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STUDY OF INDUSTRY MOTIVATION FOR POLLUTION PREVENTION

DRAFT

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by

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DRAFT March 31, 1997

STUDY OF INDUSTRY MOTIVATION FOR POLLUTION PREVENTION

Pollution Prevention Policy Staff
U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

This document, "A Study of Industry Motivation for Pollution Prevention," reports on a study undertaken by the Pollution Prevention Policy Staff (PPPS) of the U.S. Environmental Protection Agency (EPA), and co-sponsored by the Department of Commerce (DOC), Department of Defense (DOD), and Department of Energy (DOE). The study had three objectives:

1) Improve the understanding by Federal agencies of whether and how environmental issues influence core business decisions — particularly involving production process operation — in order to better understand how various factors, including public policy, motivate pollution prevention in industry.

2) Improve the understanding of these factors by others with a professional interest in U.S. environmental policy — e.g., those in state and local government, industry, environmental and community groups, labor, and academia — as well as by members of the general public with an interest in environmental policy.

3) Achieve the above through a debate that relies on the best factual information available, while seeking to improve the quality of that information and its interpretation.

PPPS started its work on this study by spending one year on a prototype study through which it developed a questionnaire and a basic methodology. PPPS then hired a professional survey company to refine the methodology, and to interview more than 1000 business people anonymously — 520 randomly-selected lithographic printing companies (most of which were very small businesses), and 516 randomly-selected production managers representing the larger manufacturing companies reporting to the Federal Toxics Release Inventory (TRI). The research

company also gathered information from EPA data sources about the extent to which each of the surveyed businesses was affected by the environmental regulatory system. The following findings are based on statistical analyses of those data.

The Prevalence of Pollution Prevention

The survey found that pollution prevention activities are being practiced widely by printers and large manufacturers; however, we are unsure whether such activities have become the first resort of these businesses in meeting their environmental responsibilities. Specifically:

- 64% of printers reported implementing pollution prevention activities[1]. Of these:
  - 90% modified or substituted chemicals;
  - 73% modified image-making or prepress operations;
  - 69% implemented good operating practices; and
  - 58% modified press operations.
- 85% of large manufacturers (TRI facilities) included in this survey reported implementing pollution prevention activities[2]. Of these:
  - 96% implemented good operating practices;
  - 93% modified production related processes;
  - 91% improved materials handling practices;
  - 76% substituted chemicals or raw materials or modified their product; and
  - 64% modified cleaning or degreasing operations.

For the large manufacturers reporting to TRI, however, no association was found between the reporting of pollution prevention activities and the actual percent of TRI chemical waste reduced (normalized for production), one quantitative indicator of pollution prevention.

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[1] This motivation study reflects a higher incidence of reported pollution prevention activity (64%) than that reported to the 1994 TRI Public Data Release (41.9%) because the motivation study interviewed only lithographic printers. These printers generally do not report to TRI. Most printers reporting to TRI are part of the industry's gravure sector.

[2] This motivation study reflects a higher incidence of reported pollution prevention activity (85%) than that reported to the 1994 TRI Public Data Release (32%) for three reasons. First, the motivation study asked about pollution prevention activity over a two-year period, versus the one-year period reported to TRI. Second, the motivation study interviewed production managers, individuals actually responsible for performing pollution prevention, whereas the TRI data relied on information reported by company environmental, health, and safety staff. Third, the motivation study asked respondents about all pollution prevention activity (both TRI- and non-TRI-reported chemicals) versus TRI's questioning of pollution prevention for only the TRI-reported chemicals at a facility.

Traditional Environmental Regulatory Programs

The survey showed that traditional environmental regulatory programs were almost unrivaled in making business decision makers aware of their environmental obligations. That said, the ability of these programs to facilitate business efforts to meet those obligations might still be improved.

For large manufacturers, contact with enforcement personnel was associated with reduction in TRI waste normalized for production. Also, the use of certain types of pollution prevention activity by large manufacturers was associated with the amount of interaction the large manufacturers had with the regulatory system or with technical assistance organizations.

Environmental regulatory requirements ranked near the top of issues considered very important by the production managers in their overall job responsibilities. Environmental regulatory requirements were ranked nearly last on the list of issues printers considered very important, although very few printers reported considering environmental issues not at all important.

Environmental enforcement actions were reportedly among the most important factors in getting respondents to first consider environmental issues in their jobs.

Interaction with the regulatory system was also related to an increase in the reported importance of: 1) company environmental policies and management directives, 2) pollution control and waste disposal costs, and, for large manufacturers, 3) the environmental impacts of their products during use or disposal. Also, production managers ranked government requirements as one of the strongest influences on their final choice of equipment and operations; these requirements were ranked in the middle by printers.

Government publications and assistance providers did not rank high among reported sources of environmental information about alternative practices or technologies. Despite this finding, contact with assistance and enforcement organizations increased the reported importance of government publications and assistance providers as sources of environmental information.

Although advice from government employees ranked at the bottom of the list of strong influences in the final choice of equipment and operations, interaction with both the regulatory system and technical assistance organizations increased the reported influence of this advice. Also, contact with regulatory and assistance personnel increased the reported influence of the compliance costs on the final selection of equipment or operations.

Technical Assistance

Most printers and production managers recently having contact with technical assistance programs reported implementing pollution prevention activities as a result of those contacts. For printers, contact with technical assistance programs was related to an increase in the reported importance of environmental issues in overall job responsibilities, as well as an increase in the reported importance of the cost of input materials and the availability of environmental technology information. A greater number of production managers contacted by technical assistance organizations reported that pollution control or compliance costs were a strong influence in their final choice of equipment and operations.

Pollution Prevention Planning

Almost half the printers and two-thirds of the production managers reported conducting their evaluations of environmental alternatives as part of government-required (Federal, state, local) pollution prevention plans (see page 2-27).

Motivators Not Directly Related to Public Policy

Employee morale and level of productivity, and the sources, quality, and cost of raw materials topped the list of issues that printers and production managers reported as being very important to their job responsibilities. Trends in customer preferences for the respondent's product was ranked near the top, although it was ranked below environmental regulatory requirements by production managers.

Printers ranked the environmental interest of the respondent, family, and friends at the top of the list of factors — along with environmental enforcement actions — as very important for first getting them to consider environmental issues in their jobs.

Printers ranked vendors and suppliers at the top as sources of environmental information about alternative practices or technologies. Company employees were ranked at the top by production managers, well ahead of vendors and suppliers.

Total Quality Management (TQM) plans and materials or chemical accounting reports were mentioned frequently in connection with evaluations of alternative practices and technologies. These chioces were ranked behind only government-required pollution prevention plans.

Production efficiency and other non-environmental benefits were ranked highest among issues reported by printers and production managers as very important in influencing the final choice of equipment and operations. For printers, the top rank was shared by availability of information on particular practices and technologies. Information availability was ranked near the top by production managers.

The Respondents and Their Firms

Of the 520 printers surveyed, 38% were company owners, 19% were presidents, 13% were general managers, and 13% were operations or production managers. Of the remaining 17%, all seemed to be in core business functions such as production or sales, and none reported themselves to be environmental specialists of any sort.

Twenty-eight percent of the printers reported having 1-2 production employees, 25% had 3-4 production employees, 24% had 5-7 production employees, 12% had 8-19 production employees, and 10% had 20 or more production employees on an average shift. An increase in printing company size was associated with an increase in pollution prevention activities as well as interaction with regulatory and technical assistance programs. For this reason, some of the observed associations between printers' responses and interaction with regulatory and assistance programs may be partly a result of company size.

Of the 516 large manufacturers contacted, 61% of the respondents reported themselves to be productions or operations managers; 17% had some other position in operations, manufacturing, or engineering; 10% were owners or top managers; 5% managed environmental affairs; and most of the rest were in core business functions such as quality management or product planning.

Twenty-three percent of the large manufacturers had 1-19 production employees, 28% had 20-40 production employees, 24% had 41-100 production employees, and 25% had 100 or more production employees on an average shift. Of the 5% of TRI respondents working in *Fortune 100* companies, most had more than 100 production employees on an average shift.

Issues for Further Study

The above findings illuminate the hypotheses that underpin pollution prevention policy, yet they raise many questions as well. In the course of carrying out this study, the researchers developed approaches for answering these questions, and hope to conduct a study with such refinements at some point in the future.

CHAPTER ONE
INTRODUCTION

This document, "A Study of Industry Motivation for Pollution Prevention," reports on a study undertaken by the Pollution Prevention Policy Staff of the U.S. Environmental Protection Agency (EPA), and co-sponsored by the Department of Commerce (DOC), Department of Defense (DOD), and Department of Energy (DOE). The study had three objectives:

1) Improve the understanding by Federal agencies of whether and how environmental issues influence core business decisions — particularly involving production process operation — in order to better understand how various factors, including public policy, motivate pollution prevention in industry;

2) Improve the understanding of these factors by others with a professional interest in U.S. environmental policy — e.g. those in state and local government, industry, environmental and community groups, labor, and academia — as well as by members of the general public with an interest in environmental policy.

3) Achieve the above through a debate that relies on the best factual information available, while seeking to improve the quality of that information and its interpretation.

PPPS started its work on this study by spending one year on a prototype study through which it developed a questionnaire and basic methodology. PPPS then hired a professional survey company to refine the methodology, and to interview more than 1000 business people anonymously — 520 selected randomly to represent the lithographic printing industry (composed mostly of very small businesses), and 516 production managers selected randomly to represent the larger manufacturing companies reporting into the Federal Toxics Release Inventory (TRI). The research company also gathered information from EPA data sources about the extent to which each of the surveyed businesses was affected by the environmental regulatory system. The following findings are based on statistical analyses of those data. See Appendix A for a discussion of the research methodology.

The survey results and other information were analyzed statistically. The raw data, the statistical analysis, and EPA's preliminary interpretations were made available to hundreds of environmental policy experts and the general public through the list servers of the National Pollution Prevention Roundtable and the Printers National Environmental Assistance Center, and through direct mailings to various organizations and trade associations. EPA's findings comprise the second chapter of this report. The third chapter discusses improvements that EPA would make to the methodology, and areas of further research indicated by the findings. Discussion of the research methodology and statistical analysis, and the survey instrument, are attached as appendices.

"Pollution prevention" involves incorporating environmental considerations into core business decisions

A definition of "pollution prevention," the phenomenon the Federal agencies wished to better understand with this study, is useful here. With the passage of the Pollution Prevention Act of 1990, Congress declared it "to be the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible." In implementing the Pollution Prevention Act, EPA defines "pollution prevention" as:

(a) "source reduction" — being any practice which reduces:

— the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and

— the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

(b) other practices that reduce or eliminate the creation of pollutants through:

— increased efficiency in the use of raw materials, energy, water, or other resources; or

— protection of natural resources by conservation.

This definition is considered to be technologically focused because it describes the characteristics of the technologies and work practices constituting pollution prevention (e.g., reducing the amount of hazardous substances entering any waste stream). It also describes the technologies and work practices not defined as pollution prevention (hence the phrase, "prior to recycling, treatment, or disposal"). This definition is the sense in which "pollution prevention" is used throughout this report.

In addition, the term "pollution prevention" is sometimes used in this study with respect to business behavior, rather than in terms of the technological results of that behavior. The basic premise of this behavioral approach is fourfold:

1) Many businesses isolate fundamental business decisions, such as those regarding the financing, design, production, costing, pricing, and marketing of products and services, from environmental considerations.

2) To the extent that a business tries to meet its environmental protection obligations without accounting for them in core business decisions — strictly at the "end of the pipe" — the business may be passing over more cost effective and protective strategies.

3) Pollution prevention involves addressing environmental considerations in these core business decisions, and EPA promotes pollution prevention in order to facilitate the use of more cost-effective and protective strategies.

4) The best way to assess EPA's effectiveness in promoting pollution prevention is from the context of the core business decision maker.

Exhibit 1 on page 1-7 illustrates this concept, depicting a simplified view of the world of the product and process designers, equipment operators, and managers at the core of business. Currently, the Clean Air Act, Clean Water Act, and the Resource Conservation and Recovery Act address air emissions, discharges to water, and the management of hazardous waste respectively as isolated phenomena. This one-pipe-at-a-time approach, which divides up the business into individual environmental media, is illustrated by the smokestacks, drainpipe, and waste barrels.

As mentioned, businesses often separate environmental decisions from core business decisions, which, in the extreme, makes pollution prevention impossible. Instead, environmental matters are often handled at the end of the pipe by compliance specialists, who focus on the complex regulatory schemes and have limited interaction with product and process designers, production managers, and others at the core of the business.

Myriad other issues confront the core businesspeople on a daily basis. These issues include purchasing and using supplies and equipment, interacting with their community, and responding to the needs of the customer. All of these issues can have profound environmental implications.

In promoting pollution prevention, EPA's challenge is to enable and encourage the core decision makers to weigh environmental considerations in their daily decisions as naturally as they weigh the other issues.

1.1 EXAMINING POLLUTION PREVENTION HYPOTHESES

In the twenty years since EPA first mentioned "source reduction" as being the most preferred of environmental management approaches, US environmental policy makers and policy advocates have advanced a wide variety of proposals for promoting pollution prevention. Each of these proposals is based implicitly or explicitly on a hypothesis of what motivates or inhibits industrial pollution prevention. Some of the most common hypotheses are stated below:

- Strict joint and several Superfund liability motivates pollution prevention by raising the business's anticipated cost of hazardous waste disposal, thus making it cost effective for the business to address environmental considerations in its core business decisions. (This hypothesis presumably does not apply to the prevention of air emissions, water discharges, or wastes that are destroyed, which tend not to be covered by Superfund liability.)

- Promulgating and enforcing tough waste management and pollutant limiting standards, even one medium at a time, motivates pollution prevention by raising the business's current cost of managing hazardous waste and controlling air emissions and wastewater discharge, thus making it cost effective for the business to address environmental considerations in core business decisions.

- Allowing a business extended compliance deadlines, reduced fees or penalties, or reduced monitoring costs, if it investigates or practices pollution prevention, motivates pollution prevention by (a) reducing the business's cost of pollution prevention compared to end-of-pipe waste and pollution management approaches, and (b) drawing the business's attention to pollution prevention measures it might have otherwise missed.

- Changing customer specifications to favor environmentally-superior products and production processes allows a business to expand its business as a direct consequence of pollution prevention.

- Requiring a business to publicly report its toxic material releases or use motivates pollution prevention by (a) bringing the attention of top management or other core business decision-makers to toxic releases or use, and (b) associating the release or use of toxic materials with bad publicity in the minds of business decision-makers.

- Providing the business technical assistance promotes pollution prevention by (a) providing access to pollution prevention information the business might not have otherwise had, and (b) focusing the attention of business decision makers on pollution prevention measures they otherwise might have missed.

- Inviting the business to participate in a program that publicly recognizes pollution prevention excellence motivates pollution prevention by (a) drawing the business's attention to pollution prevention measures it might have otherwise missed, and (b) associating pollution prevention with good publicity in the minds of business decision-makers.

— Supporting pollution prevention research, development, and diffusion provides businesses access to pollution prevention technologies and practices that might not otherwise be available for years.

— Requiring or encouraging the business to develop plans for preventing pollution promotes pollution prevention by leading the business's environmental and core business decision makers to work together to make more rational and cost effective decisions with respect to their prevention and management of waste and pollution.

— Requiring or encouraging a business to publicly announce its pollution prevention goals and progress towards those goals promotes pollution prevention by associating pollution prevention progress with good publicity in the minds of the business decision-maker.

Inhibition of Pollution Prevention

— The fragmented and unpredictable nature of environmental regulatory programs leads businesses to insulate core business decisions from environmental compliance requirements, which, in the extreme, makes pollution prevention impossible.

— Specific end-of-pipe technologies are often required explicitly by regulatory programs, inhibiting the use of pollution prevention technologies and practices.

— Specific end-of-pipe technologies are often encouraged implicitly by regulatory programs, inhibiting the use of pollution prevention technologies. In particular, EPA often bases standards on the performance of a "reference technology" — typically a pollution control technology — and publishes "development documents" that discuss the performance of the reference technology. Industry compliance specialists and consultants, as well as state, local, and EPA permit writers, tend to rely heavily on the development documents in choosing and approving technologies to meet the requirements. A higher burden of proof is therefore placed on pollution prevention technologies and practices not discussed in the development documents.

Individuals in Federal, state, and local agencies, in the private sector, and in environmental advocacy groups have worked directly with programs that embody these hypotheses, and have seen most of them as being effective at some level. The prototype study that formed the basis for this study found that "everything seems to work for somebody" — among the forty-two business respondents interviewed for the prototype study there were supporters and detractors of nearly every major type of pollution prevention policy.

1.2 REACHING THE RIGHT RESPONDENTS

While no precise measurement exists of how environmental issues are integrated into business decisions at a particular firm, let alone an entire industry segment, several steps were taken to get an indication of this integration through this survey.

First, the survey was directed toward production line decision makers. Second, in introducing the survey, the researchers made every effort not to convey the idea that "environmental protection" was the preferred answer to the question about important factors in respondents' jobs. In fact, as can be seen from the survey instrument, the only time respondents heard the word "environment" before hearing the question about job responsibilities was in the statement, "The survey is sponsored by Department of Commerce, Department of Energy, and Department of Defense through an Environmental Protection Agency contract." (Mention of EPA as the contractor was required by Office of Management and Budget policy.) Third, environmental factors were listed neutrally along with a wide range of other possible factors in the first question about job responsibilities.

Of the 520 printers surveyed, 38% were company owners, 19% were presidents, 13% were general managers, and 13% were operations or production managers. Of the remaining 17%, all seemed to be in core business functions such as production or sales, and none reported themselves to be environmental specialists of any sort.

Twenty-eight percent of the printers reported having 1-2 production employees, 25% had 3-4 production employees, 24% had 5-7 production employees, 12% had 8-19 production employees, and 10% had 20 or more production employees on an average shift. An increase in printing company size was associated with an increase in pollution prevention activities as well as interaction with regulatory and technical assistance programs. For this reason, some of the observed associations between printers' responses and interaction with regulatory and assistance programs may be partly a result of company size.

