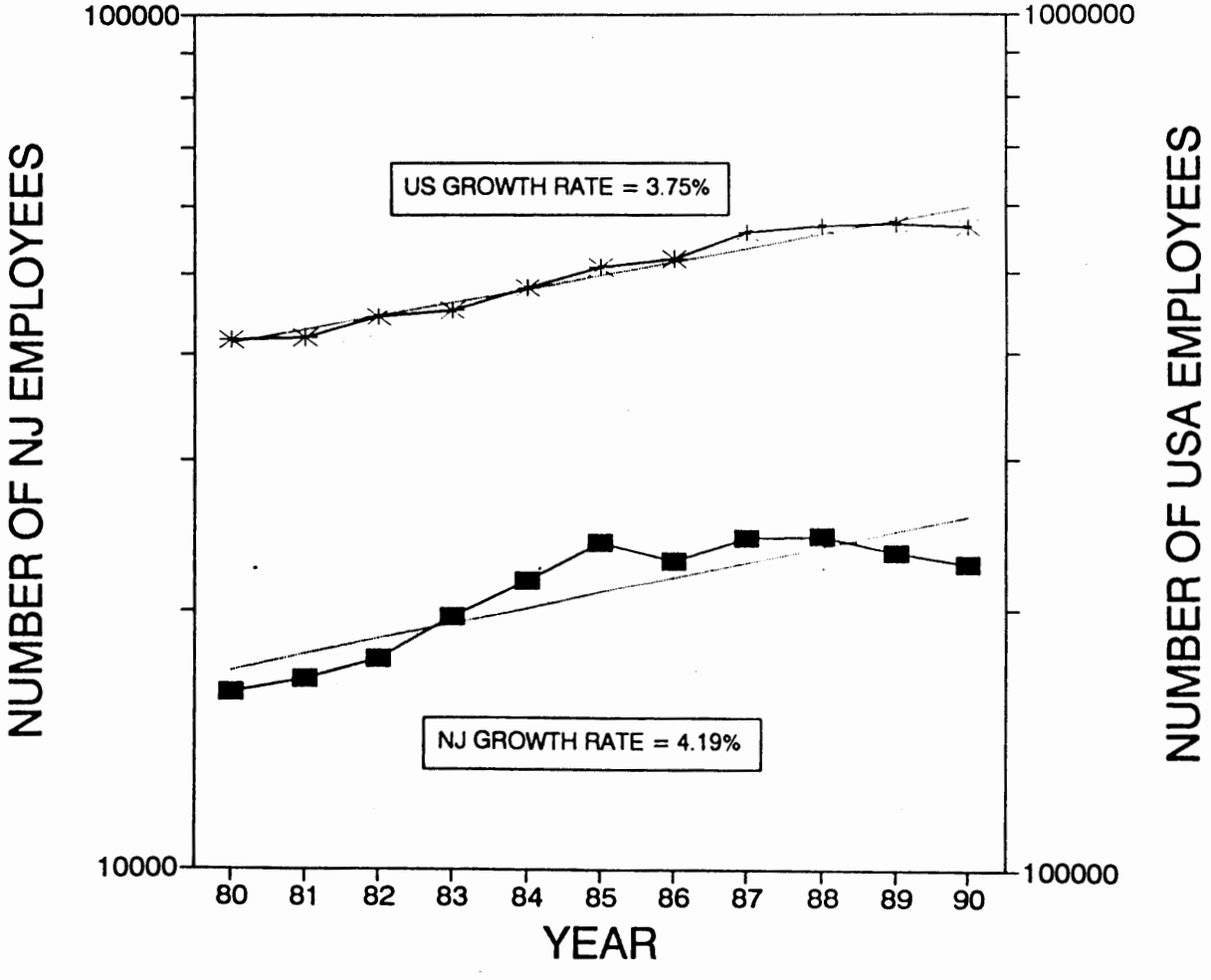


FIGURE 9

SIC 275 - PRINTING NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH

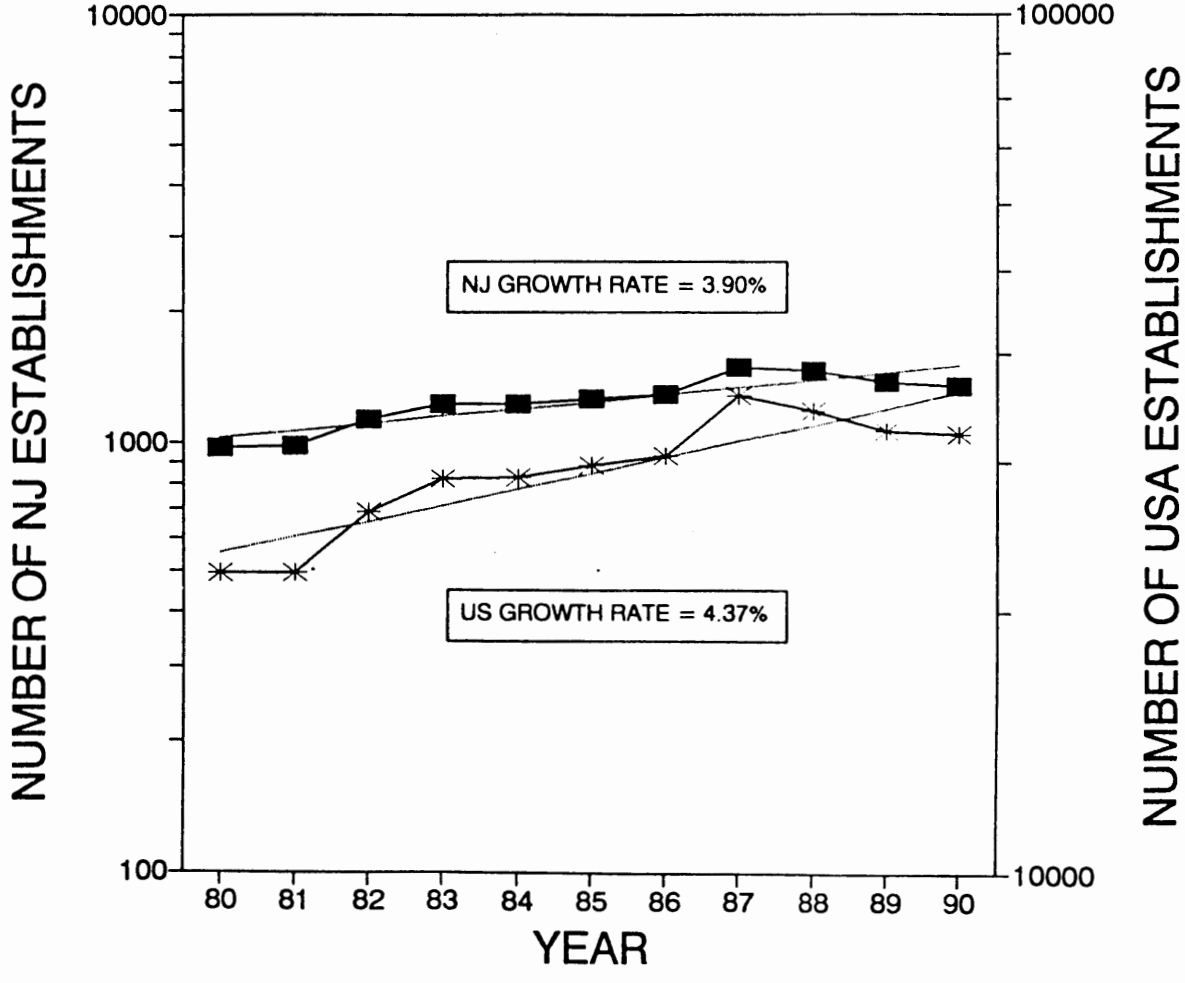


FIGURE 10

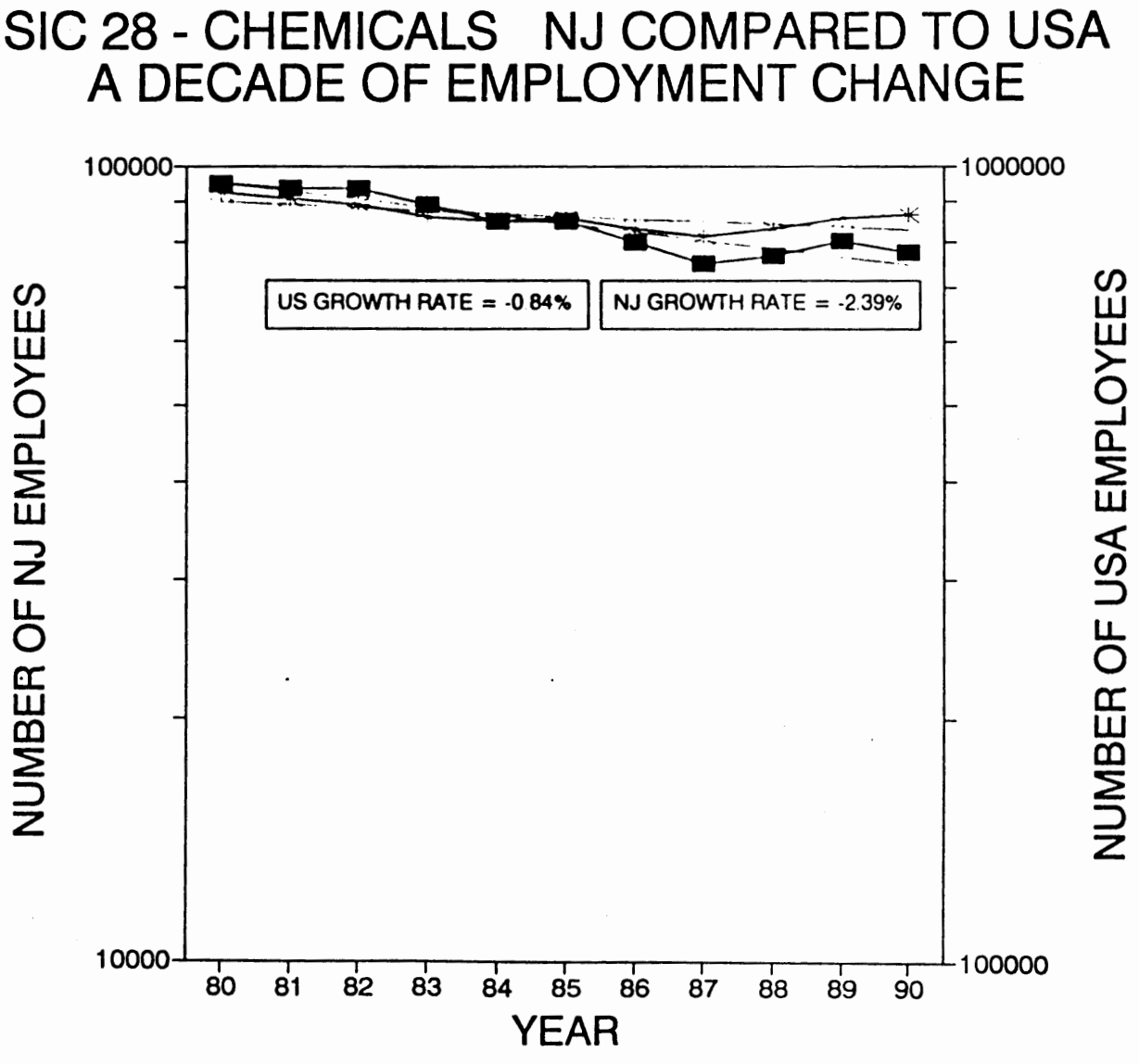

SIC 28 - CHEMICALS NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE
100000
10000
1000000
100000
US GROWTH RATE = -0.84%
NJ GROWTH RATE = -2.39%
NUMBER OF NJ EMPLOYEES
NUMBER OF USA EMPLOYEES
80 81 82 83 84 85 86 87 88 89 90
YEAR

FIGURE 11

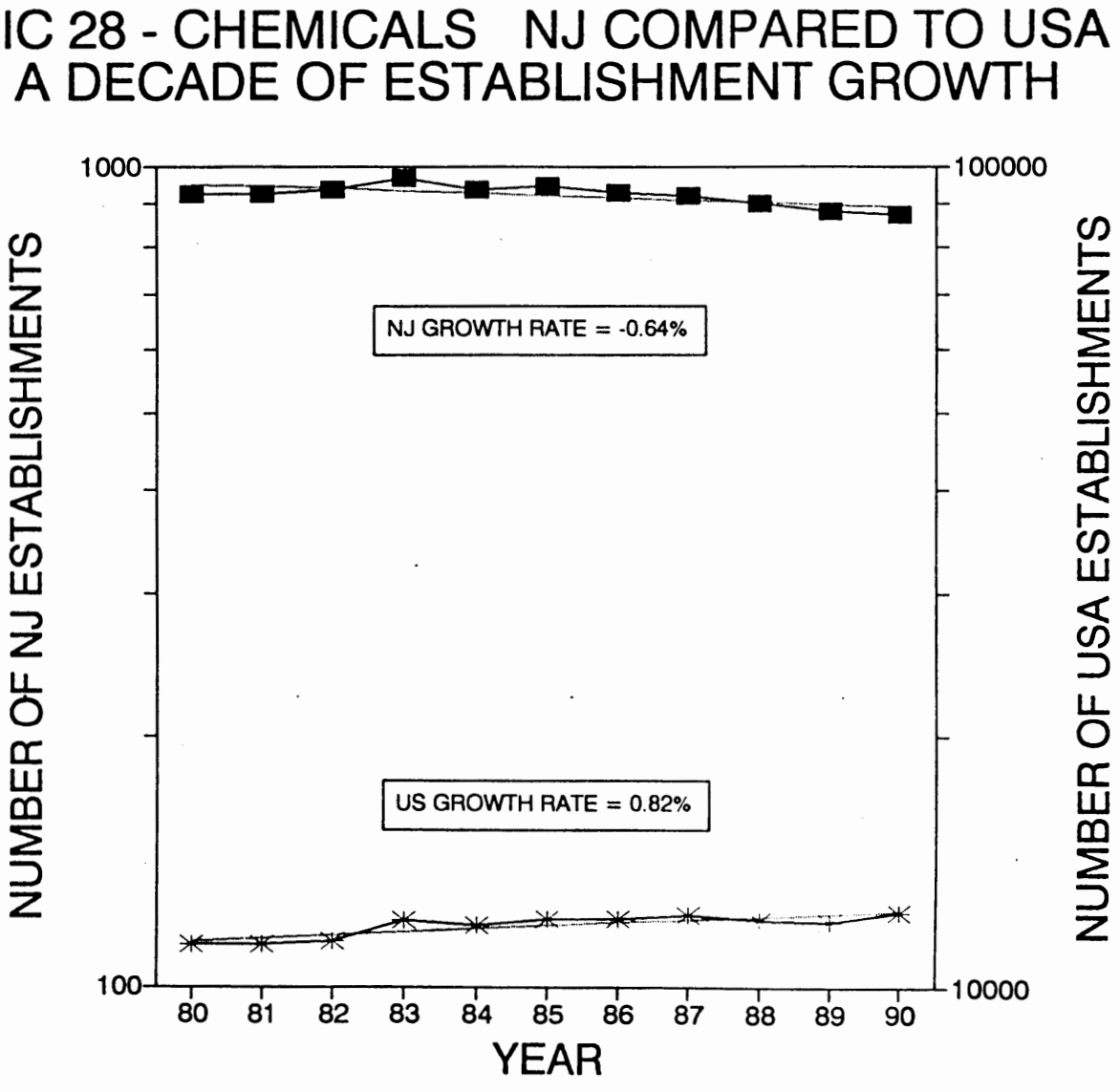

SIC 28 - CHEMICALS NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH
NUMBER OF NJ ESTABLISHMENTS
NUMBER OF USA ESTABLISHMENTS
1000
100
100000
10000
NJ GROWTH RATE = -0.64%
US GROWTH RATE = 0.82%
80
81
82
83
84
85
86
87
88
89
90
YEAR