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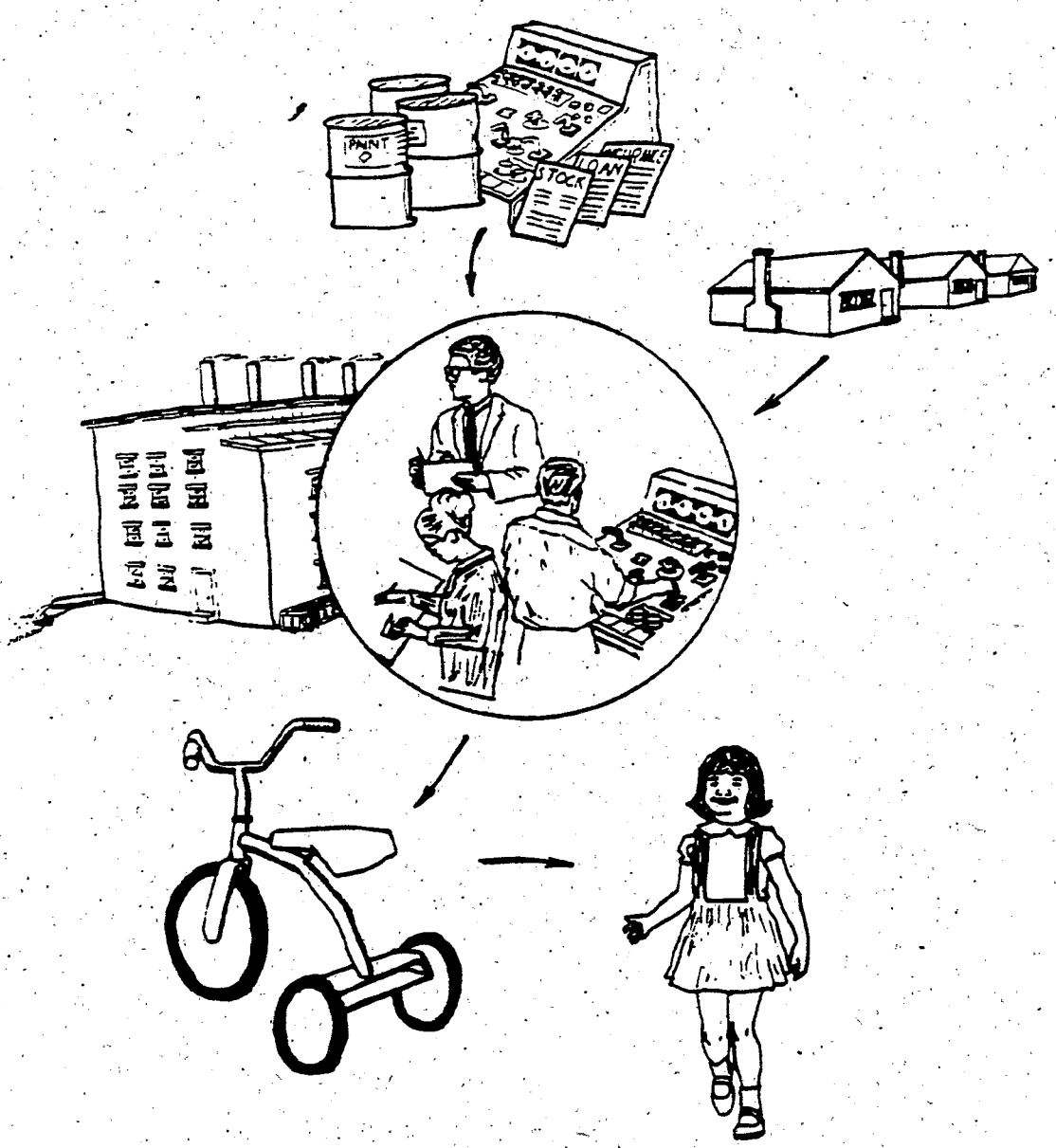
Twenty-three percent of the large manufacturers had 1-19 production employees, 28% had 20-40 production employees, 24% had 41-100 production employees, and 25% had 100 or more production employees on an average shift. Of the 5% of TRI respondents working in *Fortune 100* companies, most had more than 100 production employees on an average shift.

1.3 THE CHALLENGES

The challenges confronting anyone committed to promoting pollution prevention are to learn whether the above hypotheses are more accurate in describing some types of businesses than others, whether different policy approaches (based on the hypotheses) work better for some types of businesses than others, whether some policy approaches work best in conjunction with others, and whether the positive effect of some policy approaches might be better delivered in another way. This study and subsequent studies based on it are intended to help EPA and its stakeholders meet those challenges.

Exhibit 1
Pollution Prevention from the Business Point-of-View



CHAPTER TWO
FINDINGS

2.1 INTRODUCTION

This chapter discusses the findings of the "Study of Industry Motivation for Pollution Prevention." and summary of the comments received by reviewers of the August 16, 1996 draft of this study.

The findings are stated in the following way. First, the Pollution Prevention Policy Staff's interpretation of a set of statistical evidence is stated in plain English in italics. Each plain English interpretation that is not self-explanatory is then followed by the statistical evidence on which it is based. In those cases where reviewers had alternative interpretations, their comments are listed at the end of the section.

All the statements represent a statistical relationship with a chi square p-value of .05. The chi square p-value is a measure of how strongly two variables are related to each other. For example, assume that 60% of small firms and 70% of large firms report practicing pollution prevention. A chi-square p-value of .05 means a 5% probability that no difference exists between small and large firms and that the survey results are due to the random selection of variation within the sample. In a few cases, we present statistical relationships at the chi square p-value of .10 (marked by an *). In those instances, there is a 10% chance that the reported values were due to a random result. In the few cases where we found strong relationships that we could not interpret, we placed them at the end of each section for the reader's interest. Another statistic, the confidence interval or confidence limit, is used to characterize the robustness of rates and fractions within the sample. A 95% confidence limit means that the statistics observed within our sample group matches the statistics for the entire population of U.S. facilities with a 5% probability of error. Unless otherwise noted, the 95% confidence interval for all values presented is less than positive or negative 10% (i.e., observed statistics for our sample group are assumed to be less than 10% greater or lesser than those for the U.S. population, with a 5% probability of error).

A few terms are used for brevity. The word "printers" refers to the 520 respondents from the lithographic printing companies surveyed. The phrases "large manufacturers" or "TRI respondents" refer to the 516 respondents chosen at random from the list of large manufacturing companies reporting to the Federal Toxics Release Inventory, 90% of whom told the surveyors that they were involved in managing or implementing production at some level. The term "RCRA generators" refers to companies registered with EPA as hazardous waste generators. The term "Technical assistance organizations" refers to government-funded organizations in the business of providing information and assistance in addressing environmental issues.

Finally, strong associations exist between firm size and the respondents' answers. Because larger printers tended to have more interaction with regulatory and assistance programs, direct causality between observed patterns of printer responses and either firm size or interaction with regulatory or assistance programs could not be determined in every instance. With the TRI respondents, no association was found between size and contact with assistance programs, and reported contact with regulatory personnel actually decreased with increasing firm size.

2.2 MAJOR FINDINGS

2.2.1 Major Finding #1: Pollution Prevention Activities are Being Practiced Widely by Large Manufacturers and Printers.

This section assesses the extent to which pollution prevention is being practiced in the lithographic printing industry and among large manufacturers (more precisely, manufacturers reporting to the Federal Toxics Release Inventory (TRI)).

Pollution prevention defies precise measurement. Because the "right" type and amount of pollution prevention is different for each firm, obtaining precise measurements of industry's progress towards the optimal level of pollution prevention is very difficult.

2.2.1.1 Reported Pollution Prevention Activities

The primary indicator of pollution prevention activity was respondents' reports of pollution prevention practices. A few Federal environmental programs require businesses to report their pollution prevention activities qualitatively. The information gathered on pollution prevention activities in this survey differed from those reports in two primary respects. First, this survey did not question the environmental, health and safety specialists located at an industrial facility or environmental staff at the corporate level. Rather, the survey focused on production managers: those individuals responsible for making the day-to-day decisions that have the greatest impact on both the production and waste generated at a facility --production managers. Consequently, we would expect a more complete reporting of pollution prevention activities from them.

Second, respondents were asked to report their pollution prevention practices using language intended to be familiar to them, rather than to environmental experts. For example, not even the words "pollution prevention" were used in the pollution prevention practices section of the survey. Throughout this report, whenever respondents are said to have "implemented pollution prevention activities" in general, or to have implemented particular types of pollution prevention activities, it is because they responded positively to the questions in Appendix C.

When asked whether pollution prevention activities were implemented:

i) *64% of printers reported implementing pollution prevention activities.*

Of these:
- 90% modified or substituted chemicals,
- 73% modified image-making or prepress operations,
- 69% implemented good operating practices, and
- 58% modified press operations.

ii) *85% of large manufacturers reported implementing pollution prevention activities.*

Of these:
- 96% implemented good operating practices,
- 93% modified production related processes,
- 91% improved materials handling practices,
- 76% substituted chemicals or raw materials or modified their product: and
- 64% modified cleaning or degreasing operations.

2.2.1.2 How Printers' Size Affected Pollution Prevention Activity

One variable long thought to explain much of the pollution prevention-related behavior of businesses is the size of the facility or corporation. To explore the issue further, printers were asked how many production personnel work on an average shift. Of the printers, 28% reported having 1-2 production employees, 25% had 3-4 production employees, 24% had 5-7 production employees, 12% had 8-19 production employees, and 10% had 20 or more production employees on an average shift. (In the following discussion, these size categories will be referred to below as "size quartiles," occasionally grouping the largest two size categories).

The reported frequency of printers' pollution prevention activities was related to firm size. In particular:

i) *More larger than smaller printers reported pollution prevention activities.* Pollution prevention activities were reported by:

- 51% of printers in the first size quartile,
- 57% in the second quartile, and
- 77% in the third and fourth quartiles.

2.2.1.3 How TRI Respondents' Size Affected Survey Responses

To explore the effect of facility and corporation size on pollution prevention-related behavior, the production managers were asked how many production personnel work on an average shift. Researchers also identified those respondents working in facilities owned by *Fortune 100* corporations.[1]

Of the large manufacturers (which employed the TRI respondents) 23% had 1-19 production employees, 28% had 20-40 production employees, 24% had 41-100 production employees, and 25% had 100 or more production employees on an average shift at that facility. (Each of these size categories is referred to as a "quartile" in the following section.) Most of the *Fortune 100*-owned facilities had more than 100 production employees on an average shift. *Fortune 100*-owned facilities were represented by 16% of the facilities in the first size quartile, 14% in the second quartile, 14% in the third quartile, and 56% in the fourth quartile.

The reported frequency of pollution prevention activity at TRI facilities was related to facility size. In particular:

i) *The larger manufacturers reported pollution prevention activities more frequently.* TRI respondents reporting pollution prevention activities included:

- 76% of the first size quartile,
- 80% of the second quartile,
- 93% of the third quartile, and
- 90% of the fourth quartile.

No association was found between size of TRI facilities and the actual amount of waste reduction as reported to the TRI. (A chi square p-value of 0.31 was calculated by crossing the number of production employees and the percent of waste reduced normalized for production as reported to the TRI.) As noted in section 2.2.1.4, this result may be due to the shortcomings of the reported TRI data on this matter.

ii) *All* Fortune 100 *respondents reported modifying production-related processes, compared with 93% of the other TRI respondents.*

iii) *More larger than smaller manufacturers reported chemical substitution.* TRI respondents who reported substituting chemicals or raw materials or modifying their products included:

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[1] The *Fortune 100* consists of the one hundred largest revenue-producing American companies as rated by *Fortune* Magazine.

- 62% of the first size quartile,
- 74% of the second quartile,
- 81% of the third quartile, and
- 83% of the fourth quartile

iv) *More* Fortune 100 *respondents than other TRI respondents reported chemical substitution:*

- 93% of *Fortune 100* TRI respondents reported substituting chemicals or raw materials or modifying their products, compared with 75% of the other TRI respondents.

v) *More larger than smaller manufacturers reported cleaning process changes.* TRI respondents that reported modifying cleaning or degreasing operations included:

- 51% of the first size quartile,
- 56% of the second quartile,
- 66% of the third quartile, and
- 77% of the fourth quartile

vi) *More* Fortune 100 *than other TRI respondents reported improved materials handling:*

- 99% of *Fortune 100* TRI respondents reported improving materials handling practices, compared with 90% of other TRI respondents.

2.2.1.4 TRI Reports by Large Manufacturers

One indicator of pollution prevention used here was drawn from reports by large manufacturers to the TRI of the amount of toxic chemicals entering the waste stream prior to recycling, treatment, transfer, disposal, and release. For each respondent, TRI chemical waste reported for 1994 was subtracted from waste reported for 1993. To account for how much waste reduction (or increase) was due to changes in the level of production activity, the change in waste generation was multiplied by the activity index reported in 1993 and divided by the activity index reported in 1994. The whole was then divided by the 1993 waste number to create a percentage measure. (A more detailed explanation can be found in Appendix B.)

As discussed in the *1994 TRI Public Data Release*, "thorough and accurate assessment of [pollution prevention] progress requires more detailed information than is included in [the TRI reporting form]." TRI can provide only a broad indication of whether source reduction is

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occurring, but does not measure actual quantities of source reduction.[2] Despite this limitation, the calculation of changes in waste generation produces the best available quantitative data on industrial progress in preventing pollution. No such data, however flawed, are even available for small businesses such as printers. Collecting such data for printers, or collecting more precise data for large manufacturers, was beyond the scope of this study.

Keeping these issues in mind, the data tell us the following:

i) *No association was found between TRI waste generation and pollution prevention activities. The number of large manufacturers that reduced their TRI waste normalized for production was nearly the same as the number of large manufacturers that increased their TRI waste normalized for production:*

- 25% of TRI respondents reduced waste normalized for production by more than 14%,
- 23% reduced by 0%-14%, 2% reported no change,
- 20% increased waste normalized for production by 0%-14%, and
- 25% increased by more than 14%.

2.2.1.5 Other Interpretations

Kevin Mills of the Environmental Defense Fund agrees with EPA's finding that pollution prevention activities are being practiced widely by printers and large manufacturers but adds that, "we cannot be sure that these pollution prevention practices are being done for the right reasons (i.e., that the environment is on par with cost and quality in guiding product and process changes)."

Dale Kalina of R.R. Donnelly and Sons believes that, "the correlation between pollution prevention and TRI reporting is unclear and may be misleading. Many pollution prevention initiatives may significantly reduce wastewater discharges, air emissions, or waste generation, yet not impact TRI reporting at all if the pollution prevention initiatives are in areas where TRI chemicals are not used or, in certain cases, where the pollution prevention activity actually introduces a TRI chemical into a process where it had not been previously used."

Mr. Kalina also notes that the pollution prevention activities reported by "printers need to be closely scrutinized. All four of the [pollution prevention activities listed] are routine business operations for printers." Mr. Kalina believes the pollution prevention rate among printers to be higher because, "it would be very surprising if none of these activities had occurred over a two year period for any printer."

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[2] A detailed discussion of this distinction appears in Appendix B.

Gary Miller of the Illinois Waste Management and Research Center believes that not all the reported "pollution prevention activities" may result in actual pollution prevention, and that EPA is assuming a great deal by listing the printer-reported changes as pollution prevention activities. Mr. Miller states that, "while one type of waste might have been reduced as a result of undertaking these activities, other types of waste may have been increased. Companies often don't think comprehensively on a multi-media level. And they don't quantitatively measure the amount of waste reduced or the actual costs and economic benefits."

Michael Eck of the U.S. Army is not surprised by the lack of association between reported pollution prevention activities and actual TRI reduction because, "the low hanging fruit is mostly gone and the pollution prevention being done generally affects a small amount of the waste stream." Mr. Eck believes that "we need better ways to measure pollution prevention results and [also need] some measure of environmental management costs."

For the recommended approach for exploring these issues further, see section 3.2.1.

2.2.2 Major Finding #2: Regulatory Programs are Almost Unrivaled in Capturing the Attention of Core Business Decision Makers.

Programs that set and enforce limits on the waste materials that can be released into air, water, and land rarely favor pollution prevention explicitly over other methods of limiting the releases. Nevertheless, traditional regulatory programs, which establish the context in which businesses decide to prevent pollution, are argued to be both motivators and inhibitors of pollution prevention. The many statistical observations discussed in the remainder of this subsection suggest that traditional environmental regulatory programs are almost unrivaled in bringing the attention of business decision makers to their environmental obligations. There may be room, however, to improve the programs' effectiveness in facilitating business efforts to meet those obligations.

Two types of information on respondents' involvement with regulatory programs were gathered for this study. First, respondents were asked if they had been contacted by someone enforcing regulations. Such personnel could have included inspectors from EPA, OSHA, and state and local agencies. Second, records of each respondent's EPA permits, inspections, and enforcement actions were gathered from EPA databases.

2.2.2.1 Reported Pollution Prevention Activities

i) Pollution prevention activities were reported more frequently by respondents with air or water permits:

- 89% of TRI firms with air or water permits reported pollution prevention activities, as opposed to 77% of RCRA-registered firms, and 84% of firms not currently known to be in these regulatory systems.

ii) *Improved materials handling was reported more frequently by respondents inspected:*

- 93% of TRI respondents inspected by EPA within the past two years reported improving materials handling, as opposed to 88% of those not inspected.

iii) *Improved materials handling was reported more frequently by respondents with enforcement actions:*

- 99% of TRI respondents in firms that had faced an EPA enforcement action in the past two years reported improving materials handling, as opposed to 91% of those without enforcement actions.

iv) *Production-related process modifications were reported more frequently by respondents with enforcement actions:*

- 100% of TRI respondents with enforcement actions reported modifying production-related process, compared with 93% with no enforcement actions.

v) *Improved materials handling was reported more frequently by respondents not in the RCRA or air or water permit systems:*

- 96% of TRI firms not currently known by EPA to be in RCRA or air or water regulatory systems reported improved materials handling, as opposed to 91% of those with air or water permits, and 88% of RCRA-registered TRI firms.

vi) *Good operating practices were reported more frequently by respondents not in the RCRA system:*

- 96% of TRI firms with no recorded interaction with regulatory programs and 98% of those with air or water permits reported implementation of good operating practices, as opposed to 91% of TRI respondents with only RCRA registration.

2.2.2.2 Reported Importance of Regulatory and Assistance Programs

Aspects of the regulatory system were among the issues mentioned most frequently as important determinants of environmental decision making. In particular:

- Environmental regulatory requirements ranked near the top of issues considered to be very important by the production managers of large manufacturers (see Figure 1).

- Environmental enforcement actions were among the most important factors in getting both TRI respondents and printers to first consider environmental issues in their jobs (see Figure 3).

- Government requirements ranked among the top issues for production managers and in the middle for printers as strong influences on the final choice of equipment and operations (see Figure 5).

- On the other hand, environmental concerns were ranked nearly last on the list of issues printers considered very important (see Figure 2). This finding may be due to the relatively little interaction between the typical small printer and the regulatory system, as compared with large manufacturers reporting to the TRI.

Contact with the regulatory system increased the reported importance of both the regulatory system and assistance programs on various aspects of environmental decision making.

i) *Enforcement actions were reported as being very important more often by TRI respondents with enforcement actions:*

- 76% of TRI respondents with recent enforcement actions reported that enforcement actions against their companies were very important in first getting them to consider environmental issues in their jobs, as opposed to 64% of TRI respondents with no enforcement actions.*[3]

ii) *Enforcement actions were reported as being important more often by printers with enforcement actions:*

- 88% of printers reporting contact with enforcement personnel reported environmental enforcement action against their company as being somewhat or very important in first getting them to think about environmental issues in their work, as opposed to 75% not contacted. *

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[3]Results with a chi-square p-value of .10 are indicated by an asterisk.

iii) *Similarly, environmental regulatory requirements ranked near the top of issues considered to be very important by the production managers of large manufacturers:*

- 82% of TRI production managers ranked possible environmental regulatory requirements as very important in their job responsibilities, surpassed only by 88% for employee morale and level of productivity; and 86% for the sources, quality, and cost of raw materials and inputs;

- 70% ranked possible environmental impacts of their products during use or disposal as very important, well above the 48% for bottom-ranked "technological advances in manufacturing the product;"

- Fewer than 2% considered environmental concerns to be not at all important.

iv) *Also, a greater number of production managers reporting contact with enforcement personnel ranked the environmental impacts of their products as being very important to their job responsibilities:*

- 72% of TRI respondents who reported being contacted by enforcement personnel ranked the possible environmental impacts of their products during use or disposal as being very important in their job responsibilities, compared with 46% of those not contacted by enforcement personnel;

- 88% of TRI respondents and 66% of printers reported that government requirements were strong influences on their final choice of equipment and operations. Government requirements were ranked among the top of the list of such influences for TRI respondents and in the middle of the list for printers.

v) *Government requirements were ranked as a strong influence by more printers reporting contact with enforcement personnel.*

- Of the printers contacted by enforcement personnel, 78% reported that government requirements were a strong influence in their final choice, compared with 56% of those not contacted.

Figure 1: **Environmental regulatory requirements ranked near the top of issues considered to be very important by the production managers of large manufacturers.**

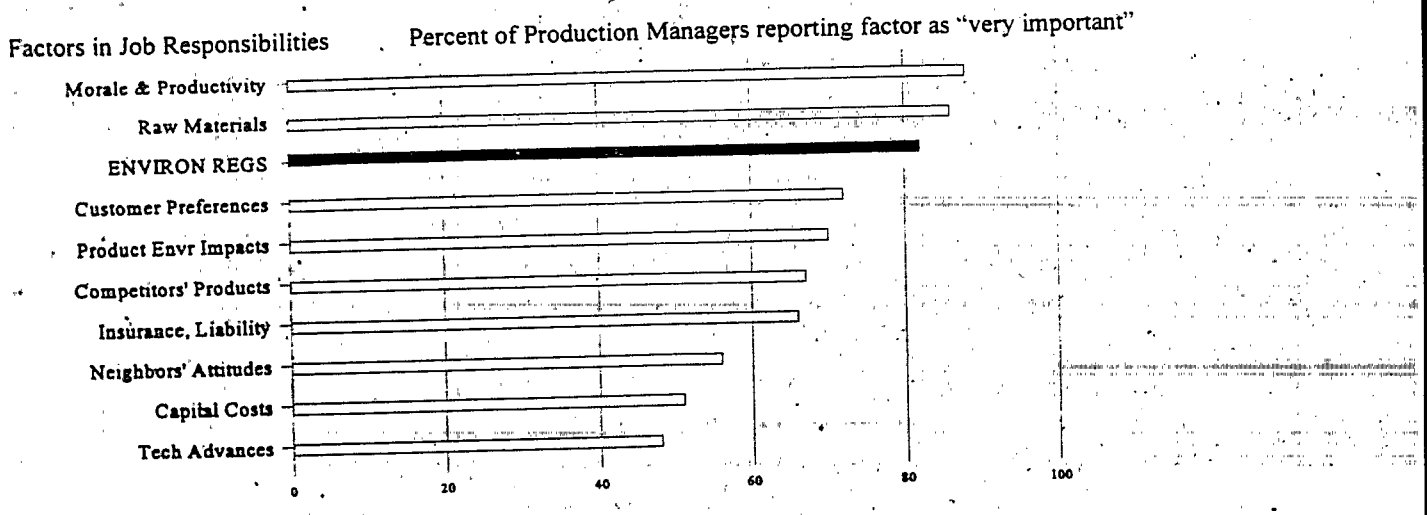

Figure 2: **Environmental concerns were ranked nearly last on the list of issues printers considered to be very important.**

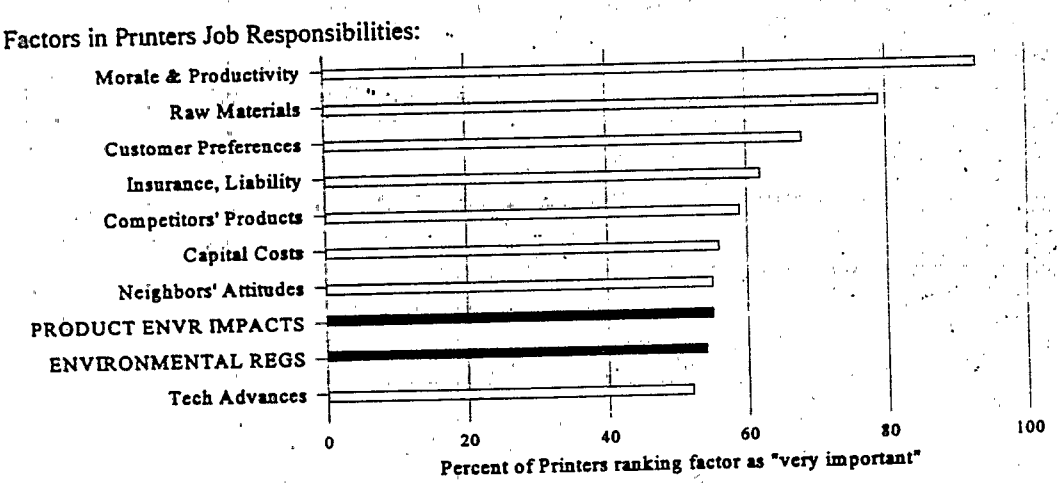

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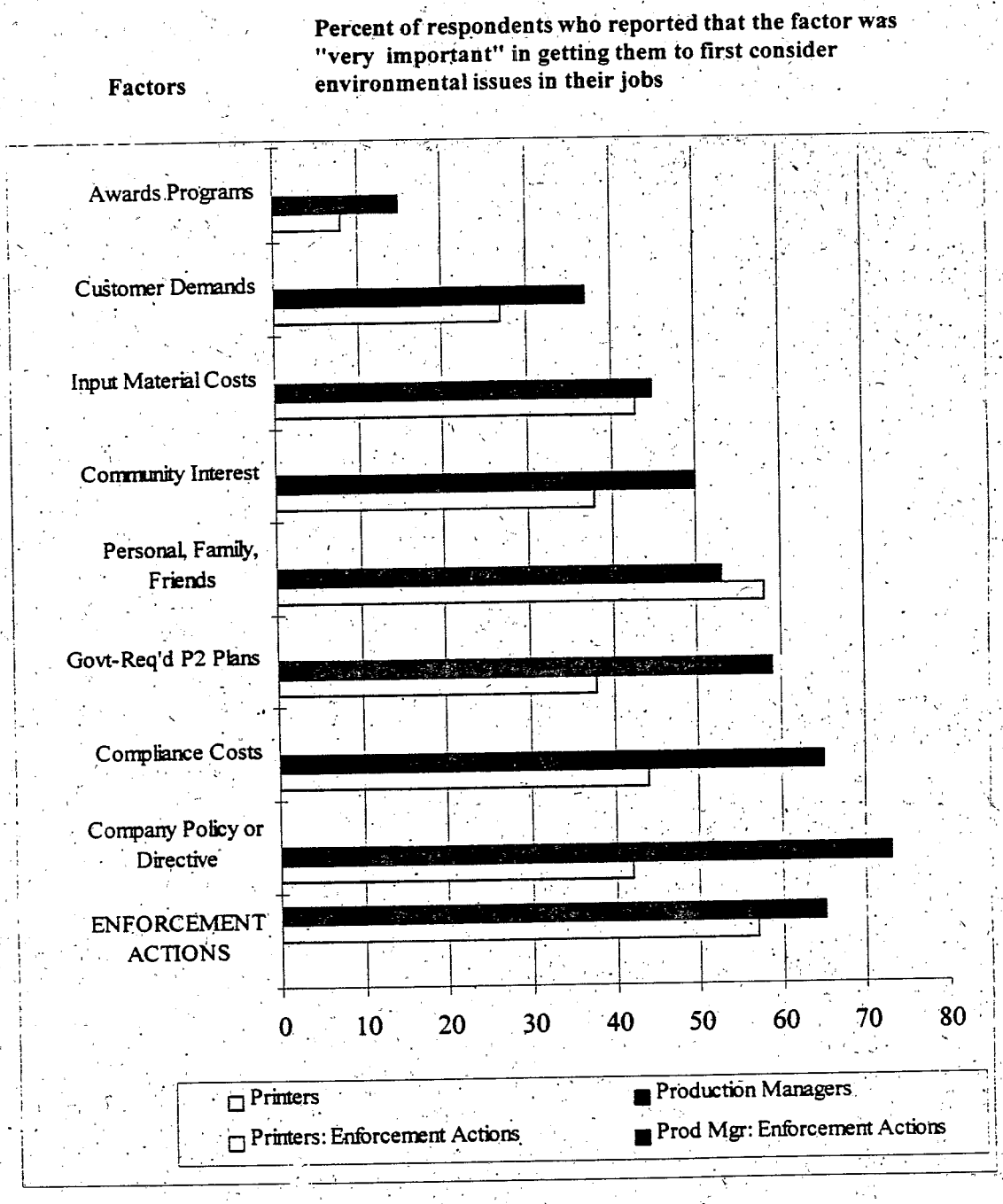
Figure 3: Environmental enforcement actions were among the most important factors in getting respondents to first consider environmental issues in their jobs.



2-8

Figure 4: Government publications and assistance providers did not rank high among reported sources of environmental information about alternative practices or technologies. However, contact by assistance and enforcement organizations apparently increased the recognized importance of government publications and assistance providers as sources of environmental information.

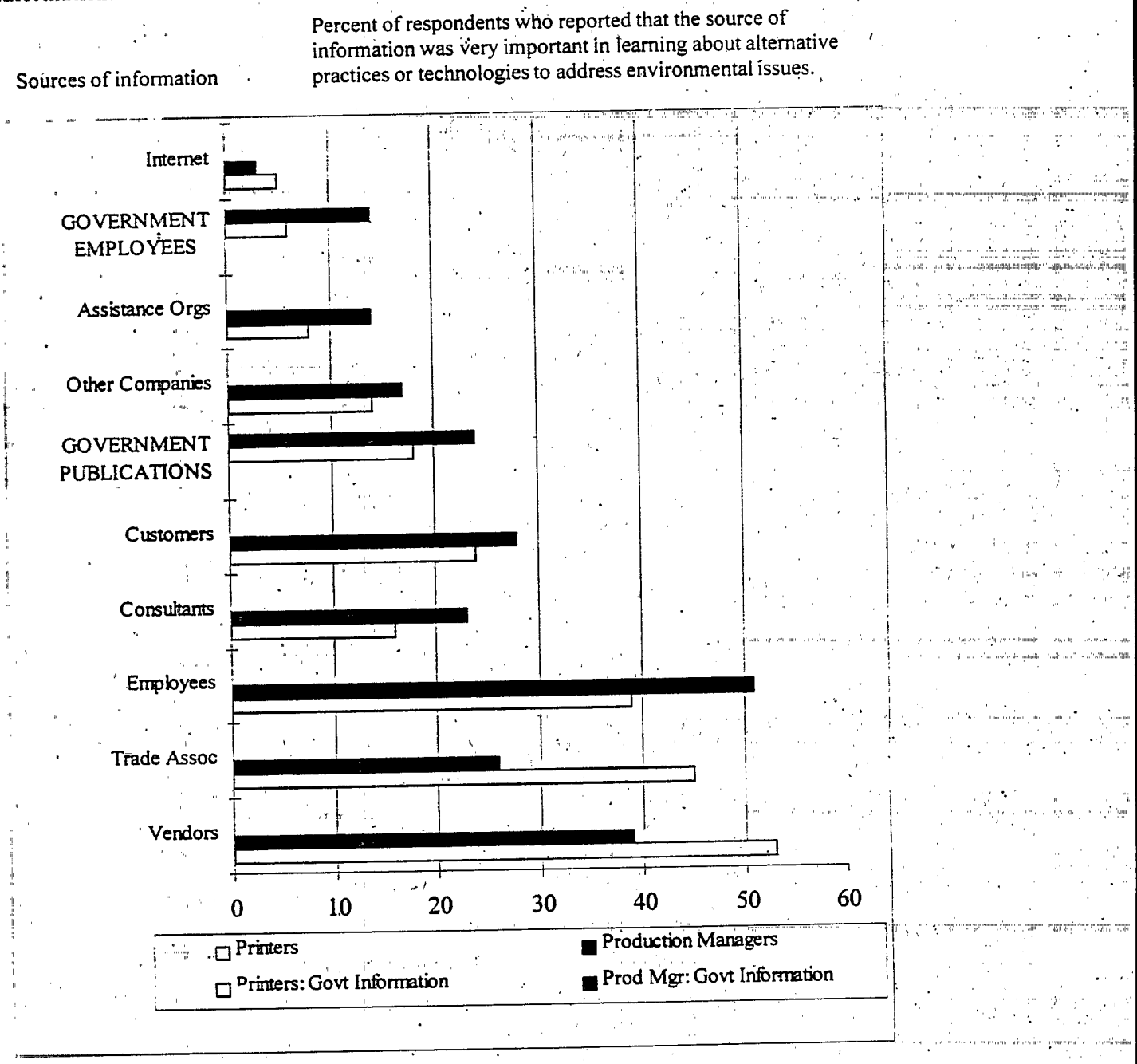
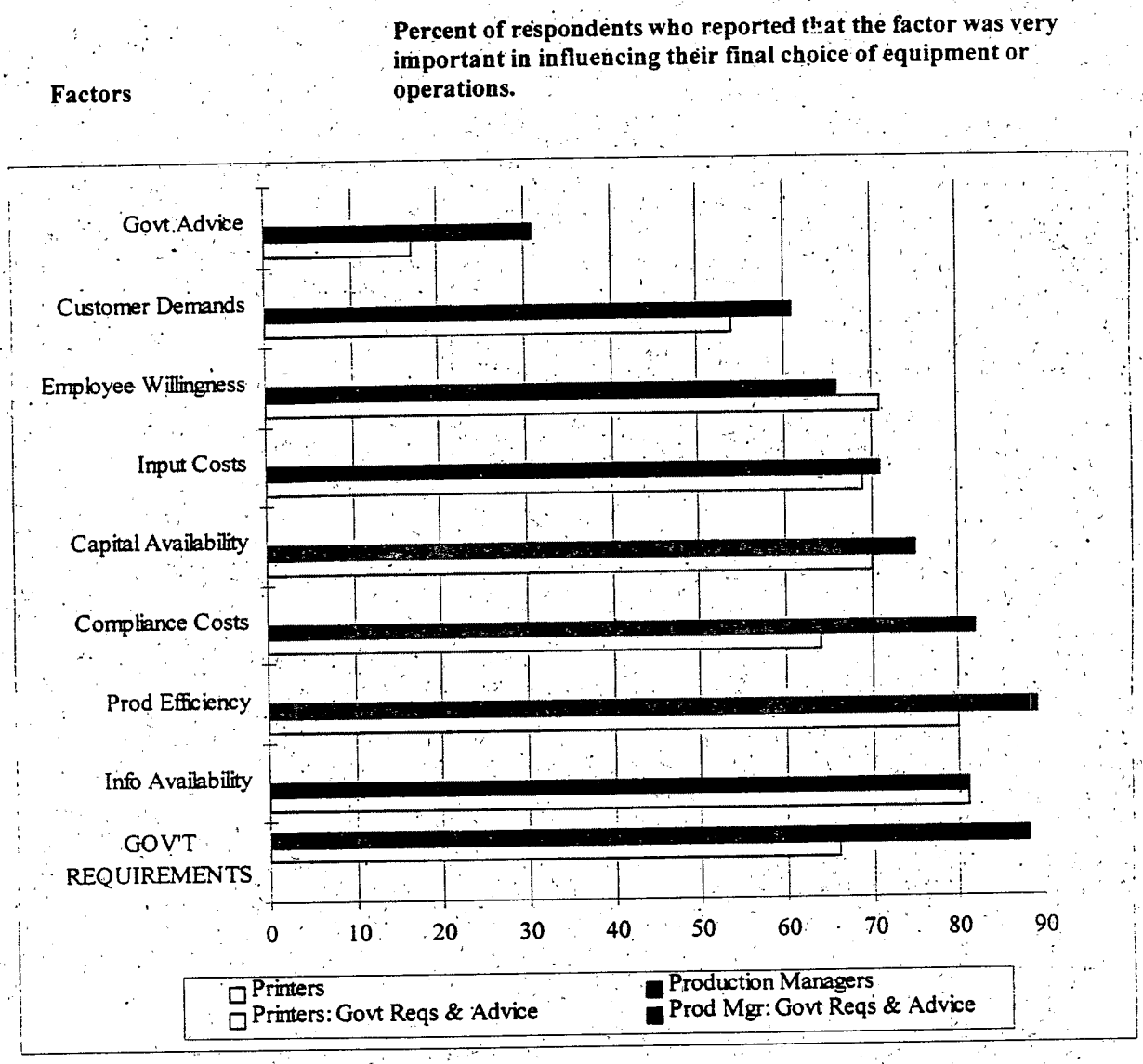


Figure 5: Government requirements ranked among the top for production managers and in the middle for printers as strong influences on the final choice of equipment and operations.



vi) *Government requirements were ranked as a strong influence by more TRI respondents recently inspected:*

- 92% of TRI respondents inspected by EPA in the past two years reported government requirements to be a strong influence on their final choices of equipment or operations, as opposed to 84% of those not inspected.

Only one observation runs contrary to this general trend:

vii) *More production managers not facing enforcement actions ranked environmental regulatory requirements as important to their job responsibilities:*

- 83% of TRI respondents that had not faced recent enforcement action reported possible environmental regulatory requirements as important to their job responsibilities, compared with 66% of TRI respondents from companies that had faced recent EPA enforcement actions.

2.2.2.3 Reported Importance of Government as a Source of Information

i) *Government employees and publications were not among the sources of information most often reported as very important:*

- 14% of TRI respondents and 6% of printers cited government employees as very important sources of environmental information about alternatives practices or technologies, placing this source at the bottom of the rank of environmental information sources;

- 44% of TRI respondents and 22% of printers reported that government employees were somewhat important sources;

- 24% of TRI respondents and 18% of printers reported that government publications were very important sources of information, placing them in the middle rank of such sources;

- 49% of TRI respondents and 39% of printers reported that government publications were somewhat important sources;

- TRI respondents and printers both ranked government advice at the bottom of a list of influences on the final choice of equipment and operations.

ii) *Government employees were reported to be important sources of information more often by TRI respondents recently inspected:*

- 63% of TRI respondents recently inspected by EPA reported that government employees were very important or somewhat important sources of environmental information about alternative practices or technologies, compared with 52% of those not inspected.

iii) *Government employees were reported to be important sources of information more often by TRI respondents reporting contact with enforcement personnel:*

- 61% of TRI respondents reporting contact by enforcement agencies reported that government employees were very important or somewhat important sources of environmental information, compared with 38% of those not contacted by enforcement personnel.

iv) *Government publications were reported to be important sources of information more often by printers reporting contact with regulatory personnel:*

- 25% of printers reporting contact with regulatory personnel reported government publications to be very important sources of information, compared with 13% of those not contacted.

v) *Government publications were reported to be important sources of information more often by TRI respondents recently inspected:*

- 78% of TRI respondents inspected recently by EPA reported that government publications were very important or somewhat important sources of information, compared with 68% of those not inspected.

vi) *Government advice was reported to be a strong influence more often by TRI respondents recently inspected:*

- 35% of TRI respondents inspected by EPA in the past two years reported that advice from government employees was a strong influence on their final choice of equipment or operations, as opposed to 26% of those not inspected.

vii) *Government advice was reported to be a strong influence more often by TRI respondents reporting contact with enforcement personnel:*

- 33% of TRI respondents who were contacted by enforcement personnel in the previous two years reported that advice from government employees was a strong influence, compared with 9% of those not contacted.

viii) *Government advice was reported to be a strong influence more often by printers reporting contact with enforcement personnel:*

- 30% of printers reporting contact with enforcement personnel reported that advice from government employees was a strong influence in their final choice, compared with 7% not contacted.

ix) *Contact with enforcement personnel apparently increased the strength of opinion about government publications as a source of environmental technology information:*

- 25% of the TRI respondents reporting contact with enforcement personnel ranked government publications as very important and 27% ranked government publications as not important at all, compared to respondents not contacted, of whom only 9% said government publications were very important and 17% said they were not important at all.