FIGURE 12

SIC 283 - PHARMAC. NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE

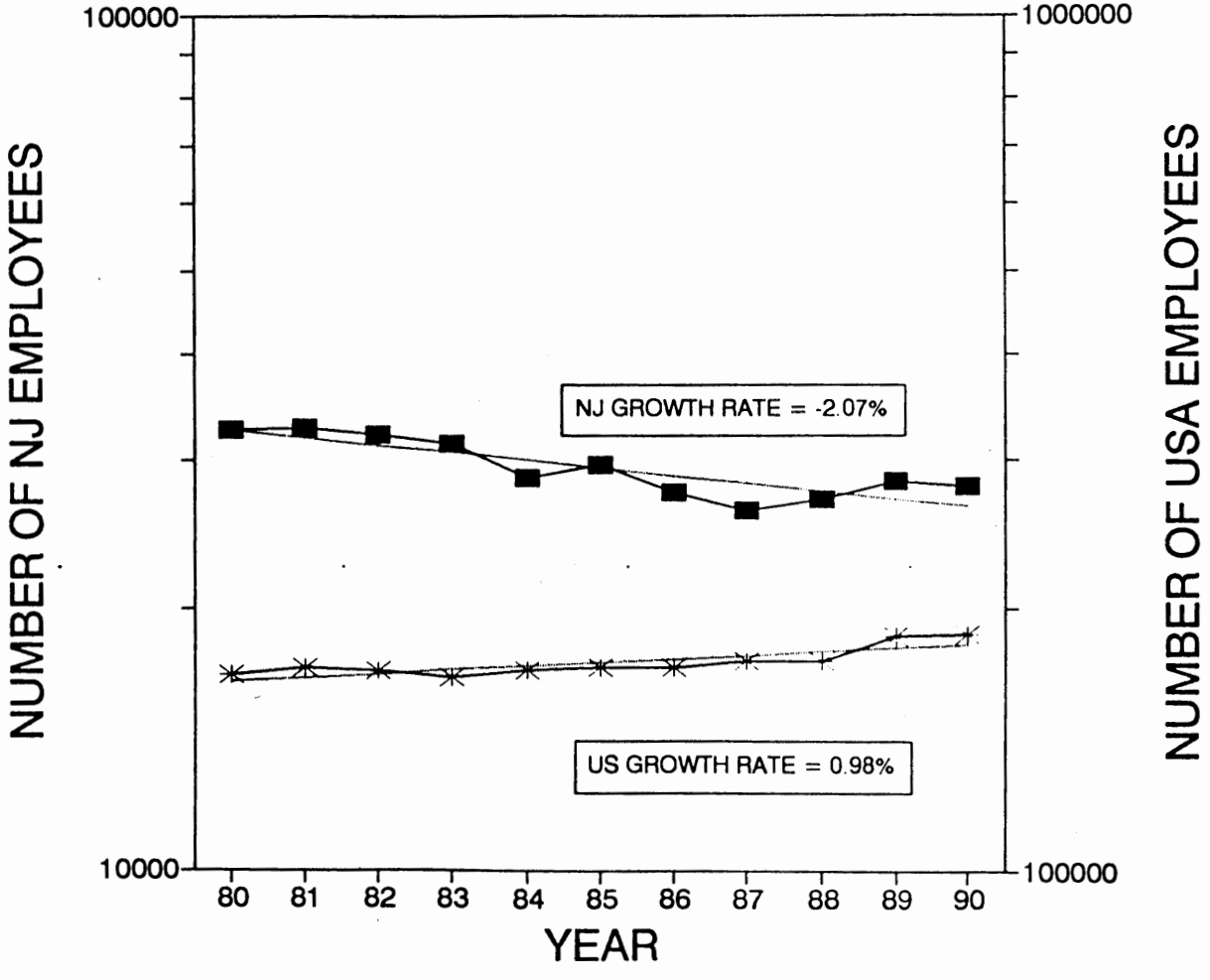


FIGURE 13

SIC 283 - PHARMAC. NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH

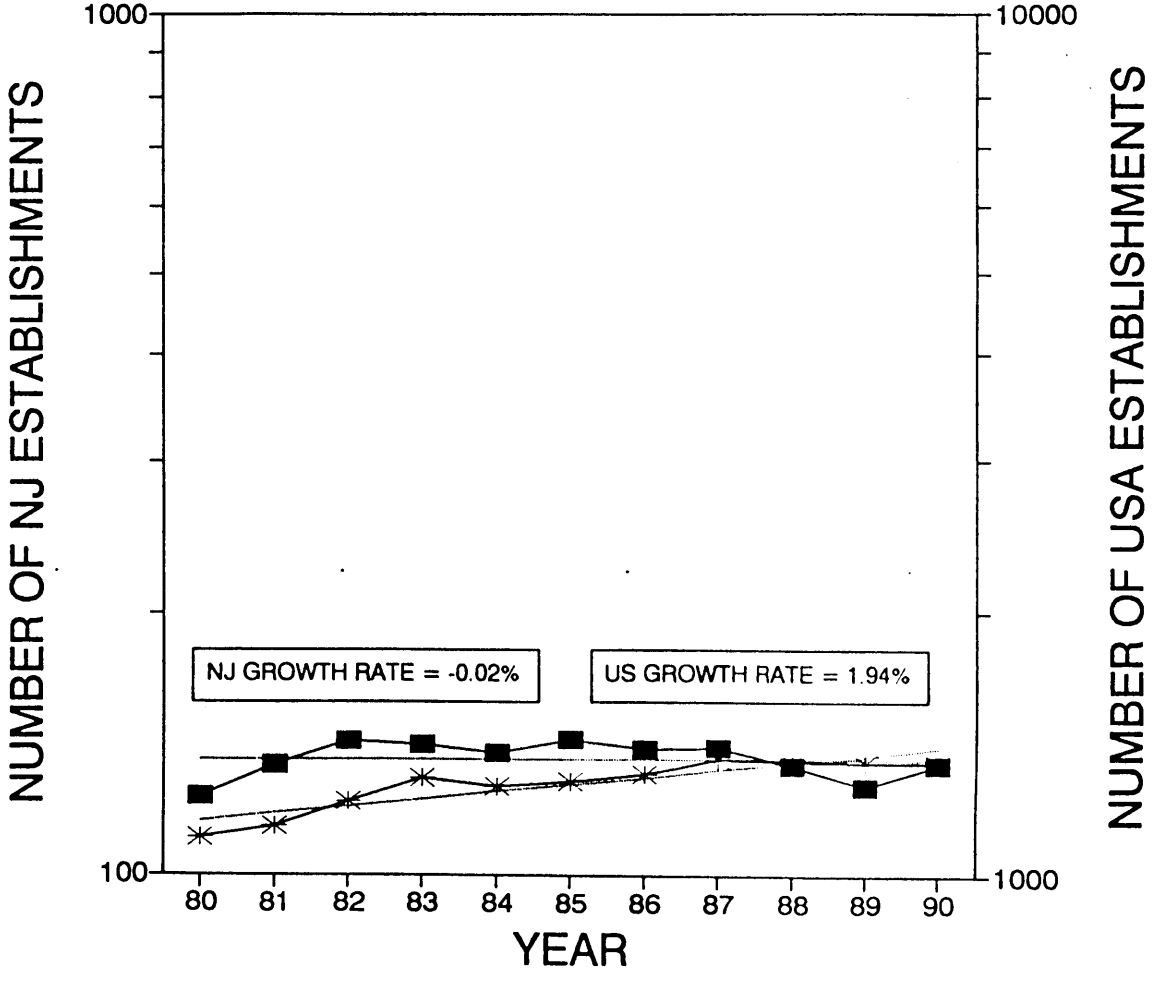


FIGURE 14

SIC 30 - PLASTICS NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE

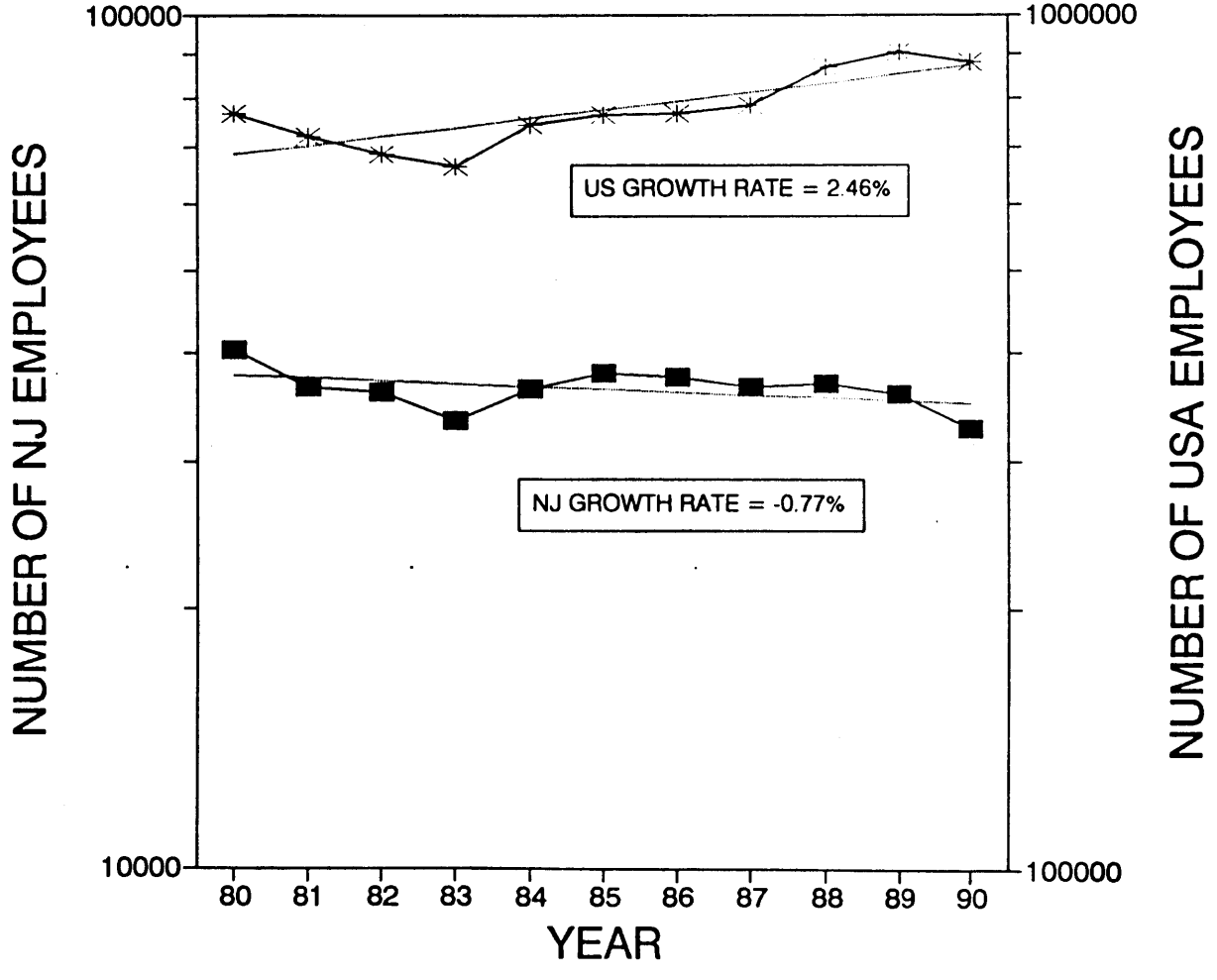


FIGURE 15

SIC 30 - PLASTICS NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH

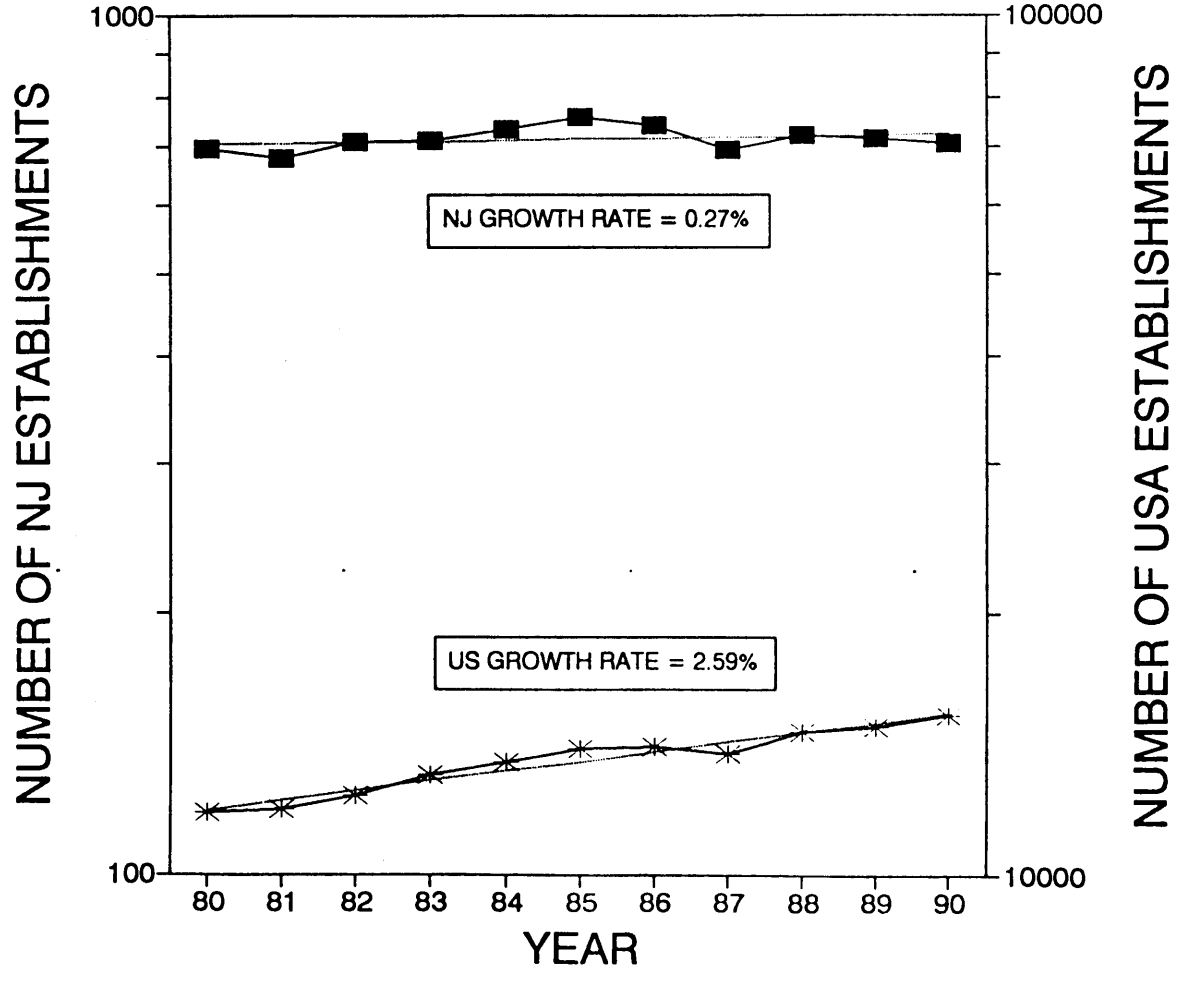


FIGURE 16

SIC 308 - PLASTICS NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE

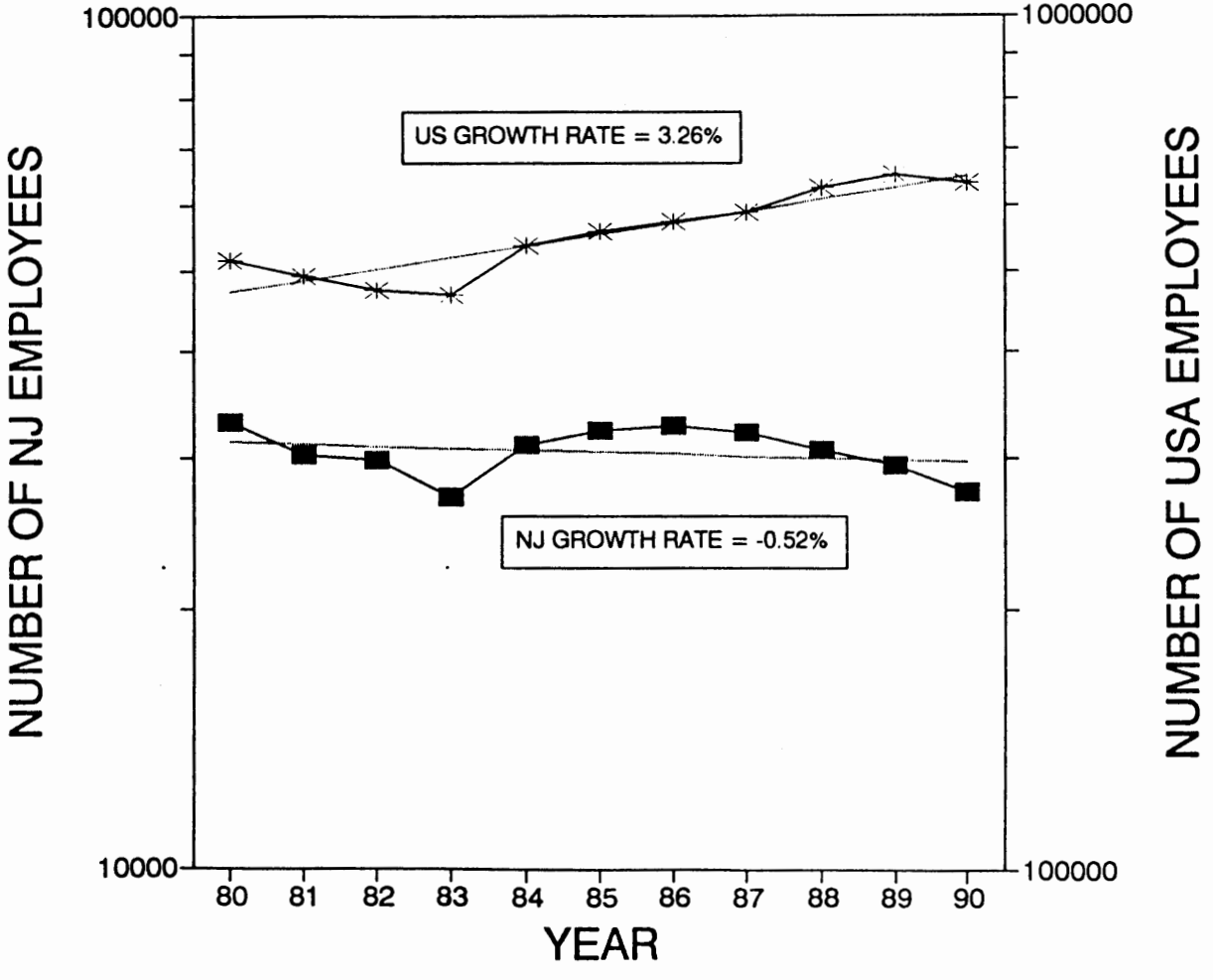


FIGURE 17

SIC 308 - PLASTICS NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH

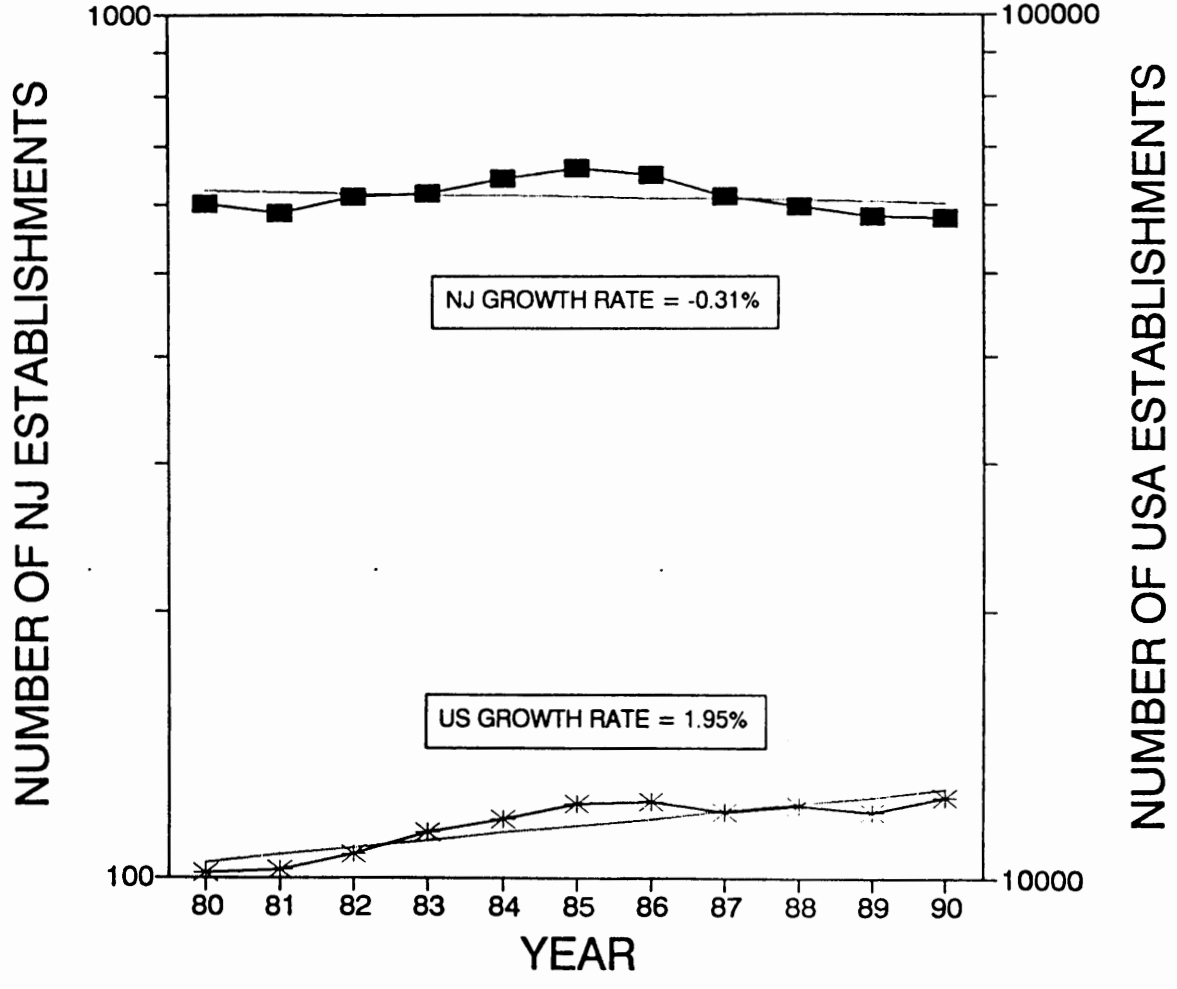


FIGURE 18

SIC 3471 - ELECPLAT. NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE

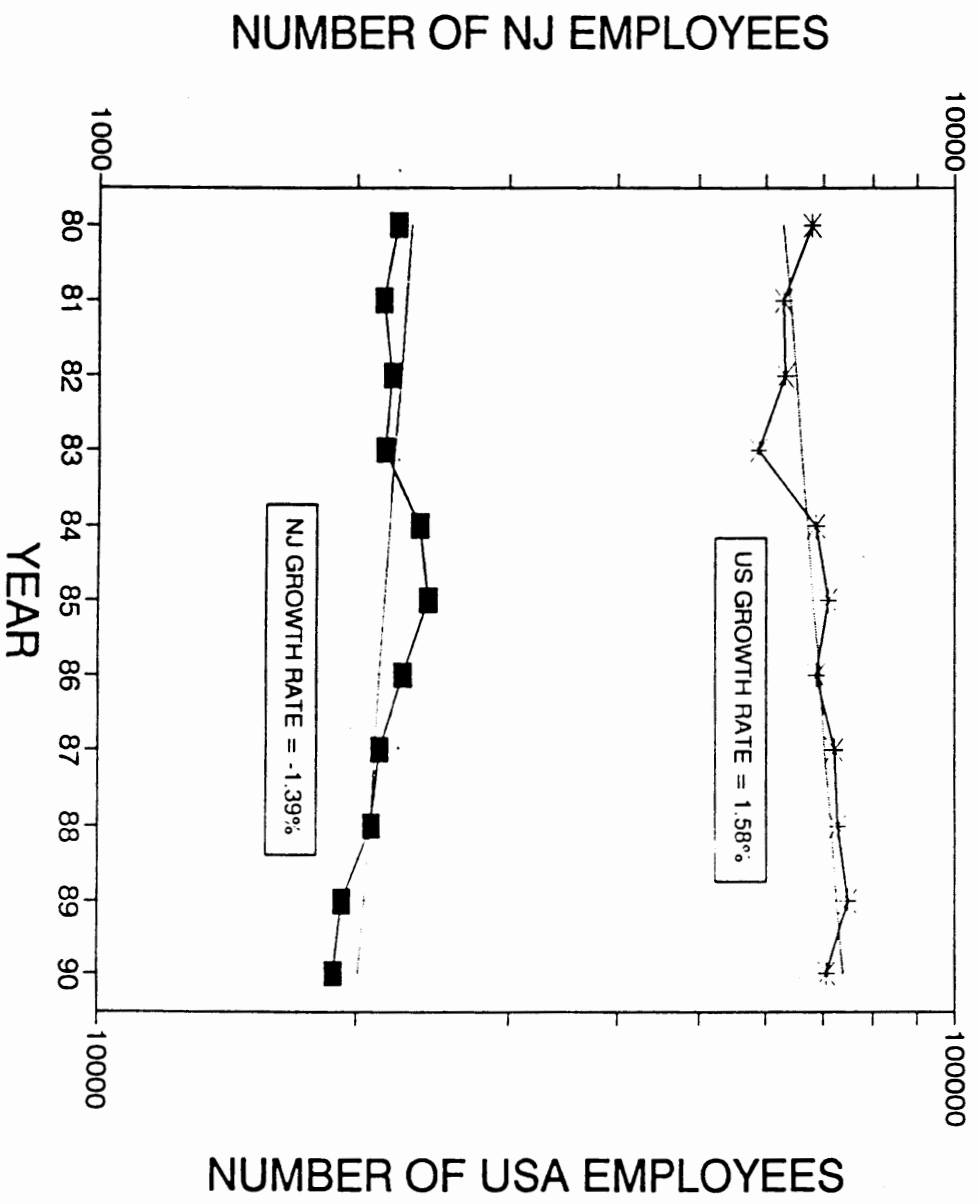


FIGURE 19

SIC 3471 - ELECPLAT. NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH

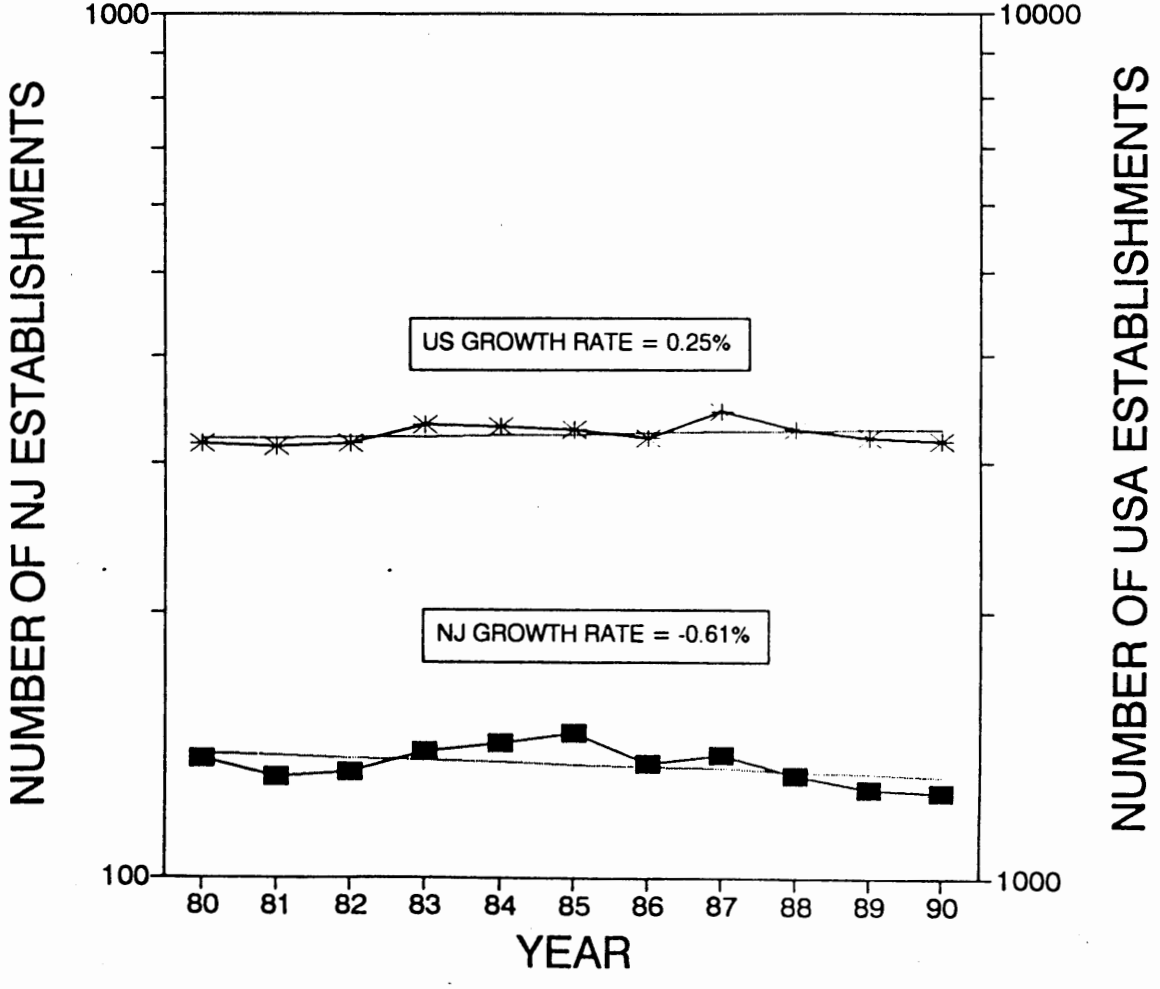


FIGURE 20

SIC 36 - ELECTRONICS NJ COMPARED TO USA
A DECADE OF EMPLOYMENT CHANGE

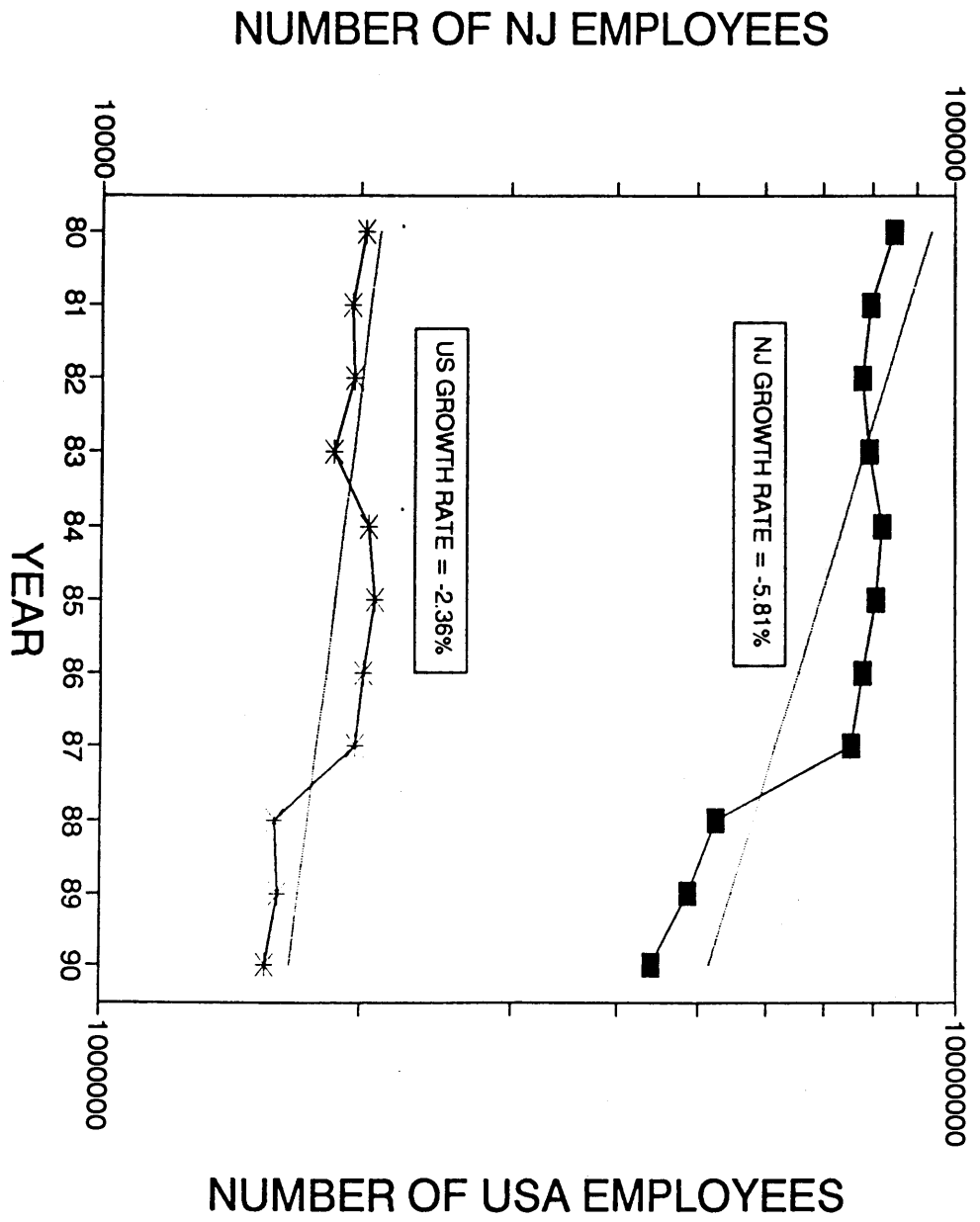


FIGURE 21

SIC 36 - ELECTRONICS NJ COMPARED TO USA
A DECADE OF ESTABLISHMENT GROWTH

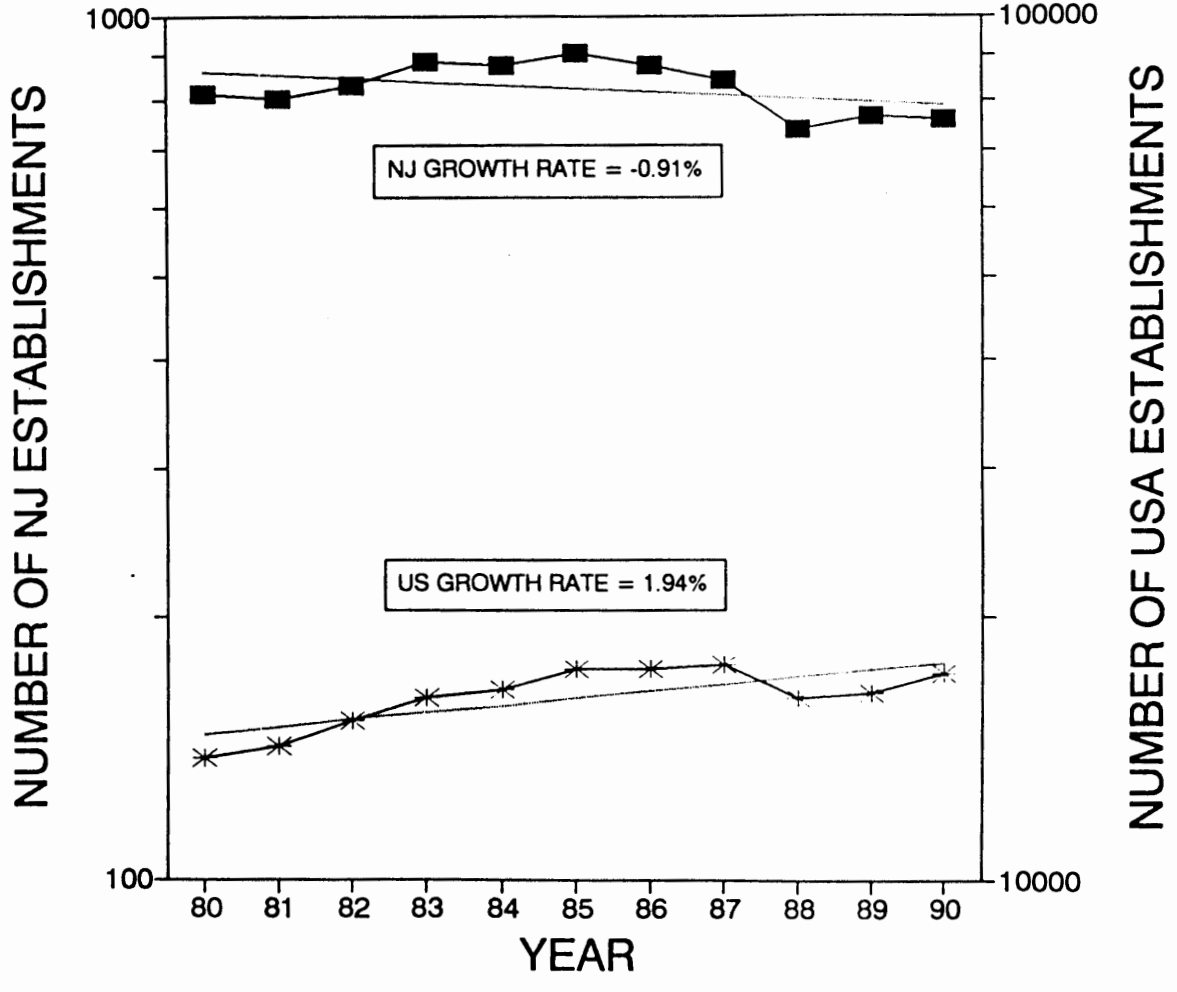


FIGURE 22

SIC 365 - ELECTRONICS NJ COMPARED TO US
A DECADE OF EMPLOYMENT CHANGE

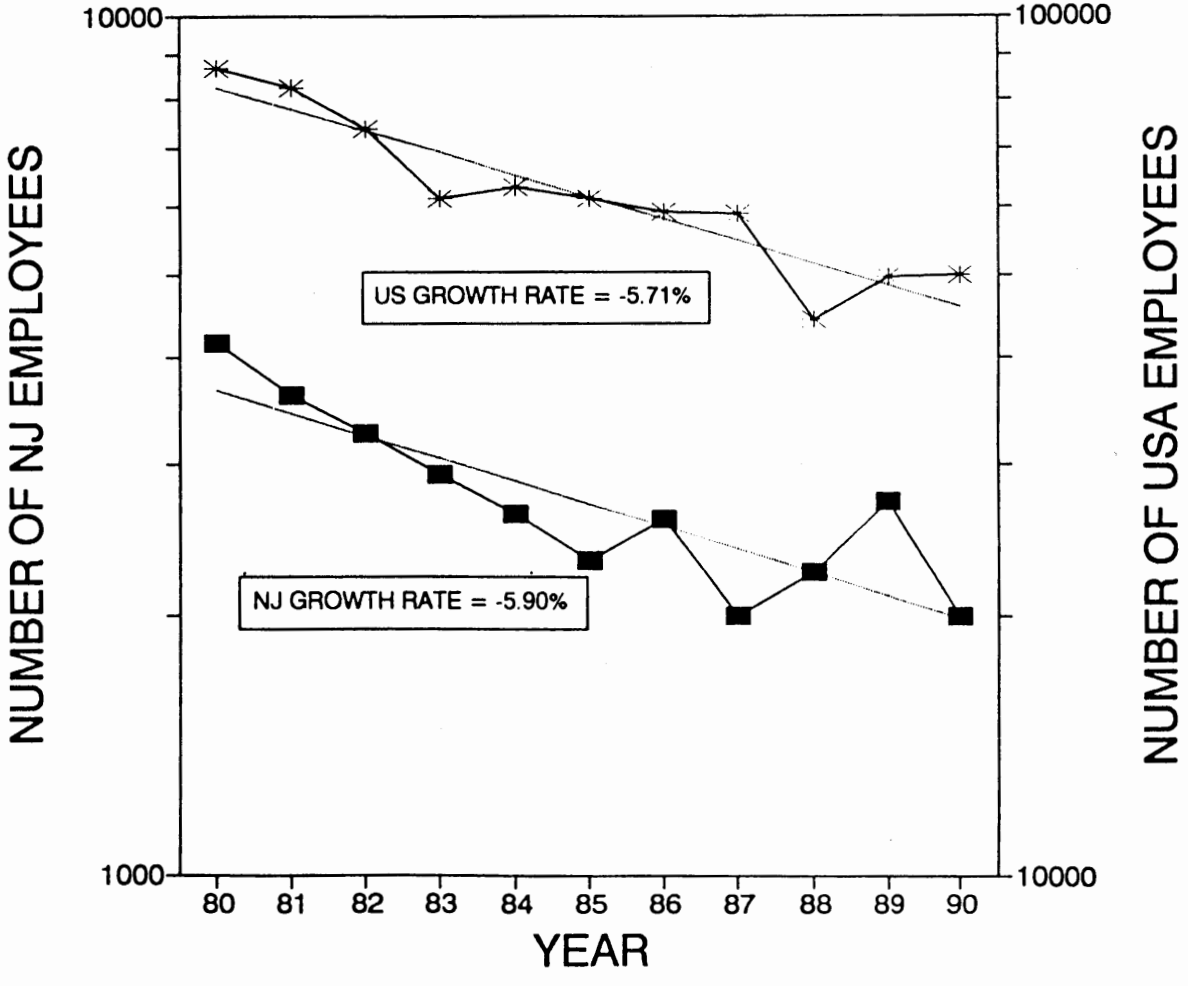


FIGURE 23

SIC 365 - ELECTRONICS NJ COMPARED TO US
A DECADE OF ESTABLISHMENT GROWTH

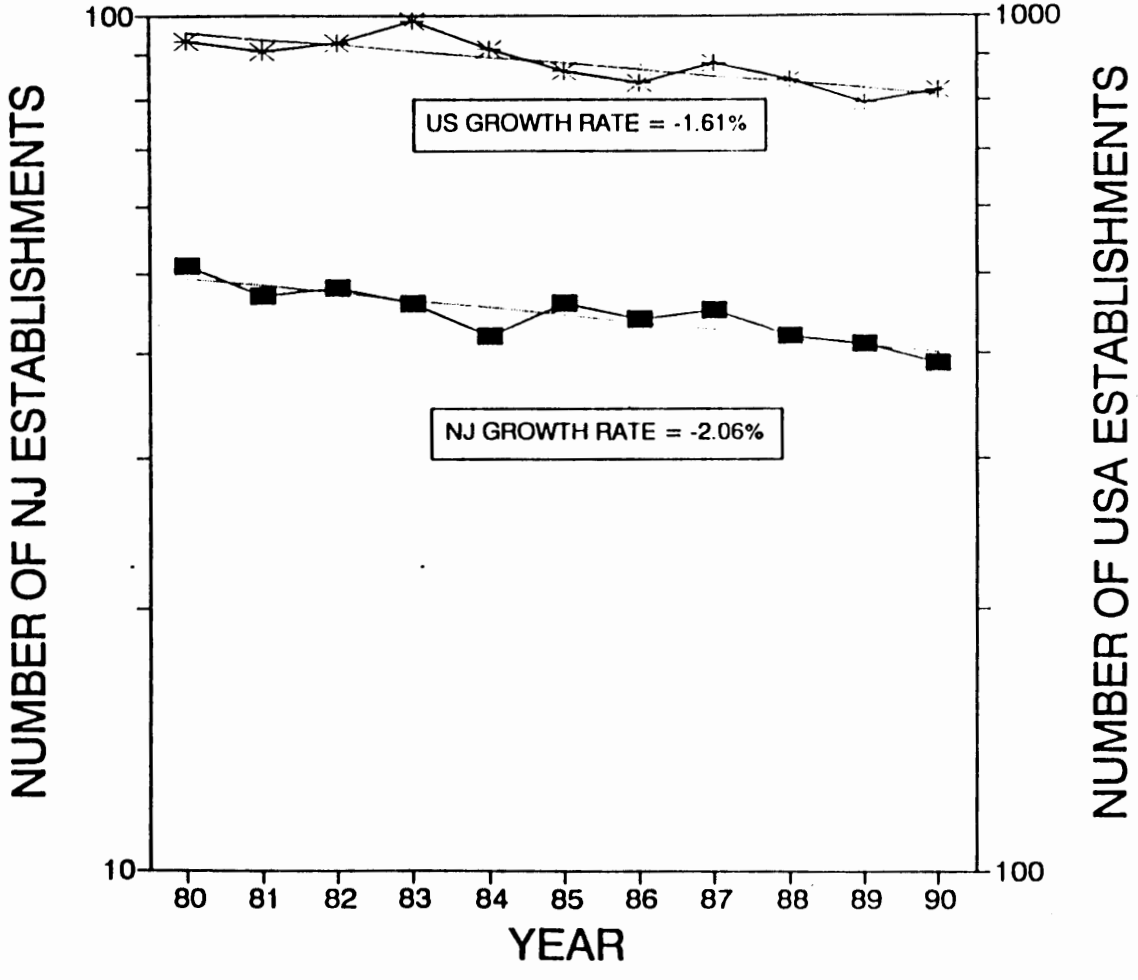


FIGURE 24

SIC 366 - ELECTRONICS NJ COMPARED TO US
A DECADE OF EMPLOYMENT CHANGE

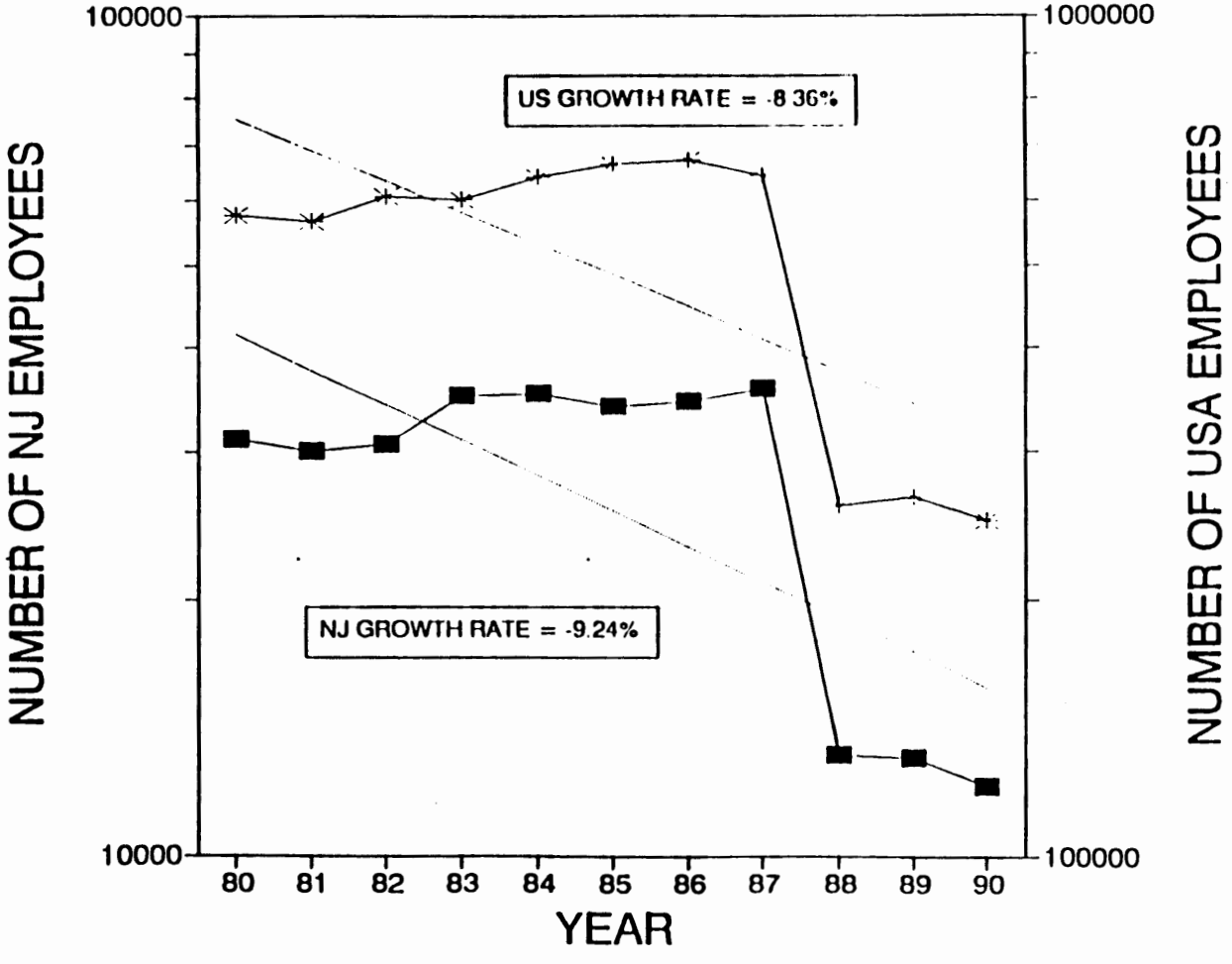


FIGURE 25

SIC 366 - ELECTRONICS NJ COMPARED TO US
A DECADE OF ESTABLISHMENT GROWTH

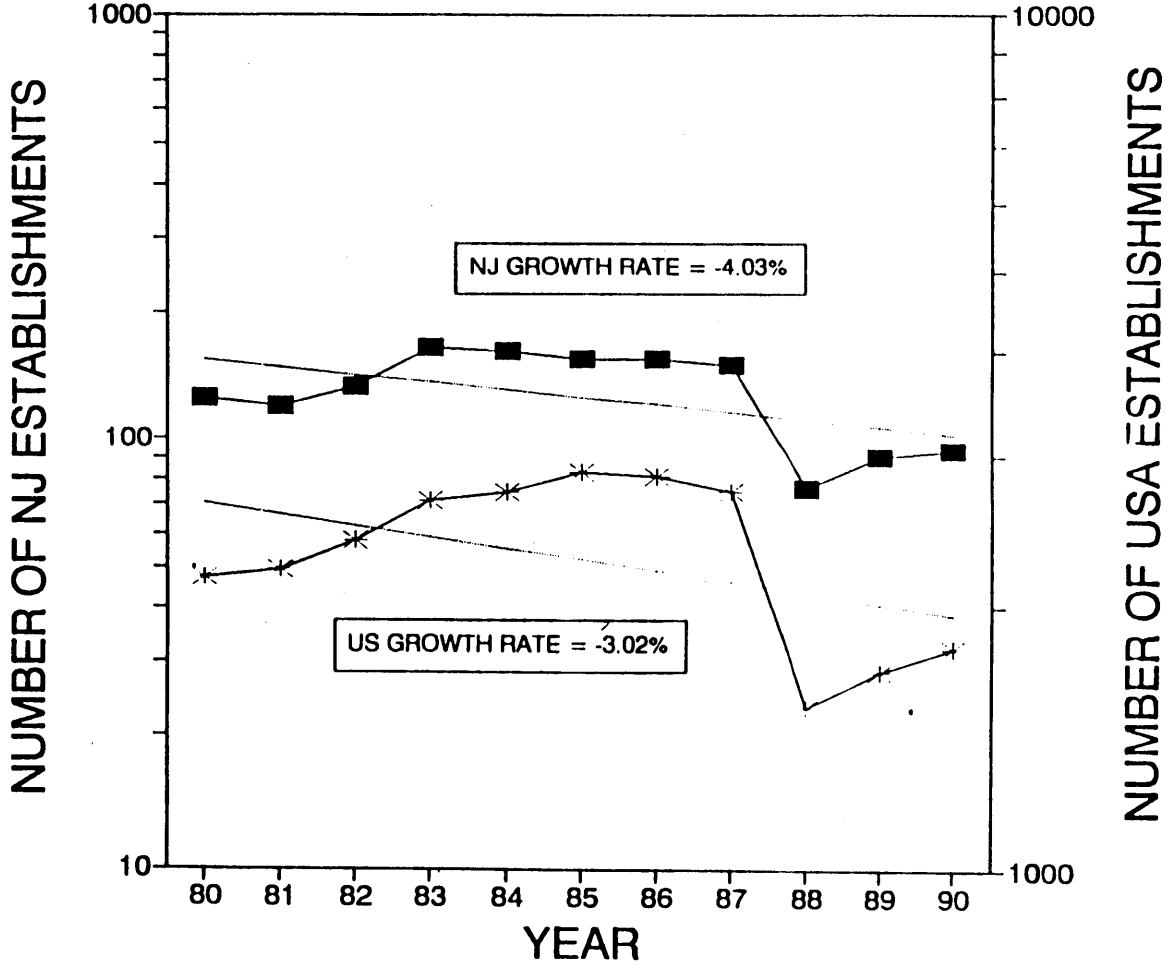