- Similarly, 27% of TRI respondents contacted by technical assistance organizations reported government publications to be very important while 28% reported them as not important at all, compared with 17% and 24%, respectively, for respondents not contacted by technical assistance organizations.

x) *The smallest and largest manufacturers seemed to consider government employees to be more important sources of environmental technology information than did the middle size range of manufacturers.* TRI respondents reporting that government employees were very important sources of environmental information about alternative practices or technologies included:

- 20% of the first size quartile,
- 8% of the second quartile,
- 12% of the third quartile, and
- 17% of the fourth quartile.

Note that the technical assistance organizations discussed in section 2.2.3 likely represent a subset of the government employees and publications discussed here.

2.2.2.4 Other Aspects of Business Activities

The regulatory system apparently had an impact on other reported influences on business life.

i) *More TRI respondents with enforcement actions reported company environmental policies and directives as being important:*

- 100% of TRI respondents facing EPA enforcement actions in the past two years reported that company environmental policies or management directives were very important or somewhat important in first getting them to consider environmental issues in their work, as opposed to 94% of TRI respondents with no enforcement actions.

ii) *More printers reporting contact with enforcement personnel reported company environmental policies and directives to be very important:*

- 91% of printers reporting contact with regulatory personnel ranked a company environmental policy or management directive as somewhat or very important in first getting them to think about environmental issues in their work, compared with 69% of those not reporting such contact.

iii) *More TRI respondents inspected by EPA reported company environmental policies or directives to be very important:*

- 78% of TRI respondents inspected by EPA in the past two years reported that company environmental policies or management directives were very important in first getting them to consider environmental issues in their work, as opposed to 66% of those not inspected.

iv) *More TRI respondents in the air, water, or RCRA systems reported compliance costs to be very important:*

- 65% of air or water permit holders reported that environmental protection or waste disposal costs were very important in getting them to first consider environmental issues in their jobs, compared with 62% of those registered only with the RCRA program, and 52% of those not in any of these regulatory programs. *

3-1

v) *The reported importance of other job responsibilities was related to enforcement actions:*

- 1% of TRI respondents with enforcement actions reported that the attitude of the company's neighbors and community was not at all important in their job responsibilities, compared with 6% of those without enforcement actions; *

- 72% of TRI respondents with enforcement actions reported that technological advances in manufacturing their products were a very important factor in their job responsibilities, compared with 47% of those without enforcement actions;

- 65% of TRI respondents and 57% of printers reported environmental enforcement actions to be very important in getting them to first consider environmental issues in their jobs, placing the issue near the top of the rank of such issues.

vi) *Influence of self, family, and friends was reduced by interaction with the regulatory system.*

- 60% of TRI respondents not registered with the RCRA, air or water permit systems; 53% of those with air or water permits; and 48% of those registered with the RCRA program only reported the interest of self, family and friends in the environment to be very important.

2.2.2.5 Size

Firm size is often hypothesized as influencing firm behavior. The picture is clouded in the case of printers, because contact with the regulatory system increased with increasing size.

The larger the printer, the greater the likelihood of being registered as a hazardous waste generator. Printers registered with the RCRA program included:

- 2% of the first size quartile,
- 3% of the second quartile, and
- 4% of the third quartile.

The fourth quartile distribution included:

- 14% of the second largest size category, and
- 23% of the top size category. *

The larger the printer, the greater the likelihood of reported contact by regulatory personnel. Printers reporting being contacted by someone enforcing regulations, such as inspectors from EPA, OSHA, or state or local agencies, included:

- 28% of the first size quartile,
- 41% of the second quartile, and
- 44% of the third quartile.

The fourth quartile distribution included:

- 43% of the second largest size category, and
- 50% of the top size category

(1% of printers were known, through EPA's database, to have been visited by an EPA inspector, and fewer than 1% were known to have been subject to a recent enforcement action. As a result, no association between these variables and firm size could be observed.)

Due to the direct relationship between printer size and the likelihood of contact with regulatory and/or technical assistance programs (see next section), the following observations may be due more to such contact than to printer size considered in and of itself. (Contact with such programs increased their reported influence; therefore, we believe that program contact, rather than firm size, was predominant.)

i) *More larger printers reported environmental regulations to be important.* Printers reporting possible environmental regulatory requirements as important to their job responsibilities included:

- 48% of the first size quartile,
- 51% of the second quartile, and
- 57% of the third quartile.

The fourth quartile distribution included:

- 59% of the second largest size category (with 8-19 production employees), and
- 72% of the top size category (more than 19 production employees).

ii) *The smallest and largest printers were more likely to report compliance costs as being very important.* Printers reporting compliance costs as very important for first getting them to consider environmental issues in their jobs included:

- 53% of the first size quartile,
- 41% of the second quartile,

- 32% of the third quartile, and
- 49% of the top quartile.

iii) *More large printers reported government requirements to be a strong influence in the final selection of equipment and operations.* Printers reporting government requirements to be a strong influence in their final choice of equipment or operations included:

- 58% of the first size quartile,
- 61% of the second quartile, and
- 64% of the third quartile.

The fourth quartile distribution included:

- 88% of the second largest size category, and
- 71% of the top size category.

In contrast with printers, TRI firm size was inversely related to reported contact with enforcement personnel. TRI respondents comprising 93% of the first size quartile, 85% of the second quartile, 88% of the third quartile, and 81% of the fourth quartile reported contact with enforcement personnel. This result may be due to production managers being more insulated from the regulatory system at larger facilities.

iv) *Environmental regulations seemed most important to production managers from the smallest and the largest manufacturers. TRI respondents reporting that possible environmental regulatory requirements were very important to their job responsibilities included:*

- 89% of the first size quartile,
- 78% of the second quartile,
- 77% of the third quartile, and
- 85% of the fourth quartile.

2.2.2.7 Other Interpretations

Kathryn Barwick of the California Department of Toxic Substance Control believes that this study suggests that "government still, even in these days of deregulation, has a strong role to play as a motivator for environmental improvement."

Ms. Barwick notes that this study suggests room for improvement with respect to the integration of pollution prevention into enforcement. Ms. Barwick believes that technical materials may have a greater effect when distributed in concert with enforcement activities.

Dale Kalina of R.R. Donnelly and Sons is not surprised by the "correlation between recent inspections and the value of government employees' environmental information. [He believes] this is probably due to the need of the inspected facilities to address issues raised by the inspectors. Who better to ask advice of than the person who tells you you have a problem?"

Lisa Doerr of Citizens for a Better Environment (Minnesota) noted that customer demands reportedly ranked next to last in importance in influencing the final choice of equipment and operations. Taken at face value, this statistic would suggest that customer demand is not an effective motivator. Ms. Doerr theorizes that this result simply reflects that customers did not make demands; and if they had made demands, "customer demands would have ranked at the top of the list instead of next to last."

2.2.2.8 Observations Without Obvious Interpretations

- 90% of TRI respondents with air or water permits reported raw materials to be very important in their overall job responsibilities, compared with 80% for the non-permit holders.

- 87% of TRI respondents reporting contact by enforcement personnel cited employee morale and level of productivity as being very important in their overall job responsibilities, compared with 97% for those not reporting enforcement visits.

- 66% of TRI respondents reporting contact by enforcement personnel cited cost and quality of competitors' products as being very important in their overall job responsibilities, compared with 84% of those not contacted.

- 72% of TRI respondents with only a RCRA identification number and no permits reported cost and quality of competitors' products to be very important to their job responsibilities, as opposed to 65% of respondents with air or water permits and 63% of respondents not in any of these regulatory programs.

For the recommended approach to exploring these issues further, see section 3.2.2.

2.2.3 Major Finding #3: Technical Assistance is a Significant Influence on a Firm's Pollution Prevention Activity.

Dozens of government-funded organizations across the country provide environmental assistance and information to business. Most of these organizations are based in state or local agencies, universities or business assistance centers, and many receive some Federal funding. The establishment of such technical assistance organizations is the oldest and most prevalent public policy approach intended specifically to promote pollution prevention.

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Respondents were asked in particular about contact they had with the following four types of technical assistance organizations: assistance programs based in regulatory agencies, university programs, government technical assistance or compliance office programs, and programs based in a business assistance or development office.

2.2.3.1 General Observations

i) *Most printers and production managers recently contacted by technical assistance programs reported implementing pollution prevention activities as a result of those contacts.*

- Of those recently in contact with a technical assistance program, 61% of printers and 53% of production managers reported implementing pollution prevention activities as a result of those contacts.

Printers

- 43% of printers reported contact with technical assistance organizations.

- Of those that reported contact with one of the four types of organizations mentioned above, 61% reported that their pollution prevention activities were made as a result of their contacts. Activities varied by type of assistance-providing organization.

- 60% of printers contacted by assistance programs based in regulatory agencies reported that their pollution prevention practices were made as a result of their contacts with the organizations, compared with 56% contacted by a university program, 54% contacted by a government technical assistance or compliance assistance office, and 44% contacted by a business assistance or development office.

- In a related observation, 72% of printers reporting contact with a technical assistance organization said that they implemented pollution prevention activities, as compared with 59% of the printers not contacted.

TRI Respondents

- 65% of TRI production managers reported contact with technical assistance organizations.

- Of those that reported contact with one of the four types of organizations mentioned above, 53% reported that their pollution prevention practices

were made as a result of the contacts. Percentages varied by type of assistance-providing organization.

- 68% of TRI production managers having contact with assistance programs based in regulatory agencies reported that their pollution prevention practices were made as a result of their contacts with the organizations, compared with 62% having contact with a university program, 55% having contact with a government technical assistance or compliance assistance office, and 51% having contact with a business assistance or development office.

ii) *Printers in contact with technical assistance programs were more likely to report environmental regulatory requirements as being very important:*

- 64% of printers contacted by technical assistance organizations reported possible environmental regulatory requirements to be very important in their job responsibilities, compared with 48% of printers not contacted.

iii) *Printers in contact with technical assistance organizations were more likely to report customer preferences as being very important:*

- 72% of printers contacted by technical assistance organizations reported customer preferences to be very important in first drawing their attention to environmental issues, compared with 64% of printers not contacted.

iv) *Printers in contact with technical assistance organizations were more likely to report input material costs as being important:*

- 86% of printers having contact with technical assistance organizations reported input material costs as a somewhat important or very important factor in first getting them to consider environmental issues in their jobs, compared with 77% of printers not contacted.

v) *Printers in contact with technical assistance organizations were more likely to report availability of information as being a strong influence:*

- 87% of printers contacted by assistance organizations reported that availability of information on the particular practices and technologies had a strong influence on their final decision, compared with 76% of those not contacted. *

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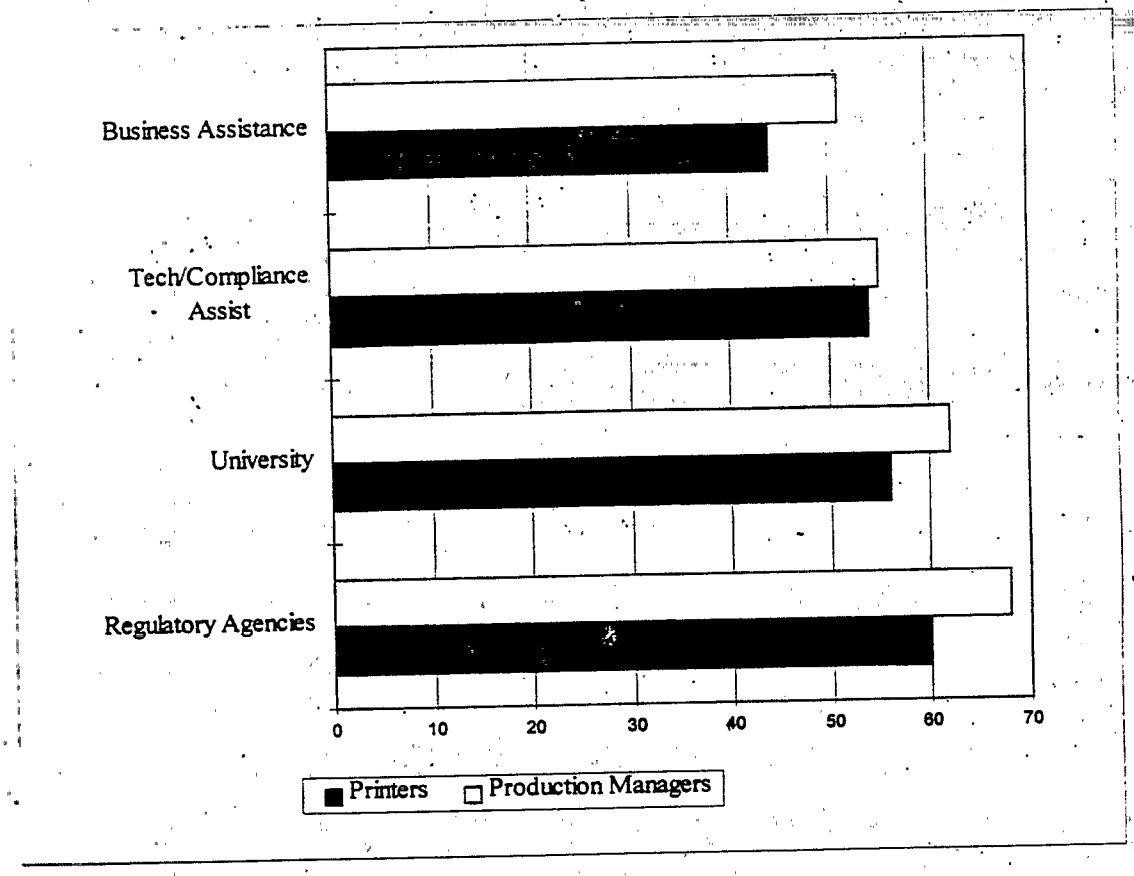
Figure 6: Percent of those printers and production managers in recent contact with a technical assistance program who reported implementing pollution prevention activities as a result of that contact, by location of program.



Location of the Technical Assistance Program

vi) *Printers in contact with technical assistance organizations were more likely to report advice from government employees as being a strong influence:*

- 23% of printers contacted by assistance organizations reported that advice from government employees had a strong influence on their final decision, compared with 13% of printers not contacted. *

vii) *Production managers managers in contact with technical assistance organizations were more likely to report advice from government employees as being a strong influence:*

- 34% of TRI respondents in contact with an assistance organization reported advice from government employees to be a strong influence on their final decision, compared with 25% not contacted by assistance organizations. *

viii) *Printers in contact with technical assistance organizations were more likely to report that assistance organizations were important sources of information:*

- 47% of printers contacted by technical assistance organizations reported "organizations providing assistance, such as universities or extension programs" to be very important or somewhat important as sources of environmental information about alternative practices or technologies, compared with 29% not contacted.

ix) *Production managers in contact with technical assistance organizations were more likely to report that assistance organizations were important sources of information:*

- 66% of TRI respondents contacted by assistance organizations reported assistance organizations to be very important or somewhat important sources of information, compared with 51% of TRI respondents not reporting contact with assistance organizations.

x) *Production managers in contact with technical assistance organizations were more likely to report that government advice was a strong influence.*

- 34% of TRI respondents in contact with assistance organizations reported advice from government employees to be a strong influence, compared with 25% of TRI respondents not contacted by assistance organizations. *

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xi) *Printers in contact with technical assistance organizations were more likely to report that government advice was a strong influence.*

- 23% of printers contacted by assistance organizations reported that advice from government employees was a strong influence in the final choice of equipment or operations, compared with 13% of printers not contacted.*

2.2.3.2 Size

i) *Larger printers were more likely to come in contact with technical assistance programs.* Printers reporting contact with technical assistance organizations included:

- 34% of the first size quartile,
- 37% of the second quartile,
- 52% of the third quartile, and
- 50% of the top quartile.

ii) *No association was found between TRI employment and reported contact with technical assistance organizations.*

- The chi square p-value produced by crossing TRI firm size and contact with technical assistance organizations was 0.53.

iii) *Similarly, no association could be found between TRI firm size and recorded EPA inspections (the chi square p-value being only 0.19).* Only 3% of TRI respondents' firms were known to have been subject to a recent enforcement action, so no association between firm size and this variable could be observed.

2.2.3.3 Other Interpretations

Gary Miller of the Waste Reduction Institute theorizes that one reason technical assistance organizations are effective is that "the organizations that contact them tend to be more progressive and open to change."

Finally, the apparent paradox exists that government employees and publications ranked relatively low in several areas, while printers and large manufacturers reported implementing pollution prevention activities as a result of contact with technical assistance organizations. This apparent contradiction might be explained by the fact that personnel and publications specific to technical assistance are likely to be a small fraction of the contact that business people have with government employees and publications.

2.2.3.4 Observations Without Obvious Interpretations

- 82% of TRI respondents having contact with technical assistance organizations reported the sources, quality, and cost of raw materials to be very important in their job responsibilities, compared with 95% of the respondents not having contact.

2.2.4 Major Finding #4: Government Requirements Perceived as Requiring Pollution Prevention Planning are Reportedly Very Influential.

Fifteen states require large businesses to develop pollution prevention or waste minimization plans. These planning requirements vary widely from those in Massachusetts and New Jersey, which specify in detail the elements of the plan, to those that make no such specifications. In addition, all generators of large quantities of hazardous waste (RCRA Large Quantity Generators) are required by Federal law to certify that they have programs in place to minimize waste. An interim final guidance on the elements of "waste minimization program-in-place" was published by EPA in 1992.

2.2.4.1 General Observations

i) Almost half the printers and two-thirds of the production managers reported conducting their evaluations of environmental alternatives as part of government-required pollution prevention plans.

Printers

- 47% plus or minus 18.6% of printers reported writing up a plan or memo, or making a presentation to management, when evaluating environmental information on alternative practices or technologies.

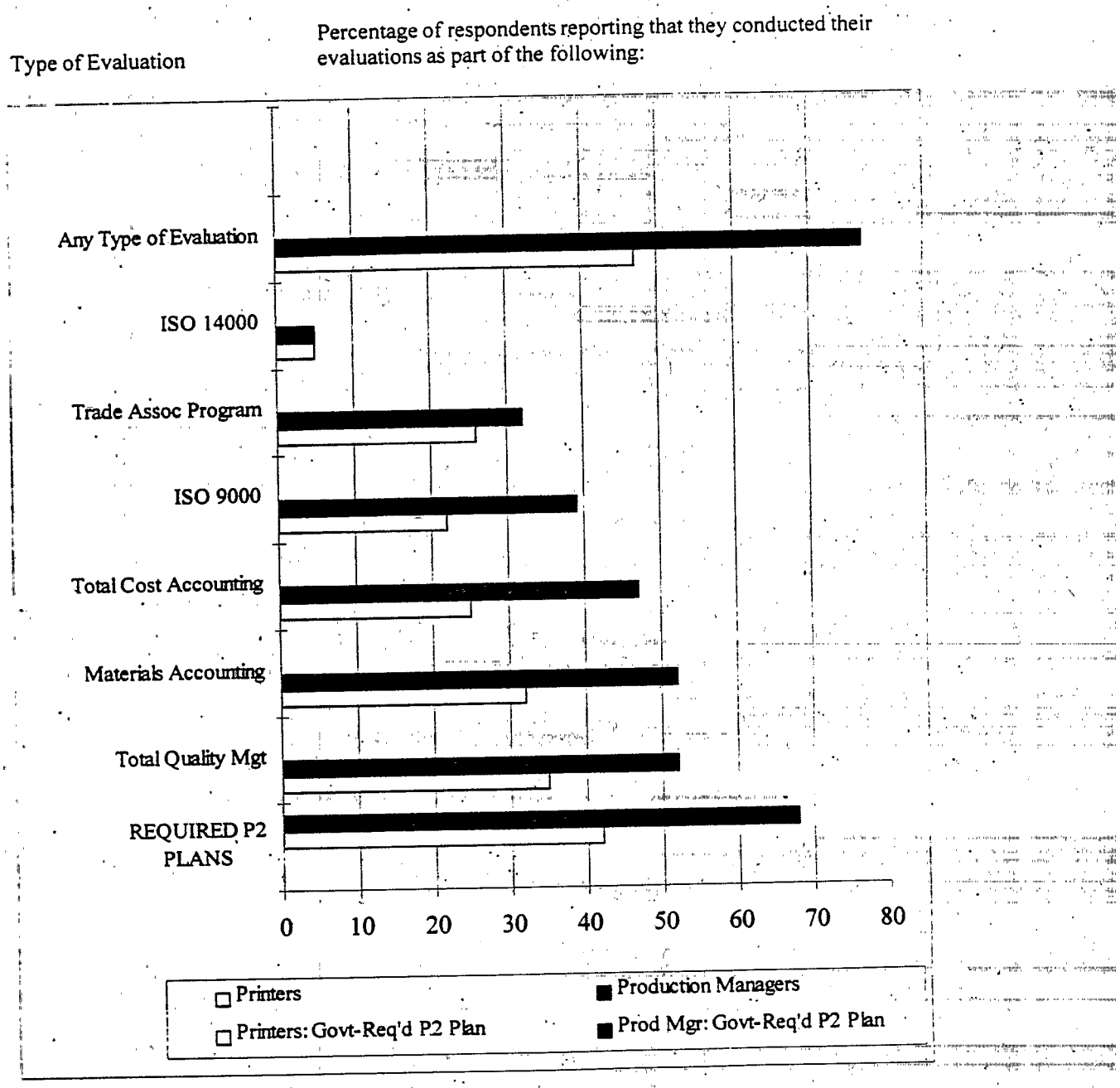
- Of these, 89% reported that the evaluations were conducted as part of, or to meet the requirements of, government-required pollution prevention plans.

TRI Respondents

- 77% of TRI respondents reported writing up a plan or memo or making a presentation to management when evaluating environmental information on alternative practices or technologies.

- Of these, 87% reported that the evaluations were conducted as part of, or to meet the requirements of, government-required pollution prevention.

Figure 7: How environmental alternatives were evaluated



ii) *59% of TRI respondents reported that state government pollution prevention planning requirements were very important in getting them to think about environmental issues at their job.*

- Planning requirements ranked behind only company environmental policies or management directives (73%), environmental enforcement actions (65%), and the company's environmental protection or waste disposal costs (63%), and ahead of five other factors.

For the recommended approach for further exploring this issue, see section 3.2.7.

2.2.4.2 Other Planning

i) *TQM plans and materials or chemical accounting reports were mentioned frequently in connection with evaluations of alternative practices and technologies:*

- 47% of printers reported writing up a plan or memo, or making a presentation to management, when evaluating environmental information on alternative practices or technologies. These evaluations were most often conducted to meet the requirements of:

  — Government-required pollution prevention plans (89%)
  — Total quality management plans (75% ± 19.4)
  — Materials or chemical accounting reports (67% ± 21.3)
  — Industry or trade association programs (54% ± 27.3)
  — Total cost accounting reports (52% ± 24.7)
  — ISO 9000 (46% ±27.0), and
  — ISO 14000 (12% ± 19.8).

- 77% of production managers reported writing up a plan or memo, or making a presentation to management, to describe the changes recommended. These evaluations were most often conducted to meet the requirements of:

  — Government-required pollution prevention plans (87%),
  — TQM plans (67%),
  — Material or chemical accounting reports (66%),
  — Total cost accounting reports (60%),
  — ISO 9000 (45%),
  — Industry or trade association programs (41%), and
  — ISO 14000 (6%).

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2.2.4.3 Other Interpretations

Gary Miller of the Illinois Waste Management and Research Center questions whether respondents understood the term "pollution prevention planning." Mr. Miller states that the number of printers and production managers claiming to conduct environmental evaluations as part of pollution prevention planning requirements is much higher than he has observed in the field (See 3.2.7).

2.2.4.4 Importance of Being Subject to Massachusetts/New Jersey Planning Requirements

Production managers in Massachusetts (MA) and New Jersey (NJ) answered several questions differently than production managers in similarly-sized firms in the rest of the country. For the most part, we were unable to interpret the observed relationship between TRI respondent location, TRI waste reduction, and reports of pollution prevention activities. Many such relationships were observed, however, and they are provided here for the interest of the reader.

i) Being in MA and NJ apparently increased the strength of opinion about the importance of trends in customer preferences.

- 74% of TRI respondents from MA and NJ reported that customer preferences were very important to their job responsibilities, and 7% reported customer preferences as not at all important, compared with 70% and 0% for the rest of the country, respectively. *

ii) Being in MA and NJ apparently reduced the strength of opinion about the attitude of company neighbors towards the company.

- 59% of TRI respondents from MA and NJ reported that neighbors' attitudes were very important to their job responsibilities, and 0% reported neighbors' attitudes as not at all important, compared with 62% and 7% from the rest of the country, respectively.

iii) Among production managers from the smallest manufacturers (i.e., those with 1-19 production employees per average shift), more from MA and NJ, representing 64 companies, reported recently substituting chemicals or raw materials or modifying their products:

- 77% of TRI respondents from MA and NJ reported recently substituting chemicals or raw materials or modifying their products, compared with 60% of TRI respondents from the rest of the U.S. *

iv) Differences also existed among production managers from manufacturers with 20-40 production employees per average shift (which included 44 companies from MA and NJ):

- 95% of TRI respondents in MA and NJ reported implementing pollution prevention activities, compared with 79% of TRI respondents in the rest of the U.S.; and

- 69% of TRI respondents from MA and NJ reported that technological advances in manufacturing their products were very important in their job responsibilities, compared with 49% of TRI respondents from the rest of the U.S. *

v) Among production managers with manufacturers employing 41-100 production employees per average shift (including 30 from MA and NJ):

- 0% of TRI respondents in MA and NJ reported that the sources and cost of capital were not at all important to their job responsibilities, compared with 7% of those in the rest of the U.S.;

- 0% of TRI respondents in MA and NJ reported that trends in customer preferences for their products were not at all important to their job responsibilities, compared with 8% of those in the rest of the U.S.;

- 60% of TRI respondents in MA and NJ reported that the company's cost of input materials was very important in first getting them to consider environmental issues in their jobs, compared with 37% of TRI respondents in the rest of the U.S.; and

- 76% of TRI respondents in MA and NJ reported that state government pollution prevention planning requirements were very important in first getting them to consider environmental issues in their job responsibilities, compared with 52% in the rest of the U.S.

vi) Among production managers in the largest manufacturers (with more than 100 production employees per average shift, including 14 from MA or NJ):

- 100% of TRI respondents from MA and NJ reported that the sources, quality, and cost of input materials were a very important part of their job responsibilities, compared with 87% of TRI respondents from the rest of the U.S.;

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- 48% of TRI respondents from MA and NJ reported that trends in customer preferences for their products were very important in their job responsibilities, compared with 79% of TRI respondents from the rest of the U.S.;

- 39% of TRI respondents from MA and NJ reported that state government pollution prevention planning requirements were very important in first getting them to consider environmental issues in their jobs, compared with 61% of TRI respondents from the rest of the U.S.*; and

- 46% of TRI respondents from MA and NJ reported that company employees were very important sources of environmental information about alternative practices or technologies, compared with 52% of TRI respondents from the rest of the U.S. *

vii) Among manufacturers employing 20-40 production employees per average shift:

- 30% of TRI respondents in MA and NJ, compared with 26% of TRI respondents in the rest of the country, reduced TRI waste normalized for production by more than 14%;

- 11% of TRI respondents in MA and NJ, compared with 21% of TRI respondents in the rest of the country, reduced TRI waste normalized for production by 0%-14%;

- 8% of TRI respondents in MA and NJ, compared with 30% of TRI respondents in the rest of the country, increased TRI waste normalized for production by 0%-14%; and

- 51% of TRI respondents in MA and NJ, compared with 23% of TRI respondents in the rest of the country, increased TRI waste normalized for production by more than 14%.

viii) Among manufacturers with more than 100 production employees per average shift:

- 36% of TRI respondents in MA and NJ, compared with 24% in the rest of the country, reported reducing TRI waste normalized for production by more than 14%;

- 28% of TRI respondents in MA and NJ, compared with 24% in the rest of the country, reported reducing TRI waste normalized for production by 0%-14%;

- 0% of TRI respondents in MA and NJ, compared with 23% in the rest of the country, reported increasing TRI waste normalized for production by 0%-14%; and

- 36% of TRI respondents in MA and NJ, compared with 27% in the rest of the country, reported increasing TRI waste normalized for production by more than 14%.

2.3 MINOR FINDINGS

2.3.1 Minor Finding #1: Employee Morale and Productivity, Input Materials, and Customer Preferences are Top Concerns for Production Managers.

2.3.1.1 General Observations

i) *Employee morale and level of productivity were at the top of the rank of issues cited as being very important in the job responsibilities of both printers and production managers of large manufacturing businesses:*

- 93% of printers and 88% of TRI respondents reported employee morale and level of productivity to be very important in their job responsibilities.

- Similarly, 71% of printers and 66% of TRI respondents reported that the willingness and ability of employees to make changes was very important in influencing the final selection of equipment or operations. This issue ranked near the top of such issues for printers and near the bottom for TRI respondents.

ii) *The sources, quality, and cost of raw materials ranked near the top of the list of issues that printers and production managers reported as being very important to their job responsibilities:*

- 86% of TRI respondents and 79% of printers reported the sources, quality, and cost of raw materials to be very important to their job responsibilities.

- On the other hand, 45% of TRI respondents and 43% of printers reported that the cost of input materials was very important in first getting them to consider environmental issues in their jobs, ranking this issue in the middle of the field.

- Also, 71% of TRI respondents and 69% of printers reported that cost of input materials was very important in influencing final choices of equipment and operations, ranking this issue near the bottom of the field.

iii) *Production efficiency or other non-environmental benefits were ranked at the top of issues reported by printers and production managers as being very important in influencing the final selection of equipment and operations:*

- 89% of TRI respondents and 80% of printers reported that production efficiency or other non-environmental benefits were very important in influencing the final choice of equipment and operations, ranking them at the top of such issues.

iv) *Trends in customer preferences for the respondent's product was ranked near the top of issues that both printers and production managers reported as being very important to their job responsibilities:*

- 72% of TRI respondents and 68% of printers reported that trends in customer preferences for the respondent's product were very important to their job responsibilities, ranking this issue near the top of the field;

- 28% of TRI respondents and 24% of printers reported that customers were very important sources of information about alternative practices or technologies for addressing environmental issues. This source placed third or fourth on the list of such factors.

Conversely:

- 61% of TRI respondents and 54% of printers reported that customer demands or willingness to accept changes in products were very important in influencing the final choice of equipment or operations. This factor was ranked near the bottom of the list;

- 37% of TRI respondents and 27% of printers reported that customer demands were very important in first getting them to consider environmental issues in their jobs. This factor was ranked near the bottom of the list.

For the recommended approach for exploring these issues further, see section 3.2.6.

v) *Several other aspects of private markets were not among the most frequent factors cited by respondents:*

- 75% of TRI respondents and 70% of printers reported that availability of capital for process changes was very important in influencing their selection of equipment or operations. This issue was ranked in the middle of such factors;

- 66% of TRI respondents and 62% of printers reported that insurance, liability, or risk management were very important factors in their job responsibilities. This issue was ranked near the middle of their lists;

- 56% of printers and 51% of TRI respondents reported that the sources and cost of capital were very important to their job responsibilities. This factor was ranked near the bottom of the list;

- 67% of TRI respondents and 59% of printers reported that the cost and quality of competitors' products were very important factors in their job responsibilities. This issue was ranked in the middle of such factors; and

- 52% of printers and 48% of TRI respondents reported that technological advances in manufacturing their products was a very important factor in their job responsibilities. This issue was ranked at the bottom of the list.

2.3.1.2 Size

i) *A greater number of the larger printers reported that employee morale and level of productivity were very important.* Printers reporting employee morale and level of productivity as being very important to their job responsibilities included:

- 83% of the first size quartile,
- 93% of the second quartile,
- 98% of the third quartile, and
- 100% of the top quartile.

ii) *A greater number of the largest printers reported that cost and quality of competitors' products were very important:*

- 65% of printers from the top size quartile reported that cost and quality of competitors' products were very important to their job responsibilities, compared with 56% to 57% of the printers in the three lower size quartiles.

iii) *No easily explained trend emerges from the association between printer size and the reported importance of customer preferences.* Printers reporting that the trend in customer preferences for their products was a very important factor to their job responsibilities included:

- 67% of the first size quartile,
- 58% of the second quartile,
- 78% of the third quartile, and
- 71% of the top quartile.

iv) *More* Fortune 100 *respondents than other respondents reported the cost and quality of competitors' products to be very important:*

- 77% of *Fortune 100* TRI respondents reported that the cost and quality of competitors' products were very important factors in their job responsibilities, compared with 66% of other TRI respondents.

v) *Similarly, the cost and quality of competitors' products were reportedly more important than other factors to fewer of the smallest manufacturers.* Manufacturers reporting that the cost and quality of competitors' products were very important factors in their job responsibilities included:

- 53% of the first size quartile,
- 73% of the second quartile,
- 71% of the third quartile, and
- 68% of the fourth quartile. *

vi) *The importance of trends in customer preferences for the product seemed to increase with firm size.* TRI respondents reporting that the trend in customer preferences for the product was a very important factor in their job responsibilities included:

- 67% of the first size quartile,
- 71% of the second quartile,
- 70% of the third quartile, and
- 78% of the fourth quartile

2.3.2 Minor Finding #2: TRI Respondents Cite Corporate Policies and Management Directives as Very Important in Getting Them to Consider Environmental Issues.

i) *Corporate environmental policies or management directives were ranked by TRI respondents as being the most important factor (mentioned by 73% of respondents) in getting them to first consider environmental issues in their jobs..*

ii) *Similarly,* Fortune 100 *respondents were more likely than other respondents to cite corporate environmental policies or management directives as being very important:*

- 94% of *Fortune 100* TRI respondents reported that corporate environmental policies or management directives were very important in first getting them to consider environmental issues in their jobs, compared with 71% of the other TRI respondents.

iii) *The largest printers were more likely to cite corporate environmental policies or management directives as being important.* Printers reporting company environmental policies or management directives as very important in first getting them to consider environmental issues in their jobs were:

- 38% of the first size quartile,
- 29% of the second quartile, and
- 36% of the third quartile.

The fourth quartile distribution included:

- 56% of the second largest size category, and
- 68% of the top size category.

For the recommended approach to exploring this issue further, see section 3.2.4.

2.3.3 Minor Finding #3: Printers Are More Likely to Cite Their Personal Interest and the Interest of Their Family and Friends as Very Important in Getting Them to Consider Environmental Issues.

i) *Along with environmental enforcement actions, printers ranked the interest of self, family, and friends in the environment at the top of the list of factors considered to be very important in first getting them to consider environmental issues in their jobs.*

- 58% of printers reported the interest of self, family, and friends in the environment as being very important in first getting them to consider environmental issues in their jobs;

- 53% of TRI respondents reported the interest of self, family, and friends in the environment as very important for first getting them to consider environmental issues in their jobs, ranking this interest in the middle among such factors;

- 50% of TRI respondents and 38% of printers reported community interest or concern as being very important for first getting them to consider environmental issues in their jobs, ranking this interest in the middle among such factors;

- 56% of TRI respondents and 55% of printers reported that the attitude of neighbors and the community toward their business was a very important factor in their job responsibilities, ranking this attitude at the bottom among such factors.

For the recommended approach to exploring this issue further, see section 3.2.3.

2.3.3.1 Size

i) *The environmental impact of products was important to a greater number of the smallest and largest printers.* The percentage of printers reporting possible environmental impacts of their products during use or disposal as a very important factor in their job responsibilities included:

- 56% of the first size quartile,
- 46% of the second quartile,
- 52% of the third quartile, and
- 61% of the top quartile.

No easily explained trend emerges from the association between printer size and the reported importance of the attitudes of company neighbors. Printers reporting the attitude of company neighbors and community toward their businesses as a very important factor in their job responsibilities included:

- 58% of the first size quartile,
- 61% of the second size quartile, and
- 45% of the third quartile.

The fourth quartile distribution included:

- 59% of second largest size range (8-19 production employees), and
- 50% of the largest size range (more than 20 production employees). *

ii) *The environmental impacts of products seemed most important to the smaller manufacturers.* TRI respondents reporting that the possible environmental impact of products during use or disposal was a very important factor in their job responsibilities included:

- 79% of the first size quartile,
- 73% of the second quartile,
- 59% of the third quartile, and
- 67% of the fourth quartile. *

2.3.4 Minor Finding #4: Vendors and Company Employees Were Cited as Very Important Sources of Information.

i) *Company employees were most often cited as very important sources of environmental information by production managers:*

- 51% of TRI respondents reported that company employees were very important sources of information about alternative practices or technologies for addressing environmental issues. This source was ranked at the top by TRI respondents and near the top by printers (39% of printers reported the same).

ii) *As sources of information about alternative practices or technologies for addressing environmental issues, vendors and suppliers were ranked at the top by printers and near the top by production managers:*

- 53% of printers and 39% of TRI respondents reported that vendors and suppliers were very important sources of information about alternative practices or technologies for addressing environmental issues.

iii) *Other private sources of information were cited as important:*

- 45% of printers and 26% of TRI respondents reported that trade associations, publications, or conferences were very important sources of such information, ranking them near the top for printers and in the middle for TRI respondents.

- 23% of TRI respondents and 16% of printers reported that consultants were very important sources of such information, ranking them in the middle for such sources;

- 17% of TRI respondents and 14% of printers reported that other companies were very important sources of information about alternative practices or technologies for addressing environmental issues. This source was ranked near the bottom of the list.

iv) *Among factors reported as very important in influencing the final selection of equipment or operations, availability of information on particular practices and technologies was ranked at the top of the list by printers and near the top of the list by production managers:*

- 81% of both printers and TRI respondents reported that availability of information on particular practices and technologies was very important in influencing their final choice of equipment or operations. This factor was ranked at the top of the list by printers and near the top of the list by TRI respondents.

For the recommended approaches for further exploring the role of employees as sources of information, see section 3.2.5.

The findings discussed in this chapter are significant and cast much light on the hypotheses discussed in chapter one. They raise many questions as well. The following chapter recommends approaches for addressing the most important of these questions.

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CHAPTER THREE
ISSUES FOR FURTHER STUDY

3.1 INTRODUCTION

This chapter proposes approaches for the next iteration of the Study of Industry Motivation for Pollution Prevention. The next phase would refine our understanding of seven questions raised by the findings discussed in the previous chapter:

1. How much pollution was actually prevented as a result of the reported pollution prevention activities?

2. What reforms to the environmental regulatory system would make respondents' jobs more productive economically and environmentally?

3. By what measure do respondents gauge their own "good environmental citizenship"?

4. What leads top corporate managers to issue environmental policies and directives, and how do they evaluate the success of production managers in achieving the objectives of those policies and directives?