FIGURE 26

SIC 367 - ELECTRONICS NJ COMPARED TO US
A DECADE OF EMPLOYMENT CHANGE

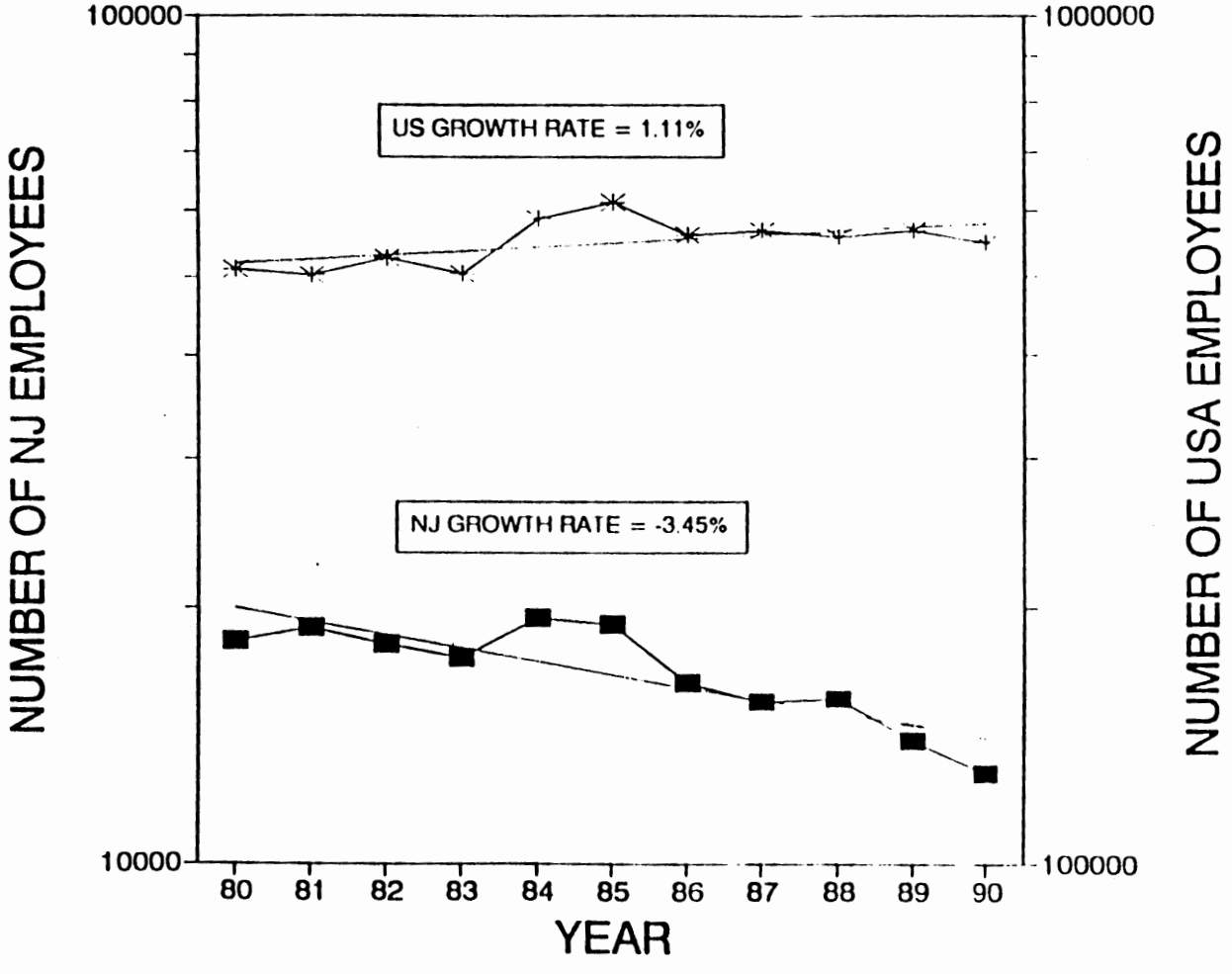
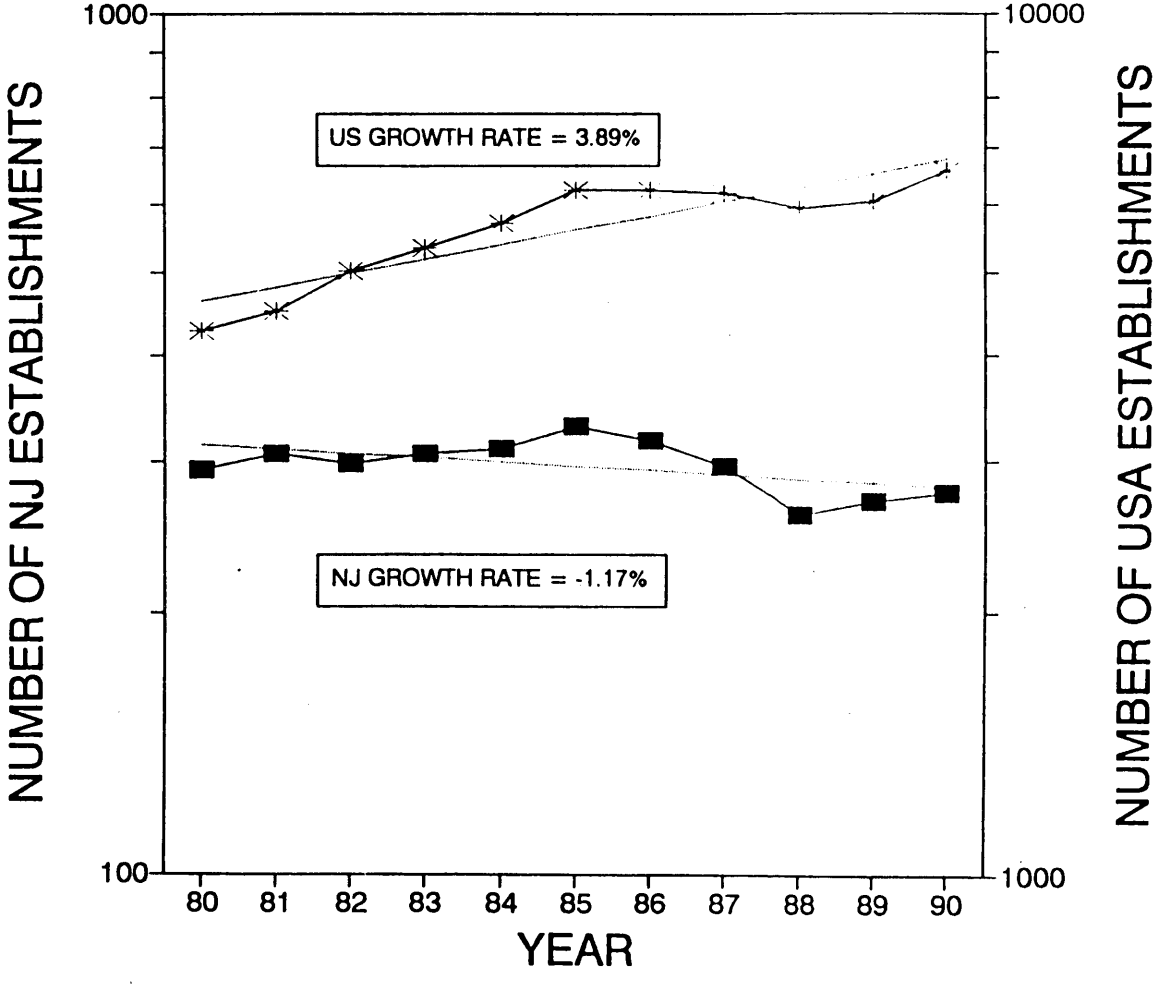


FIGURE 27

SIC 367 - ELECTRONICS NJ COMPARED TO US
A DECADE OF ESTABLISHMENT GROWTH



Appendix B

Testing the Relationship Between

Environmental Regulations and Economic Growth

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August 31, 1993

Revised September 13, 1993

Appendix B

New environmental regulations have often been challenged by opponents who have argued that stronger environmental regulations will hurt economic growth and employment. In a recent study, Stephen Meyer (1992) examined the relationship between state environmental regulations and economic growth. Meyer referred to the expected negative relationship between environmental regulations and economic growth as the environmental impact hypothesis. When he tested this hypothesis, Meyer obtained the surprising result that states with stronger environmental policies experienced more rapid rates of growth than states with weaker environmental policies—precisely the opposite relation than would be expected.

Although Meyer compensated for some of the factors that might have created a spurious positive relation between environmental regulations and economic growth, the positive relationship remained. Given the public debate surrounding environmental policy, it is important to confirm his findings. In this paper a model of the determinants of real gross state product growth is developed to test Meyer's findings. Unfortunately, the results of this study reveal that Meyer's efforts to control for spurious correlation were not sufficient. Several variables affect both economic growth and the environmental policies