5. Which company employees are important sources of environmental information and where do they get their environmental information?

6. What role do customers play in driving environmental issues?

7. What do respondents perceive to be "pollution prevention planning requirements"?

The 1996 survey instrument is assumed to be the starting point for the next survey. Each of the above issues is discussed below as modifications to the 1996 survey.

3.2 ISSUES AND RECOMMENDED APPROACHES

3.2.1 How much pollution was actually prevented as a result of the reported pollution prevention activities?

Eighty-seven percent of TRI respondents and 68% of printers reported implementing pollution prevention practices. (See Section 2.2.1.) It was not clear, however, how much pollution was prevented as a result of these activities, and existing data sources do not provide much information on the issue.

After being asked about the pollution prevention activities performed in their facilities, respondents would be asked the following questions to indicate the approximate impact of pollution prevention practices:

Of the activities you just mentioned, which were the two most important?

Please estimate the total savings or costs due to each activity.

Please estimate the reduction in environmental impact due to each activity.

Following this, the employee who filled out the company's TRI form would be asked the following questions:

Are you familiar with your company's efforts to [describe the two activities]?

Please estimate the net costs or savings due to these activities.

Please estimate the reduction in the environmental impact of each, including the impact upon TRI release if possible.

3.2.2 What reforms to the environmental regulatory system would make respondents' jobs more productive economically and environmentally?

The environmental regulatory system was reported by respondents as a prime motivator in nearly every question asked. (See Section 2.2.2.) At the same time, however, government advice and government sources of information were ranked relatively low. One interpretation of this finding is that while effective in getting the attention of production decision-makers, environmental regulatory programs are not as effective in helping decision-makers respond to the requirements.

This interpretation is supported by other statements made by industry representatives in support of proposed reforms to the environmental regulatory system. Given the limited resources of EPA and its stakeholders, it would be useful to learn which of the proposed reforms would be most productive, so that the Agency could give them the highest priority.

To gauge the relative value of reform options, respondents would be asked the following questions:

In the past two years, have you faced environmental regulatory requirements that were especially troublesome, or that for some reason led you to miss opportunities to greatly reduce the environmental impact of your facility? Please describe one or two examples briefly:

I'm going to read a list of factors that might have made your work easier in this case. Please rank these factors by the order of the benefit they would have provided you in these specific cases. [Two or more factors can be tied for any one position]:

1. One-stop shopping: Having all the environmental regulatory requirements faced by your company available to you through one government point of contact.
2. Plain English explanation: Having the environmental regulatory requirements explained in publications in plain English.
3. Compliance and technical assistance: Having a government-subsidized consultant provide compliance and technical assistance for a small fee.
4. Negotiated standards: Being able to negotiate with the environmental agency over specific regulatory requirements, possibly reducing their restrictiveness.
5. Customer Specifications: Being able to negotiate with a customer over product specifications, possibly reducing their restrictiveness.
6. Research and Development: Having a research and development laboratory attack a specific technological problem your company faced.

3.2.3 By what measure do respondents gauge their own "good environmental citizenship"?

Fifty-eight percent of printers and 53% of TRI production managers reported that, "The interest you [i.e., the respondent], your family, and friends have in the environment" was very important in first drawing their attention to environmental issues in their jobs. (Printers cited this factor most often as being very important.) This "peer pressure" aspect of environmental motivation is very poorly understood. (See Section 2.3.3).

To better understand the peer pressure aspect of environmental motivation, respondents would be asked the following questions:

When asked, "How important were each of the following factors in initially getting you to think about environmental issues at this job?" (already in the 1996 survey instrument) respondents would be offered the following options:

1. The interest your family and friends have in the environment.
2. Your interest in the environment [always asked as the last option].

(This choice would replace the single option from the 1996 survey: "The interest you, your family, and friends have in the environment.")

Respondents who report #1, above, as being very important would be asked:

How important do you think each of the following factors are in your family's and friends' assessments of your companies environmental performance?

A. News accounts of acts of environmental excellence or good citizenship by your company.
B. News accounts of environmental enforcement actions against your company.
C. News accounts of your company's TRI releases. [Don't ask this of printers].
D. News accounts of your industry's environmental performance.
E. Your own reports of your company's environmental performance.
F. Environmental or community groups' reports of your company's environmental performance.
G. Environmental or community groups' reports of your industry's environmental performance.
H. Advertisements about your company's or industry's environmental performance.

Respondents who report that #2 in the first question, above, is very important would be asked:

Please rank the following in their importance to you in assessing your own company's environmental performance:

A. Basic Compliance: Compliance with environmental regulatory requirements.
B. Government Recognition: Government recognition or awards for environmental excellence.
C. Industry Recognition: Recognition for environmental excellence given by your peers in industry.
D. Public Recognition: Recognition for environmental excellence given by environmental or community groups.
E. Comparison with Peers: Your comparison of your company's performance with your peers in industry on the basis of objective facts, such as number of enforcement actions, amount of pollutants released as shown in the Toxics Release Inventory, environmental superiority of products, etc.

3.2.4 What leads TRI business managers to issue environmental policies and directives, and how do they evaluate the success of production managers in achieving the objectives of those policies and directives?

Seventy-three percent of TRI production managers reported that some sort of management policy, directive, or program was very important in first getting them to consider environmental issues in their job, making this the most frequently cited factor. (See Section 2.3.2.) This result suggests that the most important government policies may be those that

influence top managers. To learn which top management directives are most influential, and to then learn top managers' motivations for issuing such directives, the following questions would be asked:

When asked, "How important were each of the following factors in first getting you to think about environmental issues at this job," (already in the 1996 survey) three of the options offered to TRI product managers would be:

1. A corporate environmental policy or directive;
2. A directive from your plant's top management;
3. An internal environmental audit or training.

(These three options would replace the single option from the 1996 survey: "A company environmental policy or directive from your boss or top management to consider environmental issues in your daily work or to conduct an internal environmental audit or training.")

In cases where respondents report that #2 or #3, above, are very important, surveyors would ask the plant managers at the respondents' facilities the following question:

Which of the following factors would you consider to be the primary responsibilities of your production managers?

A. Meeting production deadlines.
B. Meeting customer specifications.
C. Keeping production costs down.
D. Developing new business for the company.
E. Staying up to date on the latest production technologies.
F. Acquiring raw or input materials.
G. Maintaining employee productivity and morale.
H. Staying up to date on trends in customer preferences for your products.
I. Ensuring compliance with environmental requirements.

Which of the following factors are important in approving new products or services to be produced by your facility?

A. The facility currently has equipment technically capable of producing the products.
B. The facility currently has equipment with the physical capacity to produce the products.
C. The facility currently has employees adequately trained and prepared to produce the products.
D. If the facility does not currently have the capacity in equipment or people to produce the products, the cost of expanding the capacity is covered entirely by a

currently identified customer.

E. Producing the product will not require applying for a new environmental permit.
F. Producing the product will not increase the waste or pollution generated by the facility.
G. The product itself will not pose an environmental challenge to downstream users.

How important were each of the following factors in initially getting you to think about environmental issues at this job?

A. The interest your family and friends have in the environment.
B. The interest your company's neighbors have in your company's environmental impact.
C. A corporate environmental policy or directive from your management.
D. An internal environmental audit or training required by corporate management.
E. Customer demands.
F. Your company's cost of input materials.
G. Environmental enforcement actions against your company (always ask this question before the next).
H. Environmental regulatory requirements faced by your company.
I. Voluntary government programs, such as 33/50 or Green Lights.
J. Stockholder demands.
K. Your company's environmental protection or waste disposal costs.
L. Your personal interest in the environment (ask this question last).

In those cases where production managers reported that #1 "A corporate environmental policy or directive" was very important, or where plant managers report that C. or D., above, are important, researchers will contact the corporate management of those respondents to secure a copy of the corporate environmental policy or directive. The CEO of the corporation would then be asked the following question, in writing:

How important were each of the following factors in getting the corporation to address environmental issues through [title of the corporate environmental policy or directive]?

A. The interest your family and friends have in the environment.
B. The interest your company's neighbors have in your company's environmental impact.
C. Customer demands.
D. Your company's cost of input materials.
E. Environmental enforcement actions against your company (always ask this question before the next).
F. Environmental regulatory requirements faced by your company.
G. Voluntary government programs, such as 33/50 or Green Lights.
H. Your company's environmental protection or waste disposal costs.

I. Your personal interest in the environment (ask this question last).

3.2.5 Which company employees are important sources of environmental information, and where do they get their environmental information?

Fifty-one percent of TRI production managers reported that company employees were very important sources of environmental information about alternative technologies and practices, making this the top-ranked source of information (see Section 2.3.4).

To learn which company employees are providing the information, employees at TRI facilities would be asked the following questions:

TRI production managers asked, "how important were the following sources of information in finding out about alternative practices or technologies for addressing any environmental issues in your work" (already in the 1996 survey) would be offered the following three options:

1. Company employees specializing in environmental issues;
2. Production equipment operators or managers;
3. Other company employees.

(These three options would replace the single option used in the 1996 survey: "Company employees.")

The employee who filled out the TRI form would be asked:

How important were the following sources of information in finding out about the environmental characteristics of production technologies and practices?

1. Government employees;
2. Consultants;
3. Vendors and suppliers;
4. Government publications;
5. Trade associations, publications or conferences;
6. Organizations providing assistance such as universities or extension programs;
7. Customers;
8. Other companies;
9. Your company's employees;
10. the Internet.

Both TRI production managers and environmental specialists would be asked:

Do you feel that you have adequate access to credible and useful information on the environmental performance of equipment, operations and products?

3.2.6 What role do customers play in driving environmental issues?

Customers reportedly played an important role in environmental decision-making for a sizeable minority of the respondents. Twenty-five to thirty-five percent of the respondents (depending upon the question asked) reported that customer demands were very important in first drawing their attention to environmental issues, and that customers were very important sources of environmental information (see Section 2.3.1.1).

At the same time, the potential influence of customers could be even greater. About 70% of respondents reported that trends in customer preferences for their products were very important in their overall job responsibilities (see Figures 1 and 5). Most respondents also reported that customer demands were very influential in their final choice of equipment and operations.

To better understand the role customers can and do play in driving environmental decision-making, respondents would be asked the following questions:

Respondents reporting that customers were very important in first drawing their attention to environmental issues would be asked:

Please give two examples of customer demands that drew your attention to environmental issues.

Are these examples related to the two process changes you mentioned earlier? [See above.]

[If not, then:]

Did these customer demands lead you to make changes that greatly reduced the overall environmental impact of producing that product?

Respondents reporting that customers were very important in overall job responsibilities, but not in first drawing them to environmental issues, would be asked:

If a customer came to you with a request to reduce the environmental impact of your operations or of the product, would you be able to accommodate the request?

Respondents reporting that customers were a very important source of environmental information would be asked:

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Please give two examples of cases where the customer provided useful information.

Did you act on that information?

Respondents reporting that customers were very influential in the final choice of equipment and operations would be asked:

Did the customers' demands make it easier or harder to use equipment or operations that were better for the environment?

All the above respondents would be asked:

Were any of the customers just discussed here government or U.S. military customers?

3.2.7 What "pollution prevention planning requirements" influenced the decision-making?

Two-thirds of TRI production managers and more than 40% of printers reported evaluating information on alternative practices or technologies for addressing environmental issues as part of government-required pollution prevention plans. These respondents could have been referring to a number of planning requirements (see Section 2.2.4). The following questions would be asked to understand which planning requirements were influential.

The above-mentioned respondents would be asked:

Do you know specifically which pollution prevention planning requirement?

[If no, prompt with the following list:]

A. [Common name of the state pollution prevention or waste minimization planning requirement.]
B. The RCRA Waste Minimization Program requirement (which you have to certify to having on the RCRA manifest)
C. Spill and leak prevention planning
D. Stormwater runoff pollution prevention planning
E. Evacuation or emergency planning
F. Planning done as part of applying for a permit

Did you generate useful information as part of the planning exercise?

EPA hopes to carry out a study with such refinements at some point in the future.

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APPENDIX A
RESEARCH METHODOLOGY

A.1. SUMMARY

To conduct out this study, EPA familiarized itself with prior work on the issue, spent a year carrying out a prototype study, and developed a questionnaire and a basic methodology based on the prototype. (See "Prototype Study of Industry Motivation for Pollution Prevention," EPA 100-R-96-001.) An EPA-hired professional survey company worked with the Agency to refine the methodology and completed more than 1,000 interviews of production staff at randomly selected lithographic printers and TRI manufacturing facilities. The research company also gathered information from other sources about the extent to which each of the surveyed businesses was affected by environmental policy.

The survey results and other information were analyzed statistically. The statistical analysis and EPA's preliminary interpretations were then sent or made available to hundreds of environmental policy experts, industry representatives, and the general public via E-mail and through direct mailings to organizations and trade associations.

A.2. SAMPLE SELECTION

This study was intended to identify factors motivating pollution prevention, as well as their prevalence and effectiveness. Although the respondent sample selection was chosen randomly, both the sample source and selection methodology differed for printers and TRI manufacturers. The printer sample was selected randomly (within facilities reporting Standard Industrial Category 2752 - Commercial Lithography as their primary SIC code) from a business database maintained by Dun and Bradstreet (D&B). The extracted information included facility name, the unique D&B number, state, and telephone number. There are estimated to be 54,000 lithographic printers in the U.S. Dun and Bradstreet, thought to be the most comprehensive listing available, contains 42,226 listings of businesses reporting a primary SIC code of 2752. Among the reasons that some of the lithographers may not be contained in this particular subset of the D&B database are: (1) stand-alone lithographers may list the SIC code of the finished product (e.g., SIC 2711 - Newspaper) instead of the printing process used; and (2) in-plant operations may not classify themselves as lithographers unless it is their primary business line.

The sampling strategy for the printing sector included a larger number of completes (75 completes) for each of the four most active Great Printers states (IL, MI, MN and WI) so that we could estimate proportions plus or minus 10% with a 95% confidence interval that characterizes baseline conditions for the Great Printers Project.[1] Two hundred completes established a

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[1]The Great Printers Project, co-sponsored by the Environmental Defense Fund (EDF), Printing Industries of America (PIA), and Council of Great Lakes Governors (CGLC), is

sufficient sample size for printers throughout the remaining U.S. Four replicates (each replicate size was equal to N(completes)/.75, which accounts for standard nonresponse and erroneous information contained in the source database) were selected randomly for each of the five strata (IL, MI, MN, WI, and the remainder of the U.S.). These strata were chosen to collect baseline information on five states where Great Printers initiatives are now beginning; they were not expected to be significantly different than printers throughout the U.S. Consequently, no separate analyses are presented in this report for the various strata of printers. The post-survey weighting compensates for the oversampling of facilities from the four Great Lakes states and allows it to be incorporated with responses from all other states as a nationwide survey. The information will be used as a baseline for future assessments of the impact of the Great Printers Project.

The sample of manufacturers was selected randomly from the 1994 Toxics Release Inventory following the public data release in April 1996, when the information is essentially frozen following data quality reviews. The Toxics Release Inventory database contains every reporting TRI manufacturer. The only limitation related to the source of information for sample selection was therefore the rate of compliance by large manufacturers with TRI. The extracted information included facility name, the unique TRI number, reported D&B number, reported NPDES permit number(s), reported RCRA/EPID number(s), state, address, telephone number, and 1993 and 1994 waste generation and productivity index.

The sampling strategy for TRI manufacturers included a larger number of completes (75) for Massachusetts and New Jersey. As a result, we could narrow the 95% confidence interval to plus or minus 10% for proportions characterizing the two states with the most extensive state pollution prevention planning requirements. Approximately 350 completes for TRI manufacturers throughout the remaining U.S. would provide us with the same confidence interval for facilities in that population. As with the printers, four random replicates were generated for each of the three strata (MA, NJ, and the remainder of the U.S.).

A.3. PREPARATION OF THE SURVEY INSTRUMENT

The survey instrument was based on the questionnaire developed during the prototype study and was designed to collect as much information as possible while minimizing respondent burden in a survey of between 10 and 13 minutes in length. Respondents were promised anonymity and were offered a telephone number that they could call to request a copy of the survey results. We did not solicit detailed facility information but focused on respondents' recollection of recent experiences and opinions. Although the study was investigating pollution prevention motivation, EPA recognizes that this topic is integral to facility operations. Particular efforts were therefore made in the wording and sequencing of questions to minimize respondent

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investigating potential improvements in regulatory implementation and environmental protection.

bias associated with anticipating "correct" answers. (For example, respondents were queried about particular process changes rather than asked questions using the term "pollution prevention.") Several iterations of the survey were circulated to reviewers within EPA, a private firm involved in tracking environmental markets, academics, and government personnel at other agencies. Clearance for the study was sought and received from the Office of Management and Budget as required by the Federal Paperwork Reduction Act. (OMB generic clearance No. 2070-0034. EPA No. 1170.)

Screener questions were used to ensure that the facility was involved in manufacturing or lithographic printing and that the interview would be conducted with an appropriate staff person. The questionnaires used for printers and TRI manufacturers differed only in the description of possible process changes and screener questions. For both populations surveyed, it was critical to conduct the interview with individuals involved in production line decision-making, not those whose primary responsibility was either environmental affairs or environmental compliance. A screener question requested an individual with day-to-day responsibility for production/printing operation decisions. Because printers are typically very small operations, we first requested to speak to the owner if there were fewer than 20 employees on site (as reported in the D&B database). There was some concern that respondents might not participate because the study was sponsored by governmental agencies. To determine if there was strategic non-response due to government involvement, all those refusing to participate were prompted with an open-ended follow-up question asking them to explain why. See Administration of Survey section regarding results of open-ended query for refusals.

A.4. PRETEST AND REVISIONS

A total of 22 pretests each was administered to printers and TRI manufacturers in the first week of June. As a result of the pretest, the survey was revised to clarify parts of the questionnaire and to reduce the time required to participate. Most significantly, a detailed list of pollution prevention activities drawn up specifically for lithographic printers and a more general list for TRI manufacturers was collapsed into a series of four to five categories with listed examples. (For example, printers were asked, "In the last two years, have you made any changes in your image making processes, such as: switching to computer image editing, installing countercurrent washing, or alternative platemaking?") During the pretest, each item on the list was read as a separate question. Using the revised instrument, each list was read in its entirety unless the respondent answered during the listing. Similarly, lists of items used within several lines of questions were shortened by combining items. The number of prompts used in ranges was reduced from four to three: "very [important/valuable]," "somewhat [important/valuable]" and "not [important/valuable] at all." Finally, a number of wording and grammar changes were made to reduce the reading comprehension level required.

A.5. SURVEY ADMINISTRATION

A.5.1. Survey protocols

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The telephone survey was administered following well-tested protocols of a national survey group. All interviewers were experienced in administering surveys of establishments. Interviewers were trained in the specific information needs of the study and were provided background on the types of facilities they would be contacting. Constant supervision was provided by senior survey research staff. The survey was entered into Computer Assisted Telephone Interviewing (CATI) software so that (1) the order of items on all lists within the survey would be rotated, and (2) data were entered as the survey was administered.

To meet the goal of completing the study before the end of the Federal fiscal year on September 30th (including the linkage and analysis of survey data with outside information sources, peer review, and revisions), the survey itself had to be completed by the end of June, a period of three weeks. The survey could not be started until the first week in June due to the fact that EPA received a budget very late in the fiscal year. The most important implications of such a compressed schedule were: (1) fewer call attempts were made to each number; and (2) at least one call was attempted to most facilities contained in the four replicates. Consequently, the response rate is far lower than would be expected if the survey period had been longer; this is taken into account in the statistical weighting and subsequent analysis of the survey results. The response rate for printers was 24% and the response rate for TRI respondents was 21%.