chosen by each state and these factors must be considered jointly in assessing the effects of environmental policy on economic growth. The positive correlation between state economic growth and environmental policies disappears when these additional variables are considered.

Section I: Meyer's tests of the Environmental Impact Hypothesis

Meyer characterized the environmental impact hypothesis as the intuitively reasonable negative relationship between environmental regulations and economic growth. He argued there were four interrelated assertions regarding the hypothesis:

- *Environmentalism directly inhibits overall economic performance;*
- *Environmentalism stifles employment growth;*
- *Environmentalism depresses labor productivity and undermines industrial competitiveness;*
- *Environmentalism forces industry to flee to regions where environmental policies are less restrictive and burdensome.* [1]

Since environmental regulations increase the cost of doing business, the first two propositions assert that more regulation will cause economic performance and employment to fall. The third proposition is that labor productivity will decrease as environmental regulations force businesses to allocate scarce capital to meet environmental requirements rather than invest in R&D and innovation.[2]

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[1] Meyer (1992), "Environmentalism and Economic Prosperity," page 4.

[2] Here Meyer's logic is less clear. If the environmental impact hypothesis were true, then burdensome environmental regulations would force less productive businesses to close and only those businesses with *higher* levels of productivity would remain. This would occur because only the more productive businesses could afford the increased costs imposed by environmental regulations.

The fourth proposition states that environmentalism will cause industries to leave states with burdensome environmental regulations and move to states where environmental regulation is more lax. This proposition is intuitively reasonable if other factors are held constant. Obviously many issues are involved in any decision to relocate a plant and environmental regulations are only one among them. If, for example, a state with more burdensome environmental regulations has the resources businesses need to produce and sell their output, then plant relocation is less likely.

To analyze the environmental impact hypothesis, Meyer tested five empirical predictions:

> *(1) States with stronger environmental records should experience poorer overall economic growth compared to those with weaker environmental records.*
>
> *(2) States with stronger environmental records should experience slower employment growth compared to those with weaker environmental records.*
>
> *(3) States with stronger environmental records should experience slower construction employment growth compared to those* with *weaker environmental records.*
>
> *(4) States with stronger environmental records should experience slower manufacturing labor productivity growth compared to those with weaker environmental records.*
>
> *(5) States with stronger environmental records should experience slower overall labor productivity growth compared to those with weaker environmental records.*[3]

Meyer used data on gross state product, total (non farm) employment, construction employment and labor productivity as indicators of economic performance over the 1982-1989 period. Since this was a period of relaxed federal commitment to environmental policy, according to Meyer, there were more opportunities for state differences in environmental policies to emerge.

Meyer used state rankings from a study by Duerksen (1983) as the indicator of state environmental policies. Duerksen evaluated states in the late 1970's and early 1980's on twenty three environmental indicators and these scores were used by Meyer to rank the states' environmental records. Given these rankings, state performance in the following period from 1982-1989 was evaluated to determine whether environmental regulations hurt state economic

[3]Meyer (1992), op. cit. page 8.

growth. Presumably, states with strong environmental records would experience slower rates of growth than states with weaker records over the 1982-1989 years.

When the growth rates for real gross state product were compared, Meyer found that states with stronger environmental records had higher growth rates than those with weaker records. This result held across the five indicators of state economic performance Meyer chose. Although as mentioned earlier, there is good reason to question labor productivity as a good economic indicator for the environmental impact hypothesis, the positive relation between environmental regulations and economic performance is surprising and warrants closer examination.

Meyer also examined relative performance between the periods of 1973-1980 and 1982-1989 with similar results. This tested a weaker version of the environmental impact hypothesis that asserts that states would grow more rapidly during the 1980's when environmental regulations were relaxed relative to the 1970's when federal enforcement of environmental regulations was greater. Again, states with stronger environmental records grew more rapidly than those with weaker records.