A.5.2. Disposition of Completed Survey

In total, there were 516 completes for the TRI manufacturers and 520 completes for printers. The compressed survey period (three weeks), while not desirable, was needed to issue survey results by early August following OMB approval in early May. This schedule resulted in larger samples (2,672 manufacturers and 2,668 printers) being used in order to achieve the number of completes desired. As would be expected under such conditions, the response rate was far lower than it would have been had the survey period been longer. The overarching reason for low response rates is that the facilities with a busy signal, no answer, time arranged for a call back, or an individual not available at the time of the call (48% of the manufacturers sample and 34% of the printers sample) were not called back once the desired number of completes was reached. Several other dispositions (the status of calls, e.g., refused to participate, language barrier) may also have caused non-respondent bias. Not knowing the impact of including particular disposition groups of nonrespondents on the survey results, we grouped together all facilities thought to be in-scope to test for possible nonresponse bias. The table below provides the final disposition of all calls.

Surveys Ended with 55% Pending Callbacks and 16% Refusals		
	TRI Manufacturers	Printers
TOTAL SAMPLE	2,670	2,668
Unobtainable, business not in scope, wrong number, going/gone out of business	242	496
Subtotal	2,425	2,172
Completes	516	520
Nonrespondent Subtotal	1,909 (79%)	1,652 (76%)
FINAL DISPOSITION*		
No answer	12	13
Busy	10	11
Appointment set-up	87	95
Person not available	1,212	823
General callback	109	118
Answering machine	24	29
Break off	37	38
Final other	20	19
Language barrier	2	3
Respondent not available during study	30	47
Gatekeeper/Other refusals	366	273

* Callbacks would occur for dispositions in shaded rows.

Facilities with any of the final dispositions for which the interviewer would typically make another call attempt (shaded in the table above) are not expected to, but may be significantly different than those facilities willing to respond. Typically, Abt Associates will make 20 call attempts to a person before assigning them as unreachable. The following table summarizes the number of attempts made to recall facilities at the time the survey was completed. It shows that there were a great many pending call backs when the survey was completed.

Final Disposition and # of Attempts for Pending Callbacks at End of Survey Period

Number of Attempts	No answer	Busy	Appointment made	Person not available	General callback	Answering machine
1	1	1	64	1,067	49	3
2	1		32	341	17	2
3	3		18	183	16	5
4	3		15	132	5	8
5	3		8	91	12	2
6	2		11	64	13	
7			8	47	7	
8	1		7	34	5	
9			4	25	5	
10	2	1	5	19	3	1
11-12	6	14	6	23	74	29
13-15	3	5	3	8	17	3
16-20			1	1	4	

A.5.3 Evaluation of Possible Nonrespondent Bias

For survey results to be used with confidence, it is critical to determine that the facilities interviewed are representative of the population as a whole. It is important to demonstrate that nonrespondents are essentially similar to the facilities agreeing to participate in the survey. To identify any dissimilarities between respondent and nonrespondents of this survey, a number of comparative analyses were undertaken. Given that we do not know what nonrespondents would report, we must use known characteristics of the sample facilities to compare respondents to nonrespondents. Ideally, the evaluation of possible nonrespondent bias would include many

metrics of parameters possibly affecting facility behaviors and opinions, but this was not possible for the Pollution Prevention Motivation Survey due to the limited information available from the databases from which samples were drawn.

We began the examination of nonrespondent bias by reviewing the reasons given for nonresponse to determine if government sponsorship of the survey might have affected participation. Next, we examined differences between the few known characteristics of both respondent and nonrespondent facilities for TRI manufacturers and printers separately. From the survey itself, it was determined that facility size (employment) was strongly associated with many of the factors motivating pollution prevention. For TRI manufacturers (employment is not reported to TRI), we examined the number of Form Rs filed per facility (as an indicator of facility size and complexity of operations), as well as the percentage of facilities in each group reporting source reduction activities in Section 8 of Form R. In the case of the printer sample, we are limited to the parameters contained in the Dun & Bradstreet database. Consequently, we compared the number of employees on site for each group. The remainder of this section presents:

- coded reasons for refusal;
- tested differences among TRI manufacturers; and
- tested differences among printers.

A.5.3.1 Coded Reasons for Refusal

EPA was initially concerned that facilities might be more likely to refuse to participate knowing that the survey was sponsored by EPA than if the survey was administered by an independent organization. To meet contractual requirements, Abt Associates' interviewers identified themselves and stated that the survey was performed under EPA contract. In part to test for the effect of EPA sponsorship, we asked all those refusing to answer if they would provide us with their reason for refusal. Approximately 60% of the 639 refusals provided a reason. A review of the reasons for refusal showed that Too Busy/No Interest topped the list (72% of specified refusals). Corporate policies against participating in telephone surveys accounted for 19% of specified refusals. In all but ten cases (3% of specific refusals), sponsorship by EPA and/or the government was not cited as the reason for refusing to participate in the survey.

A.5.3.2 Tested Differences Among TRI Manufacturers

Number of Form Rs Filed. A second test of difference between respondents and nonrespondents was performed using the number of TRI Form Rs filed by facilities. This factor is associated with facility size and complexity of operations (both of which are associated with facilities' ability to pursue and interest in pollution prevention). The nonrespondents filed an average of 3.3 forms (standard deviation of 4.3). Respondents filed an average of 3.1 forms (standard deviation of 3.5). The first quartile (1 form), median (2 forms), and third quartile (4

forms) were the same for both groups.

TRI-Reported Source Reduction. The prevalence of facilities reporting source reduction in Section 8 of Form R was examined as another key indicator of bias in the sample. Of the 22,744 TRI facilities filing for 1994, 32.3% reported that they undertook source reduction for at least one of the chemicals for which a Form R was filed. In comparison, 33.0% of survey respondents reported source reduction on at least one of their 1994 Form Rs. The close proximity of these values is a strong indication that the respondent pool is representative of the TRI universe as a whole and that nonrespondent bias is not present.

Taken together, this review of TRI information indicates little difference between respondent and nonrespondent facilities, and thus a low likelihood of nonrespondent bias.

A.5.3.3 Tested Differences Among Printers

Facility Size. Examining employment at the facilities (as reported to the D&B database, from which the sample was pulled) reveals that the populations of responding facilities and nonrespondents are essentially equivalent. The respondents had, on average, 15 employees, with a standard deviation of 38. Nonrespondents had an average of 12 employees, with a standard deviation of 32. The median employment was six for respondents and four for nonrespondents. The mode, or most frequently reported value, for both groups was three employees. These values indicate that the respondent and nonrespondent populations do not differ significantly in size. Facility size is strongly associated with resources available and other factors thought to influence pollution prevention.

Based on this information, nonrespondent bias does not appear to be present in the survey of lithographic printers.

A.6. POST-SURVEY WEIGHTING

For the sample selection of printers, there were five strata. Illinois, Michigan, Minnesota, and Wisconsin were treated as four separate strata, and the establishments in the rest of the states were grouped into a single stratum. For the sample selection of TRI manufacturers, there were three strata: Massachusetts, New Jersey, and establishments in the rest of the U.S. There is a basic sample selection weight for each establishment in the sample that is considered a completed call. This weight is derived by taking the ratio of the number of establishments in a stratum population, divided by the number of establishments selected in the sample (total of all replicates). This denominator includes completes, nonrespondents, out of business, out of scope, no production, and so on. The effects of the low response rate, which affect post-survey weightings, confidence intervals of point estimates, and p-values for chi-squared analyses, are explicitly taken into account throughout the statistical analysis. A detailed discussion of the weighting protocols and derived values is included in Appendix B.

A.7. LINKAGE OF INDEPENDENT INFORMATION

To test a number of hypotheses about the possible effect of certain facility characteristics on facility behavior and decision-maker attitudes, information from outside sources was linked to each of the facilities surveyed. This information included:

- environmental permits;
- compliance history;
- facility ownership (by *Fortune 100* company); and
- one-year change in waste generation (as reported to TRI for the years 1993-1994).

The methodologies used to link surveyed facilities to facility information from other sources are described below. Percentages presented in the following section are for the unweighted sample and may not match percentages presented in the results section, where each facility's responses have been weighted.

A.8. ENVIRONMENTAL PERMITS

The first step to determine if the presence of environmental permits affected a facility's performance or decision-making was to identify all major regulatory permits associated with each facility. This permit linkage was performed using permit linkage routines recently developed by the Office of Enforcement and Compliance Assurance (OECA). Individual facilities were never identified to EPA staff.

A.8.1 EPA Permit Data on Printers

The D&B number was retrieved along with the contact information from the D&B database as part of the original sampling effort. The D&B number was then used in a linked query of EPA's Integrated Data for Enforcement Analysis (IDEA) system. The IDEA system links the databases of all major environmental media programs (e.g., Clean Air Act - CAA, Clean Water Act - CWA. Resource Recovery and Conservation Act - RCRA) at the facility level, in addition the D&B database. The linkages contained in IDEA are based on an address-match established by EPA's Facility Indexing System (FINDS). In 1995, Dun & Bradstreet developed a separate beta-test linkage using their own name- and address-matching algorithms. Each system has the capability of linking multiple permits to each facility (as represented by its unique D&B number). For the printers surveyed, the unique permits identified in the D&B beta-test and IDEA were combined for each D&B number, yielding the greatest coverage of permits. Following these procedures, a CAA, CWA, or RCRA permit was identified for just 12.5% of printers (most of which have a RCRA ID only).

A test was conducted to ensure that the majority of printers were, in fact, out of EPA's permit system rather than in the system but not readily linked to their D&B numbers. Assuming that printers were most likely to require a RCRA identification number, we undertook a search of

the 39,226 individual RCRA identification numbers in New York state for the 18 New York printers surveyed and identified just one permit (~5%), which indicates that the automated linkages may slightly under-represent the existence of permits. Further individual record searches for approximately 450 printers were not undertaken due to time constraints.

Linked Permits/Program IDs for Surveyed Printing Facilities		
Linked Permits/Program IDs	Number of Facilities	Percentage of 520 Printers Surveyed
None Identified	455	87.5
RCRA only	59	11.3
Air and RCRA	6	1.1

A.8.2. EPA Permit Data on TRI Manufacturers

The TRI manufacturers were linked to program permits somewhat differently. As with the printers, a unique identification number, in this case the TRI ID, was used in a linked IDEA query to identify program permits associated with those facilities. Each facility filing Form R under the Emergency Planning and Community Right-to-Know Act (EPCRA) must report all RCRA and NPDES numbers. These numbers were extracted and combined with all unique IDEA linked permits. Program permits were identified for approximately 90% of TRI facilities. Approximately 56% of facilities were identified with multiple permits. While not deemed necessary, additional automated linkages are possible using the D&B number (also reported on Form R) to search D&B's beta-test database.

Linked Permits/Program IDs for Surveyed TRI Manufacturers		
Linked Permits/Program IDs	Number of Facilities	Percentage of 516 TRI Manufacturers Surveyed
None Identified	50	9.7
Air only	10	1.9
Water only	15	2.9
RCRA only	152	29.5
Air and Water	4	0.8
Air and RCRA	95	18.4

Water and RCRA	77	14.9
Air. Water and RCRA	113	21.9

A.9. COMPLIANCE HISTORY

Using the permit linkages described above, the number of inspections and enforcement actions under any of the three media programs within the past two years were extracted from IDEA. The function that selects enforcement actions uses only major state and Federal actions. The flag for actions include administrative actions and judicial or criminal actions, but not the much more frequent Notices of Violation. Rather than use the actual number of inspections and actions, the data analysis was performed using a flag indicating if one or more inspections had occurred in the past two years and another flag indicating if one or more enforcement actions had occurred. Approximately 55% of the TRI facilities were inspected, and 4% were subject to at least one major enforcement action. Less than 2% of the printers were inspected with only two actions in the past two years. Of note, an inspection does not necessarily always precede an enforcement action (which can occur, for example, as a result of missing a filing deadline).

A.10. FACILITY OWNERSHIP BY A *FORTUNE 100* COMPANY

The ultimate parent D&B number of all *Fortune 100* companies was extracted by searching, by company name, a D&B database leased by EPA. As described above, the D&B number for all surveyed printers was taken from D&B during sampling and is reported for 430 (88%) of the 516 TRI manufacturers on Form R. The ultimate parent D&B number for each of the facilities was then extracted from a D&B database leased by EPA and matched to those of the *Fortune 100* companies. Approximately 5% of the TRI manufacturers and none of the printers were owned by a *Fortune 100* parent.

A.11. WASTE REDUCTION NORMALIZED FOR PRODUCTION

Facilities must report annually to TRI the amount of each TRI chemical generated as waste prior to treatment, recycling, use as energy, offsite transfer, or release. In addition, they must report an activity index with which year-to-year changes in waste generation can be normalized to account for changes in production. While changes in waste generation from 1993 to 1994 do not match the period referenced in the survey ("the past two years"), 1994 is the most recent year for which TRI reporting is available. These data elements were used to calculate a percent change for each TRI respondent as follows:

$$\%Change = \sum_{chem=1}^{n} \frac{Waste_{93} * A.I._{(93-94)} - Waste_{94}}{Waste_{93} * A.I._{(93-94)}} * 100$$

where:

Waste = sum of values of waste generation reported in Sections 8.1 through 8.7 of Form R;

$A.I._{(93\text{-}94)}$ = Activity Index representing change in production level from 1993 to 1994 (Section 8.9 of Form R).

Rather than attempting to find statistical associations related to the calculated percentage change in unit waste generation of individual facilities, the distribution of these values was used to create four quartile categories of change in waste generation: more than 14% decrease in unit waste generation, 0-14% decrease, 0-14% increase in unit waste generation, or more than 14% increase. This approach reduces the impact of including some of the extreme outlier activity index values (thought to occur when the decimal point is dropped erroneously by the filer when completing Form R). There were, at most, seven such outliers; there were no negative activity index values for the survey sample).

A.12. POST-SURVEY STATISTICAL TESTING OF CORRELATIONS AND RESULTS

The weighted frequencies (of proportions) presented in the findings section of this report were calculated for the responses to each question using the SAS statistical software package. In addition, a number of cross tabulations tables were generated to ascertain associations among specific variables (question responses and/or facility characteristics) using SAS.

Standard errors of the estimates depend on the sample size and the sample design used for the survey. For example, the standard error of a sample percentage based on a stratified random sample of a certain size may be smaller than the standard error of the percentage based on a simple random sample of the same size. Standard errors must therefore be estimated taking into account the sample design adopted for the survey. For computing the standard errors in this survey, we have used the Survey Data Analysis software (SUDAAN, which was developed and is maintained by Research Triangle Institute) specifying the proper design. SUDAAN takes into account the stratification of the population and the disproportional allocation of the sample to strata while computing the standard errors. Further details are provided in Appendix B.

APPENDIX B

SAMPLE SELECTION WEIGHTING, POST-SURVEY WEIGHTING AND STATISTICAL ANALYSIS

B.1 BASIC SAMPLE SELECTION WEIGHT

The sample selection of printers involved five strata. Illinois, Michigan, Minnesota, and Wisconsin were treated as four separate strata and the establishments in the rest of the states were grouped into a single stratum. The sample selection of TRI manufacturers involved three strata: Massachusetts, New Jersey, and establishments in the rest of the U.S. A basic sample selection weight was assigned to each establishment in the sample considered to be a complete. This weight was derived by taking the ratio of the number of establishments in the population in a stratum, divided by the number of establishments selected in the sample (total of all the three replicates), including completes, nonrespondents, out of business, out of scope, no production, etc.

Let $\mathbf{N_h}$ be the number of establishments in the hth stratum. Let $\mathbf{n_h}$ be the number of establishments selected in the sample. The sample selection weight for all establishments in the sample in the hth stratum is $\mathbf{N_h / n_h}$. The sample selection weights are given for the five strata in the printing industry andTRI manufacturers.

Selection Weights for Printers

Stratum	Number of Establishments in the Population (N_h)	Number of Establishments in the Sample (n_h)	Selection Weight (N_h/ n_h)
Illinois	2,446	400	6.115
Michigan	1,558	400	3.895
Minnesota	860	400	2.15
Wisconsin	882	400	2.205
Rest of U.S.	36,480	1,068	34.16

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Selection Weights for TRI Manufacturers			
Stratum	Number of Establishments in the Population (N_h)	Number of Establishments in the Sample (n_h)	Selection Weight (N_h/ n_h)
Massachusetts	541	400	1.353
New Jersey	673	400	1.683
Rest of U.S.	21,529	1,872	1.50

B.2 NONRESPONSE ADJUSTMENT WEIGHT

Nonresponse adjustment to the selection weight is to be made within each stratum. Out of n_h units in the hth stratum, let there be n_{ch} completes, n_{nrh} nonrespondents, and n_{oh} out of business, out of scope units. The nonresponse adjustment is then given by the ratio:

$$\frac{n_{ch}+n_{nrh}}{n_{ch}}$$

The overall weight attached to each establishment considered to be complete in the sample is given by the product of the two weights, and is:

$$W_h = \frac{N_h}{n_h}\frac{(n_{ch}+n_{nrh})}{n_{ch}}$$

It is therefore important that we clearly identify the two groups, namely, the nonrespondents and the out of business establishments that include no production establishments. The following table shows the selection weight, nonresponse adjustment, and the overall weight.

Overall Weights for Printing Facilities						
Stratum	Selection Weight	Number in Sample (n_h)	Number of Completes (n_{ch})	Number of Nonrespondents (n_{nrh})	Nonresp. Adjust.	Overall Weight (W_h)
Illinois	6.115	400	76	231	4.039	24.701
Michigan	3.895	400	78	256	4.28	16.679
Minnesota	2.15	400	80	278	4.475	9.621
Wisconsin	2.205	400	80	284	4.55	10.033
Rest of U.S.	34.16	1,068	206	603	3.927	124.15

Overall Weights for TRI Manufacturers						
Stratum	Selection Weight	Number in Sample (n_h)	Number of Completes (n_{ch})	Number of Nonrespondents (n_{nrh})	Nonresp Adjust.	Overall Weight (W_h)
Massachusetts	1.353	400	75	295	4.933	6.672
New Jersey	1.683	400	78	278	4.564	7.679
Rest of U.S.	11.50	1,870	363	1336	4.68	53.827

B.3 ESTIMATING PERCENTAGES OR PROPORTIONS

Suppose that we are interested in estimating a percentage. For example, the percent of establishments that said "yes" to the question, "In the last two years, have you made any changes to your printing operations?"

These percentages are estimated by using the data from the completes, along with the weights derived earlier. Let $\mathbf{y_{ch}}$ be the number that say yes to this question in the hth stratum. The percentage is estimated by taking the ratio $\mathbf{p_h} = [\ W_h\, y_{ch} / W_h\, n_{ch}\ ]\ 100$: the ratio of establishments that said yes to the total number of completes multiplied by 100. If we want an estimate for the whole population, then we use the ratio:

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$$p = \frac{\sum_{h=1}^{5} W_h \, y_{ch}}{\sum_{h=1}^{5} W_h \, n_{ch}} 100 \quad .$$

This ratio is computed by attaching the overall weight to each complete and then allowing the variable $\mathbf{y_{ich}}$ take a value of 0 or 1, depending upon whether the ith establishment in the hth stratum says yes to this question or not. The variable is summed all establishments and divided by the sum of the weights taken over all completes.

The variance of the stratum estimate $\mathbf{p_h}$ is obtained by computing:

$$v(p_h) = (1 - \frac{n_{ch}}{N_h}) \frac{p_h(1 - p_h)}{n_{ch} - 1} \quad .$$

The variance is based on only the number of completes. The standard error of the estimate $\mathbf{p_h}$ is given by $\sqrt{v(p)}$. The variance of **p** is given by:

$$v(p) = \frac{\sum_{h=1}^{5} W_h^2 n_{ch}^2 v(p_h)}{(\sum_{h=1}^{5} W_h n_{ch})^2} \quad .$$

The denominator is the square of the sum of the weights taken over all completes. The standard error of the estimate **p** is given by $\sqrt{v(p)}$.

B.4 ESTIMATION OF PROPORTIONS FOR SUBGROUPS

To estimate a proportion for a subpopulation or domain, for example, according to the regulatory status of establishments in the EPA databases, the procedure described below is used.

Let the domain of interest be **d** Then the overall proportion of establishments saying yes in a specific domain is given by

$$p_d = \frac{\sum_{h=1}^{5} W_h \; y_{cdh}}{\sum_{h=1}^{5} W_h \; n_{cdh}}$$

We have thus identified all the establishments belonging to the domain or having a specific regulatory status. Of those answering yes to a particular question, we use the overall weights calculated originally to calculate the proportion as follows:

$$p_{dh} = \frac{W_h \; y_{cdh}}{W_h \; n_{cdh}} = \frac{y_{cdh}}{n_{cdh}}$$

The variance of $\mathbf{p_{dh}}$ is given by:

$$v(p_{dh}) = (1 - \frac{n_{ch}}{N_h}) \frac{p_{dh}(1 - p_{dh})}{n_{cdh} - 1}$$

The variance of $\mathbf{p_d}$ is given by:

$$v(p_d) = \frac{\sum_{h=1}^{5} W_h^2 n_{cdh}^2 v(p_{dh})}{(\sum_{h=1}^{5} W_h n_{cdh})^2}$$

The standard errors of the estimates are given by $\sqrt{v(p_{dh})}$ and $\sqrt{v(p_d)}$.

The following Appendix C presents the actual survey.

APPENDIX C
INDUSTRY MOTIVATION SURVEY

IF 20 OR MORE EMPLOYEES:

WHEN CALL IS ANSWERED, SAY:
Could I please speak with the person in charge of managing (lithographic) production on a day-to-day basis? TERMINATE IF NO LITHOGRAPHY OR PRODUCTION AT THIS LOCATION.

IF FEWER THAN 20 EMPLOYEES:

WHEN CALL IS ANSWERED, SAY:
Could I please speak with the president or owner of the company? IF NOT AVAILABLE, SAY: Could I please speak with the person in charge of managing production on a day-to-day basis? TERMINATE IF NO LITHOGRAPHY OR PRODUCTION AT THIS LOCATION.

WHEN CONNECTED TO ELIGIBLE RESPONDENT, READ INTRODUCTION.

<INTRO>
Hello, my name is _____. I'm calling from Abt Associates, a national survey research company. We are conducting a confidential survey of managers at 500 (printers/manufacturing facilities) nationwide. The study is sponsored by Department of Commerce, Department of Energy, and Department of Defense through an Environmental Protection Agency contract. We are trying to identify factors associated with successful and efficient operations, such as inventory controls, quality management and new technologies. We need your input to help these agencies know when their services can be most useful and when government should get out of the way. Participation in the study is voluntary and your answers will be kept in strictest confidence.

<CONFIRM>Just to confirm that we're talking to the right person, are you involved in making production line decisions, such as changes in (printing inks/materials) or equipment to improve product quality?

YES (CONTINUE)
NO (ASK FOR NAME AND PHONE NUMBER OF APPROPRIATE PERSON; RECORD AND ASK TO BE TRANSFERRED. WHEN CONNECTED, READ INTRODUCTION.)

IF REFUSED, ASK: That's fine, do you mind telling me why?<REFUSED>

_____

_____

1. We are interested in learning what things affect decisions to alter production processes at your facility. As I ask the questions, please keep in mind that I am not an expert on your processes.

In your job responsibilities, how important are the following factors? Is/Are (READ ITEM) very important, somewhat important, or not important at all?

	Very Imp.	Somewhat Important	Not Imp. at All
a) Cost and quality of competitors' products <JBRESPA>	3	2	1
b) Employee morale and level of productivity<JBRESPB>	3	2	1
c) The sources, quality and cost of raw materials and inputs<JBRESPC>	3	2	1
d) The sources and cost of capital<JBRESPD>	3	2	1
e) Technological advances in manufacturing your product<JBRESPE>	3	2	1
f) Trends in customer preferences for your product<JBRESPF>	3	2	1
g) Attitude of your company's neighbors and community towards your business<JBRESPG>	3	2	1
h) Possible environmental impacts of your products during use or disposal<JBRESPH>	3	2	1
i) Possible environmental regulatory requirements<JBRESPI>	3	2	1
j) Insurance, liability or risk management<JBRESPJ>	3	2	1

IF BOTH h AND i = 1, SKIP TO QUESTION 11
IF MANUFACTURER AND h OR i > 1 SKIP TO QUESTION 2TM.
IF PRINTER AND h OR i > 1 CONTINUE

2P QUESTION FOR PRINTERS

<LITHO>We would like to learn about any recent changes you may have made to your lithographic printing operations. In the last 2 years, have you made any changes to your printing operations, however small?

YES	1
NO (SKIP TO Q 11)	2
DON'T KNOW(SKIP TO Q11)	3
REFUSED(SKIP TO Q11)	4

I will read a list, please say yes if you have made any of the following changes in the past 2 years. Have you...

INTERVIEWER: IF YES TO ANY ENTER 1. YOU MAY STOP READING AS SOON AS R SAY'S "YES".

	YES	NO	DK
<OPERATE>Implemented good operating practices such as: change work practices to extend film developing bath life, changed from small volume containers to bulk containers to minimize discarding of empty containers; began using alternative packaging to reduce amounts used or wasted; adopted inventory controls or better labeling procedures to reduce disposal of outdated chemicals;	1	2	8
<CHEMICAL>Modified or substituted chemicals such as less toxic inks, vegetable-based inks, inks with lower or no VOCs that is volatile organic compounds, fountain solutions lower in VOCs or alcohols, adhesives lower in VOCs such as water-soluble adhesives, prepress chemicals or films that are less toxic or generate less waste, or blanket and roller washes lower in VOCs.	1	2	8
<IMAGEMAK>Modified image-making or prepress operations such as switched to computer image editing; changed to countercurrent washing chemicals; adopted alternative platemaking technologies that reduce waste such as laser, waterless, or non-silver plates.	1	2	8
<PRESSOP>Modified press operations such as made mechanical or equipment adaptations such as ink levelers, web break detectors, registration systems, fountain chillers automatic blanket washers; started using alternative binding techniques which create less waste or pollution; or started using alternative printing chemistries such as water-developed lithographic plates.	1	2	8

SKIP TO QUESTION 3

2TM QUESTION FOR TRI MANUFACTURERS

<MANUFAC>We would like to learn about any recent changes you may have made to your production operations. In the last 2 years, have you made any changes to your production operations, however small?

YES	1
NO (SKIP TO Q 11)	2
DON'T KNOW(SKIP TO Q11)	3
REFUSED(SKIP TO Q11)	4

IF NO, SKIP TO Q.11.

I will read a list, please say yes if you have made any of the following changes in the past 2 years. Have you...

	YES	NO	DK
<IMPLEMENT>Implemented good operating practices such as: improved maintenance scheduling, record keeping, or the production schedule to minimize equipment and feedstock changeovers; or improved inventory controls, or labeling to reduce disposal of outdated chemicals?	1	2	8
<HANDLE>Improved materials handling practices such as: improved storage and transfer procedures, installed overflow alarms, automatic shut-off valves, or vapor recovery systems, or implemented an inspection or monitoring program to prevent spills and leaks?	1	2	8
<SUBSTIT>Substituted chemicals or raw materials or modified your product such as: used more pure raw materials, or used substitute chemicals or materials reducing pollution or waste generation; changed to aqueous cleaners from solvents or other materials; or changed the composition of your product, product specifications, or product packaging to reduce waste streams or pollution?	1	2	8
<MODIFY>Modified production related processes such as: instituted recirculation within a process, modified equipment, or layout, used a different process catalyst to reduce pollution or waste generation; improved draining equipment or procedures to reduce dragout from chemical or rinse tanks; or improved rinse systems, equipment or operation to reduce water use, wastewater or waste generation; or improved surface preparation, coating spray systems or application techniques to reduce pollution or waste generation.	1	2	8

<PROCESS>Modified cleaning or degreasing operations such as: changed cleaning, degreasing, stripping or cleaning operations or equipment to reduce pollution or waste generation; or changed to mechanical stripping or cleaning devices from solvents or other materials.	1	2	8

3. We would like to learn about how you make your decisions to change your production operations. We'd like to ask you about what might have first made you think about environmental issues, then where you get information on process changes, then how you decide on what change to make, and finally how the final decision was made.

   Let's start with what made you first consider environmental issues. How important were each of the following factors in first getting you to think about environmental issues at this job. Was/were (READ ITEM) very important, somewhat important, or not important at all? **(ROTATE)**

	Very Imp.	Somewhat Important	Not Imp. At All	DK
a) The interest you, your family, and friends have in the environment<FIRSTA>	3	2	1	8
b) Community interest or concern<FIRSTB>	3	2	1	8
c) A company environmental policy or directive from your boss or top management to consider environmental issues in your daily work or to conduct an internal environmental audit or training<FIRSTC>	3	2	1	8
d) Customer demands<FIRSTD>	3	2	1	8
e) Your company's cost of input materials<FIRSTE>	3	2	1	8
f) Your company's environmental protection or waste disposal costs<FIRSTF>	3	2	1	8
g) Environmental enforcement actions against your company<FIRSTG>	3	2	1	8
h) Government programs that provide awards or recognition for environmental excellence<FIRSTH>	3	2	1	8
i) State government pollution prevention planning requirements<FIRSTI>	3	2	1	8

4. For the changes that you have made to production processes, how *important were the* following sources of information in finding out about alternative practices or technologies for addressing any environmental issues in your work?

Were/Was (READ ITEM) very important, somewhat important or not important at all as a source of information about alternative practices or technologies to address environmental issues.

	Very Imp.	Somewhat Important	Not Imp. At All
Government employees <SOURCESA>	3	2	1
Consultants<SOURCESB>	3	2	1
Vendors and suppliers<SOURCESC>	3	2	1
Government publications<SOURCESD>	3	2	1
Trade associations, publications or conferences<SOURCESE>	3	2	1
Organizations providing assistance such as universities or extension programs<SOURCESF>	3	2	1
Customers<SOURCESG>	3	2	1
Other companies<SOURCESH>	3	2	1
Your company's employees<SOURCESI>	3	2	1
the INTERNET<SOURCESJ>	3	2	1

Other (SPECIFY) <SOURCESK> _____

_____

IF LESS THAN 20 EMPLOYEES FROM SAMPLE DATA, SKIP TO Q.10.

5. <EVALUATE>Now we'd like to know how your company evaluates information on alternative practices or technologies for addressing environmental issues. Do you usually write up a plan or memo or make a presentation to management for describing the changes you are recommending and their pros and cons?

YES 1
NO (SKIP TO Q.7) 2
DON'T KNOW (SKIP TO Q.7) 8

6. Were these evaluations conducted as part of, or to meet, the requirements of...

	YES	NO	DK
Total quality management or TQM plans?<REQUIREA>	1	2	8
ISO9000?<REQUIREB>	1	2	8
ISO14000?<REQUIREC>	1	2	8
Industry or trade association programs<REQUIRED>	1	2	8
Total cost accounting reports?<REQUIREE>	1	2	8
Material or chemical accounting reports?<REQUIREF>	1	2	8
Government-required pollution prevention plans?<REQUIREG>	1	2	8

7. <TITLE>What is the job title of the highest ranking person in the company who must approve technical process changes when there is little or no investment involved?

CIRCLE ONE, DO NOT READ ENTIRE LIST UNLESS NECESSARY.

CHAIRMAN OF THE BOARD 1
PRESIDENT/CEO 2
OWNER 3
CHIEF FINANCIAL OFFICER/CFO 4
CORPORATE ATTORNEY/LAWYER 5
PLANT MANAGER 6
PRESS OPERATOR/LINE SUPERVISOR 7
QC MANAGER 8
OTHER (SPECIFY) 96

_____

_____

8. <INVEST>When there is a significant capital or operating investment, is it the same person?

YES (SKIP TO Q.10) 1
NO 2

9. <SIGNOFF>Who has to sign off on or approve capital or operating investment decisions?

CIRCLE ONE, DO NOT READ ENTIRE LIST UNLESS NECESSARY.

CHAIRMAN OF THE BOARD 1
PRESIDENT/CEO 2
OWNER 3
CHIEF FINANCIAL OFFICER/CFO 4
CORPORATE ATTORNEY/LAWYER 5
PLANT MANAGER 6
PRESS OPERATOR/LINE SUPERVISOR 7
QC MANAGER 8
OTHER (SPECIFY) 96

_____

_____

10. We've gone over information sources and how you evaluated changes to your operations related to environmental issues. Now we want to get an idea of what drove the final decision.

I'm going to read a list of factors that could have influenced your final choice of equipment or operations. Please tell me whether each was a strong influence on your final decision.

Was/Were (READ ITEM) a strong influence on your final decision?

(ROTATE, EXCEPT "Production efficiency..." SHOULD ALWAYS BE LAST)

	YES	NO	DON'T KNOW
Government requirements<DECISIONA>	1	2	8
Advice from government employees<DECISIONB>	1	2	8
Availability of information on the particular practices and technologies<DECISIONC>	1	2	8
Willingness and ability of employees to make changes<DECISIOND>	1	2	8
Customer demands or willingness to accept changes in products<DECISIONE>	1	2	8
Availability of capital for process changes<DECISIONF>	1	2	8
Cost of input materials<DECISIONG>	1	2	8
Cost of pollution control options or other compliance-related costs<DECISIONH>	1	2	8
Production efficiency or other benefits not related to the environment<DECISIONI>	1	2	8

SKIP TO QUESTION 12

11. How influential are the following sources of information on environmental issues? Is/Are (READ ITEM) very influential, somewhat influential, or very influential? (ROTATE)

	Very Inf.	Somewhat Influential	Not Inf. At All
Government employees<INFLUNTA>	3	2	1
Consultants<INFLUNTB>	3	2	1
Vendors and suppliers<INFLUNTC>	3	2	1
Government publications<INFLUNTD>	3	2	1
Trade associations, publications or conferences<INFLUNTE>	3	2	1
Organizations providing assistance such as universities or extension programs<INFLUNTF>	3	2	1
Customers<INFLUNTG>	3	2	1
Other companies<INFLUNTH>	3	2	1
Your companies employees<INFLUNTI>	3	2	1
the INTERNET<INFLUNTJ>	3	2	1

Other (SPECIFY) <INFLUNTK> _____

_____

ALL RESPONDENTS SHOULD ADDRESS THE REMAINING QUESTIONS

12. <CONTACT>Now I have some questions about contacts your company may have had with government agency employees regarding any aspect of your production operations.

In the past 2 years, have you been visited or contacted by someone enforcing regulations such as inspectors from a regulatory agency such as EPA, OSHA or a state or local agency?

YES 1
NO (SKIP TO Q.15) 2

13. <HOWCON>How were you contacted.....READ LIST. MULTIPLE RESPONSE.

By telephone

Mail

In person at your facility

In person, outside your facility

NO OTHER MENTIONS

IF NO OR DON' T KNOW TO ALL ITEMS IN QUESTION 2, SKIP TO Q. 15.

14. <REGULAT>Earlier you identified changes to your production operations. Were any of these changes made as a result of your contacts with regulatory enforcement personnel?

YES 1
NO 2

15. <ASSIST>In the past 2 years, have you been visited or contacted by any organizations providing assistance on environmental matters?

YES 1
NO (SKIP TO Q.25) 2

16. Do you know if they were from a...

		YES	NO	DK
a.	regulatory agency<FROMA>	1	2	8
b.	government technical assistance office such as your state's technical assistance office or compliance assistance office<FROMB>	1	2	8
c.	business assistance or development office such as a Small Business Development Office or extension service<FROMC>	1	2	8
d.	university program<FROMD>	1	2	8

IF NO OR DK TO ALL, SKIP TO Q.25

17. IF NO TO Q.16.a, SKIP TO Q.19, IF YES TO Q.16.a,...

<INDIVID>How were you contacted by the individual from the regulatory agency providing assistance? READ LIST. MULTIPLE RESPONSE

BY TELEPHONE

MAIL

IN PERSON AT YOUR FACILITY

IN PERSON, OUTSIDE YOUR FACILITY

NO OTHER MENTIONS

IF NO OR DON'T KNOW TO ALL ITEMS IN QUESTION 2, SKIP TO Q.19.

18. <CHANGES1>Were any of the changes you mentioned earlier made as a result of your contacts with this organization?

YES 1
NO 2

19. IF NO TO Q.16.b. SKIP TO Q.21. IF YES TO Q.16.b,...

<TECHNIC>How were you contacted by the individual from the government technical assistance or compliance assistance office? READ LIST. MULTIPLE RESPONSE.

BY TELEPHONE

MAIL

IN PERSON AT YOUR FACILITY

IN PERSON, OUTSIDE YOUR FACILITY

NO OTHER MENTION

IF NO OR DON'T KNOW TO ALL ITEMS IN QUESTION 2, SKIP TO Q.21.

20. <CHANGES2>Were any of the changes you mentioned earlier made as a result of your contacts with this organization?

YES 1
NO 2

21. IF NO TO Q.16.c, SKIP TO Q.23, IF YES TO Q.16.c,...

<BUSINESS>How were you contacted by the individual from the business assistance, development office or extension service? READ LIST. MULTIPLE RESPONSE

BY TELEPHONE

MAIL

IN PERSON AT YOUR FACILITY

IN PERSON, OUTSIDE YOUR FACILITY

NO OTHER MENTION

IF NO OR DON'T KNOW TO ALL ITEMS IN QUESTION 2, SKIP TO Q.23

22. <CHANGES3>Were any of the changes you mentioned earlier made as a result of your contacts with this organization?

YES 1
NO 2

23. IF NO TO Q.16.d, SKIP TO Q.25, IF YES TO Q.16.d,...

<UNIVERSE>How were you contacted by the individual from the university program? READ LIST. MULTIPLE RESPONSE.

BY TELEPHONE

MAIL

IN PERSON AT YOUR FACILITY

IN PERSON, OUTSIDE YOUR FACILITY

NO OTHER MENTION

IF NO OR DON'T KNOW TO ALL ITEMS IN QUESTION 2, SKIP TO Q.25

24. <CHANGES4>Were any of the changes you mentioned earlier made as a result of your contacts with this organization?

YES 1
NO 2

Finally, I have a couple of questions for background purposes only.

25. <PERSONEL>How many production personnel work on an average shift? _____

26. <JOBTITLE>What is your job title? _____

27. <STRENGTH>In terms of competiveness and financial strength, do you feel that your company is stronger, about the same, or less strong than it was two years ago?

__ STRONGER
__ ABOUT THE SAME
__ LESS STRONG
__ DON'T KNOW

28. <YEARS>How many years have you been in your current position? _____

Those are all the questions that I have. Thank you very much for your time.