Since the tests employed were simple correlations between state environmental rankings and economic performance, other variables could be responsible for the results obtained. Meyer tried to control for several possible alternatives but in each case, he corrected only for a single alternative explanation of the results. For example, he argued it is possible that states with large economies are likely to have more pollution and tougher environmental regulations because of their size. At the same time, states with large economies are more diversified economically and better able to grow rapidly. Therefore it is possible that an alternative factor, large state economies, could be responsible for the results obtained. Meyer compensated for this effect by removing the states with large economies from the sample yet the basic results were unchanged.

In a similar way, Meyer suggested that specific characteristics among a group of states (other than the characteristic of having a large economy) could be responsible for the results. Again Meyer tried to compensate for this single effect with little change in the empirical results.

This approach is flawed because multiple factors may be at work that affect state economic performance and environmental regulations. If so, these factors must be accounted for jointly and not singly as Meyer has done. Since Meyer did not attempt to model the factors responsible for state growth, the effects of these additional variables may change his results. A model of state gross domestic product growth is presented in the following section.

Section II: A Model of State Economic Growth

To determine whether other variables are responsible for the apparent relation between state environmental regulations and economic growth, we need to model the determinants of state growth. Our focus in this study is on the determinants of real gross state product growth. Economic theory indicates that a state's ability to produce output will vary with the resources available in that state. These resources include the state's labor force and its skills, the infrastructure in transportation and other support services, as well as the state's overall business climate reflecting environmental and other regulations, taxes and other variables.

Data on real gross state product were obtained from the Bureau of Economic Analysis for the same periods used by Meyer; 1973-1980 and 1982-1989. Meyer's classification of states as environmentally strong, moderate or weak and Duerksen's (1983) scores were both used to measure state environmental regulations. Since the results most strongly supported Meyer's findings when his classification scheme was used as the environmental indicator, the test results are reported for this variable only. Tests using Duerksen's environmental scores were quite similar. The rank variable was set to equal zero for those states with weak environmental records (as classified by Meyer), one for those states with moderate environmental regulations and to two for those with the strongest environmental regulations.

In table I, the results from a simple regression of real gross state product and the state's environmental classification is presented. As Meyer found, there is a statistically significant positive relationship between state economic growth and environmental ranking. Those states with stronger environmental rankings (and policies) have higher rates of growth in real gross state product.

Table I

Dependent Variable: Growth in Real Gross State Product
Usable Observations 50 Degrees of Freedom 48
Centered R**2 0.169528 R Bar **2 0.152227
Uncentered R**2 0.760712 T x R**2 38.036
Mean of Dependent Variable 30.454701266
Std Error of Dependent Variable 19.572224227
Standard Error of Estimate 18.021049397
Sum of Squared Residuals 15588.394626
Regression F(1,48) 9.7985
Significance Level of F 0.00297037
Durbin-Watson Statistic 1.667737

	Variable	Coeff	Std Error	T-Stat	Significance
1.	Constant	21.10764	3.925764	5.37669	0.0000022
2.	RANK	9.5378	3.046984	3.13025	0.0029703

To account for factors that may explain state growth over the 1982-1989 period, data were gathered for variables suggested by other studies of state growth (Bartik (1989), Browne (1980), Booth (1986, 1987), Kirchhoff and McAuliffe (1989) and Plaut and Pluta (1983)). These variables included state population growth over the period, the growth in state direct educational expenditures, the median age of the state's population in 1980, growth in total taxes levied by the state over the period, and the growth in population density (measured as the population per square mile of land area). All growth rates were measured as the percentage change from 1982 to 1989. The growth in the state's population will measure both the labor resources available to businesses as well as the potential local demand for the output produced by firms. Growth in the state's population density per square mile will reflect the extent of economic development in the state and the potential for additional growth. The growth in state direct expenditures on education captures the level of state services and may also reflect the population's skill level since more educated workers are generally more willing to commit state resources to education. The growth in the total taxes levied by the state would be expected to have a negative effect on state economic growth as it reflects a less attractive business climate. However, since total tax levels may also reflect state support services, it could have a positive effect on state growth. Finally, the growth in real gross state product from 1973-1980 was included to capture the possibility that states that grew more rapidly during the 1970's would be more likely to grow rapidly during the 1980's.

Presented in Table II are the regression results from estimating the model of state growth using White's (1980) method to correct for heteroskedasticity. Variables included were the state's environmental ranking (RANK), population growth rate (SPOPG), growth in the density of the state's population per square mile (SPOPDG), the state's growth during the 1973-1980 period (SGDPG73), and the growth in the state's taxes per capita (STXPCG).

The significantly positive relationship between the growth in real gross state product and the state's environmental ranking disappears when other variables are included to explain state growth. The growth in state taxes per capita has a positive sign which suggests it may proxy for the growth in state support services. Otherwise the overall fit of the model is quite good for what is essentially a cross-section sample.

The model was re-estimated substituting growth in per capita direct educational expenditures by state (EDDGG) for the growth in state taxes per capita. If the tax variable did proxy for state support services, it should appear here. This appears to be the case in Table III as the growth in per capita direct education expenditures is significantly positive and improves the fit of the regression model. As before, the environmental ranking variable is statistically insignificant as is the variable for state growth during the 1973-1980 period.

Table II

Dependent Variable: Growth in Real Gross State Product
Usable Observations 50 Degrees of Freedom 44
Centered R**2 0.797993 R Bar **2 0.775038
Uncentered R**2 0.941795 T x R**2 47.090
Mean of Dependent Variable 30.454701266
Std Error of Dependent Variable 19.572224227
Standard Error of Estimate 9.283134932
Sum of Squared Residuals 3791.7701433
Durbin-Watson Statistic 2.185743

	Variable	Coeff	Std Error	T-Stat	Significance
1.	Constant	19.3284	4.3939	4.39886	0.00001088
2	.RANK	1.6560	1.8461649	0.89702	0.36970584
3.	SPOPG	6.4189	0.7690732	8.34636	0.00000000
4.	SPOPDG	3.6266	0.535715	6.76974	0.00000000
5.	STXPCG	0.0536	0.020444	2.62350	0.00870304
6.	SGDPG73	0.0562	0.05099	1.10226	0.27034741

Table III

Dependent Variable: Growth in Real Gross State Product
Usable Observations 50 Degrees of Freedom 44
Centered R**2 0.848986 R Bar **2 0.831825
Uncentered R**2 0.956488 T x R**2 47.824
Mean of Dependent Variable 30.454701266
Std Error of Dependent Variable 19.572224227
Standard Error of Estimate 8.026393272
Sum of Squared Residuals 2834.6115144
Durbin-Watson Statistic 1.709653

	Variable	Coeff	Std Error	T-Stat	Significance
1.	Constant	-1.615969	6.083294	-0.2656	0.790516
2.	RANK	1.919466	1.644426	1.1673	0.2431068
3.	SPOPG	5.254452	0.761277	6.9022	0.0000000
4.	SPOPDG	-2.678404	0.558252	-4.7978	0.0000016
5.	EDDGG	0.558512	0.10469	5.3349	0.0000001
6.	SGDPG73	0.056018	0.040636	1.3785	0.1680434

Appendix B

One issue Meyer did not fully take into account is the fact that a state's choice of environmental policy is itself affected by economic and demographic variables. In an update Meyer suggested that "third factors" could account for the positive relationship between environmentalism and economic prosperity, but again, Meyer controlled for these factors one at a time and not jointly. Furthermore, simple correlations—even when controlling for a third factor—fail to account for multiple factors and underlying causal relations.

States with higher levels of income or with more rapid rates of growth in income may be more likely to pass stronger environmental legislation. To account for this and other possibilities, an ordered probit model was estimated with the state's environmental classification (weak, moderate or strong) as the dependent variable. Ordinary least squares estimates are inconsistent when the dependent variable is categorical and not continuous. Conventional probit or logit models would capture only binary effects and would not reflect the ordering of the data.

The estimation results from the ordered probit model appear in Table IV. As before, the dependent variable, rank, was set to equal zero for those states with weak environmental records (as classified by Meyer), one for those states with moderate environmental records and to two for those with the strongest environmental records. The state's direct expenditures on education in 1978 (ED78DG) had a significant and positive coefficient as did the median age of the state's population. The growth in direct educational expenditures was also significant in explaining the growth in real gross state product in Table III. What is also interesting is the negative coefficient for the real gross state product of the state in 1980 (RGSP80). Since this is the negative relation predicted by the environmental impact hypothesis, it bears further scrutiny.

The effect of a variable in probit and logit regressions cannot be interpreted in the same way as with ordinary regressions. First, the estimated coefficients are not the marginal effects of the regressors on the probabilities, so they do not represent the change in probability for a given change in the regressor. Second, with ordered probit regressions, the effect of a change in the regressor on the probability of y is only unambiguous in the case of the first and last categories. The effects of changes in the regressors on the probabilities for y in the intermediate categories is ambiguous (see Greene (1993), for example).

In the case of the effects of the relation between a state's environmental ranking and its real gross state product, we must calculate the marginal effects of changes in the real gross state product for each of the probabilities. These calculations appear below based on the mean value for the variables.

∂ Prob(rank=0)/∂ rgsp80 = 0.01728

∂ Prob(rank=1)/∂ rgsp80 = 0.00344

∂ Prob(rank=2)/∂ rgsp80 = -0.020725

These marginal effects mean that higher levels of real gross state product will increase the probability of a state having a rank of either 0 or 1 (that is, the state is more likely to have weak or moderate environmental regulations). But higher levels of real gross state product will decrease the probability that the state will have the highest ranking (the state is less likely to have strong environmental regulations). So the environmental impact hypothesis is supported in terms of the effects of real gross state product on the probability of the state having weak, moderate, or strong environmental regulations.

Table IV

Ordered Probit Model
Maximum Likelihood Estimates
Dependent Variable: State Environmental Rank

Log-Likelihood..... -44.06205
Restricted (Slopes=0) Log-L. -54.78908
Chi-Squared (3)..... 21.45407
Significance Level..... 0.8472018E-04

Cell Frequencies for Outcomes

Cell	Count	Rel.Freq.
0	18.	0.36000
1	15.	0.30000
2	17.	0.34000

N[0,1] used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob|t|>x	Mean of X
Constant	-9.988	5.445	-1.834	0.06658	
MEDAGE	0.345	0.1865	1.850	0.06435	29.536
ED78DG	0.164E-02	0.7158E-03	2.294	0.02177	2208.8
RGSDP80	-0.5484E-01	0.2893E-01	-1.896	0.05799	57.325
MU(1)	1.0155	0.2356	4.310	0.00002	

Section III: Summary and Conclusions

The effects of environmental regulations on economic growth are an important issue for public policy. Although Meyer (1992) found evidence of a positive relation between an indicator of the strength of state environmental regulations and state economic growth, that relationship does not hold when other variables which can plausibly explain state economic growth are considered. Furthermore, in assessing the forces which increase or decrease the probability that a state will have a strong environmental ranking, higher levels of real gross

state product tend to decrease the probability that the state will have a high environmental ranking.

Meyer suggested that a "third factor" could be responsible for the relationship he found between environmentalism and economic performance. The results from estimating a model of real growth in gross state product and an ordered probit model of the factors that affect a state's choice of environmental policy suggests that real gross state product and direct education expenditures may both play a role affecting the relation between environmental rankings and economic growth.

In examining the relation between environmental regulations and economic growth, the environmental indicator was the same as that used by Meyer (1992). However, since Meyer argued that the 1982-1989 period was one of reduced federal commitment to environmental regulations, it is also possible that some of the states with high environmental rankings at the time Duerksen (1983) made his assessment did not continue to enforce those regulations to the same degree in the 1980's. If so, this could explain the absence of a negative effect of environmental regulations on economic growth: some states with high rankings relaxed their enforcement during the 1980's and grew more rapidly as a result. This would support the environmental impact hypothesis if states reacted this way. No doubt the issue of environmental regulation and economic growth will continue to be researched and debated.

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